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Chapter 3

Haemorrhagic Fevers: Narratives, Politics and Pathways

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Introduction

Haemorrhagic fevers have captured popular and media imagination as deadly diseases emerging 'out of Africa' to threaten the rest of the world. Associated with wildlife vectors in forested environments, viral haemorrhagic fevers such as Ebola, Marburg and Lassa fever figure high in current concern about so-called 'emerging infectious diseases', their hot spots of origin (Jones et al, 2008), and the threat of global spread. Outbreaks have been foci for rapid and sometimes draconian international policy responses and control measures. Ebola, in particular, has acquired iconic status as a disease-specific version of what Wald has called 'the outbreak narrative' (Wald, 2008, chapter 1).

Yet alongside and sometimes intersecting with this particular, scientifically shaped view of a deadly outbreak that requires rapid external response are a variety of other narratives about haemorrhagic fevers. These pose and respond to a range of questions: who is at risk, and how? How is the relevant system of interacting social–disease ecological processes to be framed and bounded, and at what scale? Should haemorrhagic fevers be understood in terms of short-term outbreaks – as epidemics – or as part of more structural, long-term social–disease–ecological interactions, with more endemic qualities? What of the perspectives of people living with the diseases in African settings? And what of uncertainties about disease dynamics, over longer as well as shorter timescales?

In this chapter we identify four particular narratives about haemorrhagic fevers that deal with these questions in contrasting ways. We begin with the iconic outbreak narrative that treats haemorrhagic fevers as an emerging global threat. We then consider a second narrative that casts the problem in terms of deadly local disease events requiring the mobilization of rapid containment and public health measures. A third narrative argues that local knowledge and socio-cultural practices are crucial to understanding and responding to haemorrhagic fevers. Finally, we address a fourth narrative

that turns attention to longer-term interactions between social and environmental processes involved with disease patterns and vulnerabilities, as well as the areas of uncertainty, ambiguity and ignorance these generate.

As we explore, particular actors and institutions promote and adhere to these different narratives, drawing on different forms of knowledge and 'cultural models' (Hewlett and Hewlett, 2008) of disease to do so. Cultural model is here understood to mean a set of beliefs, assumptions and understandings about the nature and aetiology of a disease shared by members of a given population. Particular cultural models can inform and shape the content of narratives, but the latter are broader, incorporating dimensions of an epidemic storyline that go beyond the dynamics of the disease itself to encompass questions of how, why and for whom it is a problem; and more normative, in that narratives also contain exhortations as to what should be done about it. These narratives serve to justify contrasting institutional and policy pathways for responding to haemorrhagic fevers, with starkly differing implications for who gains and who loses. Nevertheless these different narratives also co-exist and overlap, as do the actors and networks associated with each. To some extent we can also identify a temporal sequence, with the dominance of the earlier narratives gradually receding and more recent ones coming into play. Yet there are also institutional, cognitive and political pressures that make certain narratives and associated pathways 'stickier' and more likely to dominate policy, while others receive less attention and fewer resources. In attempting to map a range of narratives that have emerged around haemorrhagic fevers in African settings, therefore, this chapter also reflects on the politics of disease control pathways. It considers the challenges of building responses that are sustainable in the face of ongoing social–disease dynamics, and which meet the priorities, needs and justice concerns of vulnerable groups – in this case, people living in haemorrhagic fever-prone African settings.

The chapter draws on literature and web-based sources together with interviews conducted by Leach with one major policy player, the WHO; Hewlett's extensive field experience with Ebola in Central Africa (Hewlett and Hewlett, 2008); and Leach's preliminary discussions of Lassa fever in West Africa in the context of long-term fieldwork on the region's social–ecological dynamics (Fairhead and Leach, 1996, 1998). Whilst far from fully comprehensive, the analysis is sufficient to suggest that in relation to other cases, haemorrhagic fevers may offer some positive lessons. A key thread running through this chapter tracks a shift from global scare stories to focused local responses in African settings, and then to responses that integrate local people's own system framings, goals and knowledge and become more effective and sustainable as a result. Yet we also argue that these responses do not sufficiently address longer-term ecological and social

dynamics and more structural shifts that may be impinging on the nature and frequency of haemorrhagic fever outbreaks and regional vulnerability to them. What are the implications of this fourth narrative for institutions and strategies, and for further research?

Background

This chapter focuses on Ebola and Lassa fever, members of a larger group of viral haemorrhagic fevers. We restrict ourselves to these two because they are the two epidemiologically most significant haemorrhagic fevers in the African context, but also because they offer significant and interesting contrasts. As we shall see, Lassa more easily illustrates key issues concerning long-term dynamics that have been underplayed in the case of Ebola, which lends itself so easily to short-term outbreak narratives.

Biomedical cultural models represent Ebola haemorrhagic fever as a fierce and extremely 'rapid killing' viral disease that causes death in 50–90 per cent of clinically diagnosed cases. Passed via blood and other bodily fluids, it leads to rapid onset of symptoms (initially high temperature, shivering and aches, leading to gastric problems on approximately the third day, rashes and throat lesions by the eighth, often accompanied by spontaneous bleeding and renal failure, and then to extreme lethargy and hallucinations) and usually death within two weeks.

Ebola is one genus within the family of filoviruses that also includes Marburg. It is a zoonotic disease, whose natural reservoir is thought to lie in rats or bats in forest environments, although there is uncertainty and unresolved debate about this, as about precise viral transmission mechanisms. Transmission from primary vectors via apes touched or consumed as bushmeat is thought to be a major infection route. The first known outbreak occurred in 1976 in the Democratic Republic of Congo (DRC) (then Zaire), near the Ebola river from which the virus takes its name. There are five species of Ebola: Zaire (the most virulent, with an 80–90 per cent case mortality rate, and occurring in tropical forest areas), Sudan (40–50 per cent mortality rate, occurring in mixed savanna-forest environments), Bundibugyo (25 per cent mortality rate, occurring in mountain forest environments) and – less common and involving only a few individuals – Reston and Ivory Coast. There is no available antiviral or vaccine, and available treatment can address only symptoms. This high case fatality has led Ebola to be listed by the US government as a potential biological weapon in the highest-risk group (biosafety level 4).

Table 3.1 shows the locations of the primary African outbreaks of filovirus (Ebola-Zaire, Ebola-Sudan and Marburg), together with the number of cases.

Table 3.1 *African Ebola outbreaks*

	Location and number of cases					
Year	**Gabon**	**Congo**	**DR Congo**	**Angola**	**Uganda**	**Sudan**
1976			318			284
1979						34
1994	52					
1995			315			
1996	37, 61					
1999			73			
2000					425	
2001	65	57				
2002		13				
2003		143, 35				
2005		12		351		17
2007–2008			264		149	

Source: adapted from Hewlett and Hewlett, 2008, p5 and CDC (cdc.gov/ncidod/dvrd/spb/mnpages/dispages/ebola/ebolatable.htm)

Several points are of note. First, following the first three known outbreaks in 1976–1979 there was a gap until 1994. Since then, outbreaks have become more frequent. Second, while outbreaks are associated with very high case mortality rates (between 25 and 90 per cent, and over 75 per cent for all recent outbreaks involving the Ebola-Zaire virus) the overall number of deaths caused by these filoviruses has been relatively low – amounting to a maximum of a few hundred in years when major outbreaks have occurred.

Lassa haemorrhagic fever is caused by a single-stranded RNA virus (of the family Arenaviridae). It is endemic in Guinea-Conakry, Sierra Leone, Liberia and parts of Nigeria, and possibly also in other countries in the West African region. It is also a zoonotic disease, whose animal reservoir is a rat of the genus *Mastomys*. People become infected through direct exposure to the excreta of infected rats or – more rarely – by transmission from person to person via body fluids. Lassa infection is asymptomatic in about 80 per cent of cases, but causes acute illness in the rest. Fever and general weakness are followed by headache, chest pain, vomiting, diarrhoea, cough, fluid in the lung cavity, bleeding from orifices, and in the late stages sometimes disorientation and coma. Deafness occurs in 25 per cent of cases. In fatal cases, it kills rapidly, usually within 14 days. But compared with Ebola, the overall case fatality rate is much lower: around 1 per cent, rising to

15 per cent of hospitalized cases (http://www.who.int/mediacentre/factsheets/fs179/en/). Nevertheless some studies estimate that 300,000–500,000 cases of Lassa fever occur annually across West Africa. The overall number of deaths is therefore much higher than Ebola, estimated at around 5,000 per year (Birmingham and Kenyon, 2001).

These contrasts in mortality figures have led some to ask whether filovirus haemorrhagic fever outbreaks such as Ebola are 'much ado about nothing' – locally devastating, but of marginal international importance (Borchert et al, 2000). Others have hailed Lassa fever as 'an unheralded problem' that demands more international attention (Birmingham and Kenyon, 2001). Certainly, the numbers of people affected by each disease are out of proportion to their international profile and the scale of Western media attention. In the following sections, we reflect on reasons for and consequences of this Ebola sensationalization and exceptionalism.

A global threat: tackling the plague emerging out of Africa

The first narrative that we consider – treating haemorrhagic fevers as an emerging global threat – follows the contours of Wald's (2008) 'paradigmatic story about newly emerging infections' rather closely. Popular, media and fictional representations, as well as the biographical accounts of key scientists, share a plot beginning with the discovery of an emerging infection, raising fears about its rapid spread through global networks to panic-stricken publics in Euro-American settings, and documenting the work of scientists to contain it.

Thus Laurie Garrett's *The Coming Plague* (1994) chronicles the 'discovery' of both Lassa fever and Ebola in accounts replete with heroic European and American doctors and self-sacrificing nurses and missionaries in remote African settings. Lassa fever was named after the village in eastern Nigeria where in 1969 an outbreak of the disease affected American nurses and brought the disease to Western attention for the first time (Garrett, 1994, p73). Tropical disease expert John Frame, nurse Pinneo and laboratory scientist Jordi Casals in New York played central roles in the identification of the 'mystery virus' as new, although a laboratory error meant that Casals nearly died from it in the process. While Frame tracked outbreaks in Nigeria, outbreaks in Zorzor, eastern Liberia brought WHO involvement and virologist Tom Monath onto the scene. Casals, Monath and Pinneo, together with investigators from the US Centers for Disease Control (CDC) 'solved the Lassa mystery' (Garrett, 1994, p90) in 1972 in the rural hospitals and villages of eastern Sierra Leone, tracking the source of infection to *Mastomys*

natalensis rats. In 1976, Joe McCormick was sent by CDC to set up a 'one man research station' in Sierra Leone – which he did, following a period spent investigating Ebola outbreaks in Central Africa en route.

The Ebola discovery story begins in Yambuku, in the then Zaire, in 1976, with an outbreak of a mysterious disease amongst local people and then the nuns at Yambuku Mission Hospital. 'Soon the hospital was full of people suffering with the new symptoms. Panic spread as village elders spoke of an illness, unlike anything ever seen before, that 'made people bleed to death' (Garrett, 1994, p103). William Close, an American doctor based in Kinshasa, was called to help by the Zairean Minister of Health, and brought in a team from CDC Atlanta. Around the same time, an apparently similar outbreak occurred in the Maridi area of southern Sudan. A WHO team collected samples there and sent them to high security laboratories in Europe and the UK. By October 1976 the WHO had released a report stating that samples from Sudan and Zaire had revealed a new virus, based on confirmation from laboratories at CDC, Anvers and Porton Down, and had initiated a major international effort to try to stop the epidemics in Zaire and Sudan (Garrett, 1994, p116). 'Almost overnight, events would snowball into an effort necessitating over 500 skilled investigators, and mobilising the resources of numerous European and American institutions, all at an indirect cost of over $10 million' (Garrett, 1994, p116). Peter Piot, Karl Johnson, Joel Breman and David Heyman of CDC, and Pierre Sureau of the Pasteur Institute, were central hero figures in this work. But while several variants of the Ebola virus were identified and theories developed that it was a zoonosis, its animal vectors remained a mystery.

Garrett's journalism was not the only media work to popularize the haemorrhagic fever outbreak narrative in the mid-1990s. Ebola was the focus of Richard Preston's book *The Hot Zone* (1994), which became the box office hit film of 1995, *Outbreak*, and influenced much related popular writing and debate at the time.[1] Such works sensationalized not just the virus's heroic discovery and its deadly nature, but also constructed it as a threat to global populations, spread by globalized travel. Thus *The Hot Zone* portrayed Ebola as a 'predatorial virus' with global implications, and this rapidly became an 'urban legend' of global proportions (Weldon, 2001). In popular science writer Dorothy Crawford's account, this predatorial virus has agency of its own:

> *the infamous Ebola virus which occasionally finds its way into the human population from an unknown animal host, causes epidemics of a highly lethal haemorrhagic fever. The virus punches holes in capillaries and blood teeming with viruses oozes into tissues and body fluids. So while the patient is prostrate with high fever, severe pain, generalized bleeding and catastrophic vomiting and diarrhoea, the*

> *viruses in body fluids take the opportunity to pass to unsuspecting family members and hospital staff.* (Crawford, 2007, p17)

Along with a variety of other microbes, Ebola has 'gone global' thanks to the accelerating speed and scale of international travel:

> *We have seen infectious disease microbes exploiting international travel routes to infect naïve populations worldwide. Many, like the acute childhood infections, have established a global distribution, while others ... are hiding in the environment, waiting for their next opportunity to strike.* (Crawford, 2007, p138)

In the haemorrhagic fever outbreak narrative, therefore, the system of concern is constructed at a global scale, with the virus seen to take advantage of new opportunities in a highly interconnected and mobile world. Concern about the potential use of Ebola and Lassa viruses in biological warfare and as agents of bioterrorism (Polesky and Bhatia, 2003) shifts the agency from the virus itself to humans who might deploy it, but dwells similarly on the devastating global implications of viral release.

This global threat outbreak narrative originates primarily from Euro-American sources – popular and sensationalized fiction and non-fiction newspaper reports, books and films about Ebola or Ebola-like outbreaks. Such books, films and other media are produced to sell, engage and entertain the public, but they also provide one of the most consistent sources of information about outbreaks to Euro-Americans. They draw on and contribute to a particular Euro-American cultural model of haemorrhagic fevers as a particular sort of disease requiring particular kinds of response (see Table 3.2).

Table 3.2 *Popular Euro-American haemorrhagic fever cultural model*

Common signs and symptoms	Flu-like, fever, vomiting, bleeding from orifices, skin rash or lesions, difficulty breathing, rapid death
Common causes – global threat	Mutant virus from foreign land (Africa, China), secret government labs, foreign terrorists
Common ways disease is transmitted	Airborne, touch
Treatment	None until high tech scientist discovers vaccine or other cure, otherwise everyone dies
Prevention and containment	Flee area of outbreak, isolate self and family, close schools and churches, wear masks
Prognosis	Not good until science discovers cure
Risk groups	Health workers and general public
Common human responses to outbreak	Panic, violence, competition

The media contribute to the Euro-American public's perceptions, knowledge and expectations about haemorrhagic fever outbreaks. Thus, for example, analysis of the approximately 60 newspaper articles about Ebola that appeared in 1995–1996 in Britain found that they all portrayed Ebola – in more or less sensationalized terms – as a horrifying disease emerging 'out of Africa' and threatening Europe and North America (Joffe and Haarhoff, 2002, pp10–11). For example:

> *A killer virus which turns body organs to liquid and makes AIDS look like a common cold could devastate Europe, health experts fear. The disease ... has been found in Germany, Italy and America and there has already been one case in Britain.* (*The Sun*, 12 May 1995)

> *Three suspected victims of the Doomsday Bug sneaked into Britain from Zaire without passports, it was revealed last night. The mother and two young children were allowed to roam London's streets for two days before immigration chiefs realised they were on the loose.* (*The Sun*, 20 May 1995)

> *Such infections could affect travellers and, in the era of air travel, an infected individual could import the disease into the United States.* (*The Guardian*, 23 May 1995)

However, Joffe and Haarhoff (2002) suggest that alongside these images of the disease invading European shores were images representing Ebola outbreaks as 'far-flung illnesses' associated with conditions in African settings. Thus certain media representations and people's readings of them interacted to construct Ebola as African, linking outbreaks with wild forests, poor African hospitals, 'bizarre' cultural practices such as eating monkey meat, and 'tribal rituals'. 'People who have contracted the disease, my impression is that they have done so in this, sort of, cave area, where the monkeys hang out' (broadsheet reader, cited in Joffe and Haarhoff, 2002, p9).

Such 'othering' by the media in the late 1990s, Joffe and Haarhoff suggest, served as a strategy for the containment of fear, presenting Ebola as posing little threat to Britain. Even as newspapers referred to the potential of Ebola to globalize, lay publics thus felt detached from these dimensions, tending to treat them as science fiction – perhaps encouraged in this by the science fiction works at the time which did indeed elaborate on the outbreak narrative theme.

The global outbreak narrative and the cultural model it is linked with have two major policy implications. First, the dramatic fear generated by a deadly disease has motivated national and international health and government

fficials to develop policy to prepare and respond to haemorrhagic fever nd other outbreaks. Media popularization increases public interest and upport for expenditures of government funds to prepare for and respond) outbreaks. Ebola in this sense is an 'exceptional' or 'master status' disease. : attracts more medical, public and media attention and resources than ther diseases, such as Lassa fever, for example, that may in fact affect ıore people and cause more morbidity and mortality. The global threat arrative has contributed to the master status of Ebola and this in turn has imulated the creation of policies and institutions at the national and local vels that have been shaped by the particular concerns raised by this vision f this disease. Thus the 1995 outbreak in Zaire, and the 'perception that ıe Kikwit outbreak was going to spread to the rest of the world' (interview, /HO, 8 July 2008) is reported as 'key to building political momentum' in ıe processes leading to the WHO's creation of a revised set of International lealth Regulations (IHR) in 2005 (Heymann et al, 1999), regulations that :e intended to guide the global response to all diseases with potential global npact (WHO, 2007c). The Kikwit outbreak, according to this view, helped ystallize a policy response within the WHO that resonated with a broader iscourse of global health security that has been gaining rapid ground in cent years (e.g. WHO, 2007a).

The second policy implication of the global threat narrative is a lack of tention to the public and their knowledge in helping to contain outbreaks haemorrhagic fevers. Popular fiction and non-fiction films and books ike emphasize the roles of medical doctors, nurses, scientists and govern- ent officials. In the end, dreadful outbreaks are contained by incredible ıd often last minute discoveries and efforts by scientists. Publics are rarely ıown or discussed in these narratives and when they are, they are often presented either as ignorant and backward (especially in African settings) as panicked and ineducable (especially in European and American ones). ledia-based representations of the public in outbreak narratives contribute the lack of serious attention to the knowledge and perspectives of the ıblic in policy, and negative images of the public in international and ıtional policies that aim to contain outbreaks.

Deadly local disease events: the building of universal rapid response

concern with haemorrhagic fevers in their African settings – rather than global disease threats – is central to a second narrative. This takes a more al focus, constructing haemorrhagic fevers as devastating disease events at require containment because of their impact on local populations.

This narrative has a long history in medicine and public health, and is adhered to and promoted by many international and national health institutions. In many respects it is the most powerful narrative of the four described in this chapter, providing key representations on which the global threat narrative draws, and providing a frame of reference for the third narrative that we consider below.

A biomedical cultural model of disease, described in the background section of this chapter, is used to explain the signs, symptoms, transmission, prevention and prognosis of Ebola and Lassa. This narrative is transmitted in medical schools and schools of public health around the world, contributing to relatively uniform and global views of correct ways to respond to local outbreaks. These emphasize disease containment at source through a universal kind of rapid response by external agencies. The system and its dynamics are framed in local terms and over the short term, whether in responding to 'outbreaks' (Ebola) or to cases as they arise in an endemic situation (Lassa). This narrative and the biomedical cultural model on which it is based directly shape dominant pathways of policy and intervention to contain Ebola and Lassa. Attempts to influence policy thus require, above all, influencing this narrative.

Thus the outbreak alert and response programmes to Ebola of the WHO and CDC from the 1990s established a standardized set of medical and public health strategies to contain the disease. Programmes of rapid response to notified outbreaks had to be triggered by national government request, and denial has sometimes been a cause of delay. Once on site, externally led teams would institute responses centred on establishing isolation units for the infected and implementing barrier nursing techniques; tracking and controlling those who had had contact with infected individuals; mobilizing the community to respond and providing health education to inform the public of symptoms and modes of transmission. Responses also involve identifying individuals who have had contact with infected individuals (contact cases) in order to watch and control their activities for 21 days (the viral incubation period), and limiting 'dangerous' local behaviours such as the washing and burial of corpses without recommended precautions (Hewlett and Hewlett, 2008, p5).

Such outbreak responses are linked to surveillance and early detection strategies. Thus after the large-scale outbreak of Ebola in Bandundu region, DRC, CDC Atlanta developed a surveillance and prevention programme to help detect and prevent future outbreaks in the region (Lloyd et al, 1999). This was based on early recognition by trained doctors, and the use of a laboratory diagnostic test on skin specimens from patients suspected to have died from the disease. While this programme was set up at the regional scale, its focus was nevertheless resolutely on local outbreaks, constructing

the system of concern as one which coincides spatially and temporally with the outbreak itself.

In some contrast with Ebola, in this 'deadly local disease event' narrative Lassa fever tends to be framed as an endemic disease that throws up particular cases, clustered relatively regularly in particular seasons and centring on a spatial 'hot spot' – the so-called 'hyperendemic' centre of the disease in Sierra Leone extending to other locales in Liberia and Guinea. Ebola, on the other hand, is presented as a disease prone to sporadic outbreaks, or epidemics. The more endemic character of Lassa fever shapes the standardized strategies that have emerged to deal with it. These include rapid transport of suspected cases from their village homes to centralized isolation and laboratory facilities; surveillance to identify all close contacts of a patient for three weeks after the start of their illness; and the initiation of searches for undiagnosed or unreported cases, as well as treating identified cases with the antiviral drug ribavarin (Merlin, 2002). However, a core challenge is in getting cases identified in order to proceed with treatment. This is difficult given that the initial clinical symptoms are non-specific and in these resource-poor settings, funds for polymerase chain reaction equipment that could rapidly confirm the presence of the virus are lacking (Birmingham and Kenyon, 2001). Thus although around 16 per cent of people admitted to hospitals in Sierra Leone and Liberia are estimated to have Lassa fever, doctors must often rely on diagnosis by elimination, excluding other conditions such as TB and malaria before presuming Lassa. Despite public education campaigns illustrating biomedical symptoms on posters in community health centres, a large proportion of Lassa fever cases in Sierra Leone's rural areas are presumed to go unreported to medical staff (interview, director, Mano River Lassa fever research network, Kenema, April 2009).

In this narrative, then, the goal is quite narrowly defined around early intervention and limiting disease mortality, with the focus on vulnerable local African populations. At least in the case of Ebola, the focus is relatively short term – dealing with haemorrhagic fever disease events as shocks (outbreaks) as they arise. Lassa fever presents a contrast, requiring more sustained engagement of health teams and measures to deal with its more endemic character.

This narrative, like the first, is co-constructed with notions of scientific authority. Epidemiology, virology and clinical medicine are the dominant forms of knowledge considered to be central to disease response and control. For haemorrhagic fevers, as emphasized at the WHO (interview, Geneva, 8 July 2008), 'epidemic control is not rocket science; it involves the simple principle of breaking the cycle of transmission'. Key roles in this are also acknowledged for 'frontline' health workers in implementing public health and control measures. In contrast, local populations have often been presented within this

narrative as ignorant, and mired in negative cultural practices – although as we shall see in the next section, the early field experience of outbreak response practitioners encouraged many to revise their views.

Thus elaborating on the details of themes sketched in the 'global threat' narrative, this local response narrative encompasses consideration of 'cultural factors' that are seen to contribute to the emergence and spread of haemorrhagic fever events. In the case of Lassa, for example, 'traditional burial ceremonies' for infected corpses are identified with risks of disease spread (Richmond and Baglole, 2003). Beliefs in traditional remedies, and misunderstandings of miscarriage (a scientifically identifiable symptom of Lassa) as attributable to witchcraft, are associated with delays to timely presentation of cases for treatment (Merlin, 2002). Medical staff in Sierra Leone lament community traditions that encourage the eating of rats, and identify dry season festivals where this happens at scale as a major cause of Lassa outbreaks (interview, Kenema, April 2009). In the case of Ebola, research in Gabon into three outbreaks between 1994 and 1997 identified a range of problematic practices, including family members remaining close to the patient to nurse him/her; hugging and touching the dead at funerals, and traditional healers' treatments such as cutting a patient's skin with unsterilized knives and applying blood to the skin (Kunii et al, 2001). The researchers presented as evidence of local ignorance the fact that only two-thirds of the population of a village suffering from an Ebola outbreak knew the name of the disease and only half could explain what kind of disease it was in scientific terms (the rest attributed it to sorcery and evil spirits) (Kunii et al, 2001).

According to this narrative, local communities and their 'culture' are granted agency and responsibility for spreading disease. And culture itself is seen as a problem to overcome. The beliefs and practices at stake are seen as requiring reform through education, as part of externally implemented control measures.

Such top-down responses and control measures have often proved unsustainable, however, facing resistance from local populations. In the case of Lassa, for example, Richmond and Baglole report people's mistrust of medical facilities and rumoured Lassa treatments there: 'People don't go to medical facilities ... [they fear that] Especially when they say they have Lassa fever, they will be given injections to kill them' (Richmond and Baglole, 2003, p1274). In the case of Ebola in Gabon in 1995–1996, for example, American and French control measures were perceived as so inappropriate and offensive by villagers that they aroused deep suspicion. International responses to a further outbreak there in 2001 met with fierce local armed resistance (Milleliri et al, 2004; see also Bausch et al, 2007). Hewlett and Hewlett (2008) document in detail which, and how, particular aspects of the response strategies caused local anxiety. Particularly significant were the

prevention of people's ability to carry out customary burial practices, and the hiding of sick and dead relatives in tarpaulined isolation units, which led people to suspect that their body parts were being stolen. These particular instances which incited worry and resentment interplayed with a broader distrust of international teams 'parachuted' in from outside.

Yet despite such instances, the late 1990s to early 2000s witnessed a greater entrenchment of this biomedically grounded, local disease event narrative, along with arguments for its wider application across the world. As the WHO argued, the Ebola outbreak in Kikwit, DRC

> *signalled a need for stronger infectious disease surveillance and control worldwide, for improved international preparedness to provide support when similar outbreaks occur ... there are new and more diverse partners able to rapidly respond to international outbreaks.* (Heymann et al, 1999, p283)

Thus was institutionalized in the WHO Global Outbreak and Response Network (GOARN), bringing together multiple agencies in a process sometimes likened to 'herding international cats' – ranging from scientific to humanitarian agencies. Ebola is described as 'peppering the history' of GOARN's creation and indeed several of its orchestrators spent earlier parts of their career at the frontline of Ebola outbreak control in the 1990s (interviews, Geneva, 8 July 2008). In the narratives of those at WHO involved in GOARN's creation and implementation, the responsive, network style of GOARN's operation enables 'each agency to play to its own strengths' (interview, 8 July 2008) in adapting to specific outbreak conditions. Nevertheless the key elements of response are generic, consisting of preparedness and early containment. In these respects the GOARN network is framed as suited to dealing with uncertainty in the sense that outbreaks will arise, but their risk, timing and location cannot be predicted (Heymann, interview 8 July 2008). A flexible response network that can be mobilized as and when needed can, in this context, be seen as a strategy for resilience.

While it is recognized as 'easy to get the boy scouts in' to the drama of dealing with an outbreak, getting them to stay on is more difficult (interview, Geneva, 8 July 2008). Thus the key challenge within this narrative is now seen to be around building national capacity for epidemic preparedness and response. Some countries (e.g. Uganda) are applauded as exemplars in this respect, making efforts build up effective links between local health centres and the national capital. Others are decried for their lack of effort (e.g. DRC). Where infrastructure and resources are lacking, effective use has been made of the surveillance infrastructure established for the global polio eradication campaign. New technologies are also expected to enhance

outbreak response, with mobile diagnostic kits, in particular, predicted by some to bring about 'a revolution as great as that brought by mobile phones' in the disease context (interview, Geneva, July 8 2008).

While the international community was expanding its ability to parachute in external teams to deal with Ebola, however, Lassa fever – initially high profile – has increasingly tended to receive less attention from the WHO and other international agencies. This is despite its higher prevalence and mortality effects. With its less rapid killing and less outbreak-like nature, it had always fitted this increasingly established outbreak-event model less well. As one senior WHO officer put it, 'we have not really dealt with Lassa – we prefer to deal with these outbreak-like haemorrhagic fevers, like Ebola' (interview, Geneva, July 2008). Moreover, from 1991 Lassa fever's hot spots in the forests of Sierra Leone and the border regions of Liberia and Guinea became engulfed in the regional conflict associated with Sierra Leone's decade-long civil war and its overspill and refugee crises in neighbouring states. The regional Lassa research centre in Kenema, Sierra Leone was closed – to be re-established slowly only from 2003 – and the disease lost the limelight in the face of more immediate concerns facing both local populations and international agencies.

Local knowledge and culture matter: Integration for acceptability

In a third narrative, haemorrhagic fevers are seen as long present amongst local populations who have developed culturally embedded ways to live and deal with them. Local knowledge and cultural logics and models can, so the argument goes, inform and be integrated into response strategies, helping to make these more context-specific, locally appropriate and acceptable. To the extent that these arguments have been taken on board within local outbreak response strategies such as through GOARN, so overlaps between this and the previous narrative are evident.

In the accounts of several scientists involved in the early Ebola responses in the mid-1990s, the realization that 'culture matters' emerged through direct field experience 'on the ground'. Thus one recalled evocatively the encounters that helped him and his colleagues to realize that Ebola responses were fundamentally 'not just about a virus', and that Western-style responses were often culturally inappropriate, provoking local fear and anxiety. For example in Gabon in 1996, he recalls: 'the eerie silence in a village with all its house doors boarded up. Entering a house where an old woman lay dying, her profound terror was matched by my own terror; in my white isolation suit I was either God or the devil' (interview, Geneva, July 2008).

In this field-experience view, a set of realizations emerged through the direct experience of outbreak response teams. These included appreciation that haemorrhagic fevers are 'weird', with the power to evoke the most profound fear amongst suffering communities; that top-down Western responses were often denying people basic human rights, such as burial of their dead; and that if the key to breaking the cycle of transmission is creating social distance between people, then this could be done more effectively by building on ways that people were also doing this themselves; 'you cannot deal with an outbreak without getting people on side' (interview, Geneva, 8 July 2008). WHO scientists involved in Ebola outbreak responses recount many stories where appreciating local cultural logics, and seeing that local practices that initially appeared bizarre were actually rational to their performers, proved important to their work.

In elaborating these realizations and in responding to them, however, this narrative also constructs the inputs of anthropologists and anthropological knowledge and tools as vital to response strategies. Thus in what is described by WHO staff as an organic, ad hoc process, anthropologists began to be involved in response teams. One was Barry Hewlett, whose pioneering 'outbreak anthropology' (Hewlett and Hewlett, 2008) has been pivotal in developing this narrative, and in its uptake by the WHO which from 2001 came to include anthropologists in integrated Ebola response teams. When his coincidental presence during the 1996 Gabon outbreak proved enlightening and helpful, Barry Hewlett subsequently persuaded WHO through personal contacts to invite him onto the teams responding to the outbreaks in Uganda in 2000–2001 and DRC in 2003, initiating an inclusion of anthropological perspectives in outbreak situations that several other anthropologists have continued.

Central to this narrative – and a key contribution of anthropology – is a focus on elucidating and re-valuing local cultural models of disease and frameworks of system dynamics, and on identifying valuable, health-enhancing local knowledge and cultural categories which can be blended productively with scientific knowledge. Thus, for instance, explanations of Ebola origins in terms of sorcery, dismissed as evidence of local ignorance in narratives one and two, are shown to make sense in their specific socio-political contexts. During the 2003 Ebola outbreak in DRC, four teachers were killed – and anthropological perspectives helped elucidate the local political–cultural dynamics through which this epidemic was being used as an excuse and context to settle old political–economic scores. This is a well-recognized phenomenon (interview, Geneva, 8 July 2008), but anthropological perspectives prove helpful in illuminating the nuances of particular cases, and the ways in which particular aspects of technological, medical and bodily practices intersect with people's views and experiences of wider politics (see Leach and Fairhead, 2007).

Table 3.3 *Local cultural model for epidemic illness (gemo) amongst Acholi people, Uganda*

Description	Bad spirit that comes suddenly like the wind and rapidly affects many people
Signs and symptoms	Mental confusion, high fever, rapid death
Cause	Lack of respect for *jok* (spirit), sometimes no reason
Transmission	Physical proximity, wind
Treatment	Talk to spirits via traditional healer

Amongst Acholi people in Uganda, for example, local framings of disease dynamics include the concepts of both endemic and epidemic (*gemo*) disease. Local perspectives on Ebola draw on both biomedical and sorcery explanations, and epidemic and endemic models (Hewlett and Hewlett, 2008). In the 1999–2000 Ebola outbreak, the international teams initially did not realize that the local people had an existing cultural model to explain the nature, transmission and prevention of epidemic illness. However, assisted by Hewlett's work, this model and the elaborate social protocols which it triggered were successfully integrated into response strategies.

Table 3.3 summarizes the Acholi's cultural model for epidemics that was utilized in the 1999–2000 Ebola outbreak.

Once the Acholi identified an illness as *gemo*, they would implement a protocol for its prevention and control. Elements of their protocol include isolating the patient in a house at least 100m from all other houses; having a survivor of the epidemic feed and care for the patient; identifying houses with ill patients with two long poles of elephant grass, one on each side of the door; limiting general movement and advising people to stay in their household and not move between villages; and, finally, keeping patients who no longer have symptoms in isolation for one full lunar cycle before moving about freely in the village. From a biomedical perspective, the protocol constitutes a broad-spectrum approach to epidemic control which also makes sense in relation to the biomedical cultural model employed by international teams responding to the outbreak. This complementarity was able to be exploited in pathways of response that blended local and scientific knowledge.

Despite evidence of such complementarities, it is also worth pointing out that local cultural models are transmitted and acquired in very different ways from the cultural models associated with the first two narratives. Local cultural models are based upon lived experiences with haemorrhagic fevers and other outbreaks, and transmitted within and between extended families. In contrast, biomedical and Euro-American cultural models are transmitted and acquired one-to-many via teachers, professional training, books, films and so on.

This 'local knowledge and culture matter' narrative carries a range of implications for pathways of response to haemorrhagic fevers. It emphasizes understanding and building on local knowledge and practices, identifying their health effects and guiding responses to harness those aspects that are health enhancing, while educating to avoid those that are health reducing. This narrative also suggests that community engagement must be central to policy approaches to containing outbreaks. In this respect, anthropological involvement has led to significant policy shifts. For instance, establishing isolation units was previously one of the first tasks of the outbreak response team while health education and community mobilization followed. Once anthropologists participated in control efforts, however, the priorities were reversed, as community engagement and understanding was seen as essential if people were to support and utilize isolation units. Further, this narrative bolsters an argument for communication and education approaches that take account of and work with local perspectives. For example, NGOs addressing Lassa fever in Sierra Leone in the late 1980s used participatory theatre and role plays to understand people's views of the links between rats and disease, and to build from these a set of mutually acceptable strategies for limiting people's contact with the disease vector (Leach, field notes, 1988).

This narrative also offers ways to understand local resistance and adapt accordingly. For instance, in DRC in 2001, the high screens used to hide victims' bodies were found to contradict funeral norms, and were modified. The narrative also emphasizes humility and respect for local practices as an essential dimension of outbreak control, whether by international or national team members. In this view, empathy and emotional support have to be added to an epidemic control team's goals. Defence of the human rights of those suffering from haemorrhagic fever has to be balanced alongside disease control aims (see also Jeppsson, 2002; Bausch et al, 2007; and Edstrom and MacGregor, this volume). Local rights and ethical concerns must be given due regard in outbreak responses and associated research and public health investigations (Calain et al, 2009). In this respect, there is a strong emphasis on social justice as a goal in pathways of disease response. Overall, this narrative highlights the need for responses to be locally contextualized and adapted to local circumstances. Context matters: technologies and practices suited to one place might be rejected in another.

In contrast with Ebola, in the case of Lassa fever there appears to have been virtually no anthropological study. Equally, with the exception of the participatory theatre example above, there is no evidence of responses incorporating local knowledge. But the disease nevertheless throws up many questions which anthropological knowledge and attention to local cultural logics could help inform. Staff of the Mano River Union Lassa Fever research network recognize that addressing these could complement the public

health-oriented 'knowledge, attitudes, practices and beliefs' studies that they have already carried out, going beyond the biomedical model on which these have been premised (interview, Kenema, April 2009). Are there, for instance, local categories and ways of distinguishing Lassa that might be helpful in the diagnostic challenge? How are symptoms that arise in Lassa understood and assigned causes, and what are the moments at which something that might correspond to Lassa is suspected? What aspects of hospitals are feared? Within the terms of the 'culture matters' narrative, addressing questions such as these could help facilitate effective, sustainable and socially just responses.

By 2008 the incorporation of anthropologists into integrated outbreak response teams had become institutionalized, at least within the WHO. The Director of Outbreak Alert and Response Operations (interview, Geneva, 8 July 2008) claimed that 'we have anthropologists at the frontline of our teams now'; that 'we would be fearful to go to the field without an anthropologist', and that 'anthropological integration is now a key pillar of our response strategy – as important as isolation'. He notes that 'this was not the case ten years ago'.

However, discussions at the WHO also revealed an intriguing 'Ebola exceptionalism' in this respect. For no other disease under the purview of GOARN, it seems, is anthropological knowledge regarded as important. This appears to reflect both the 'exotic' nature of haemorrhagic fevers: 'they are all about burial practices'; and the apparently exotic locations and 'traditional cultures' in which many outbreaks have occurred – isolated forest communities with unfamiliar, and to Western eyes bizarre, beliefs and practices. This constructs anthropology in a very particular – and old-style – way, as dealing with 'the primitive' and 'the other' in ways that echo, again, the othering of African practices in the first, global outbreak narrative. The African 'other' and haemorrhagic fevers are again equated, this time with anthropology as both broker and characterizer.

In this vein, anthropology is constructed as less appropriate or necessary for dealing with epidemics such as avian influenza, SARS and swine (H1N1) flu which have taken place in more globalized settings, where 'tradition' has broken down and 'cultures' have become homogenized (interview, Geneva 8 July 2008). For such epidemics and settings, instead, it is argued, 'social mobilization' is sufficient. In a related vein, most technical guidelines for responding to outbreaks state 'special attention must be given to the actual perception of the outbreak by the community... In particular, specific cultural elements and local beliefs must be taken into account to ensure proper messages, confidence and close cooperation of the community' (WHO, 1997). Thus, for whatever reason, the perspectives of international agencies perpetuate a particular notion of 'culture' as

confined to local settings; the impression is that rural Africans have culture, while people and institutions in more globally linked settings do not. Yet as we have discussed, particular cultural models are associated with all three of the narratives discussed thus far (Euro-American, biomedical and Acholi).

WHO staff within GOARN also note the pervasive problems of bringing natural sciences and behavioural sciences together – 'WHO is weak in this'. In this sense, the incorporation of anthropologists in response teams appears as a 'blip' in the institutional business-as-usual of dominance by epidemiologists and medical scientists – a blip made necessary by the peculiarly difficult, 'other' character of haemorrhagic fevers, rather than a frontrunner in a broader process of institutionalized interdisciplinarity in epidemic framing and response.

Mysteries and mobility: Taking long-term ecological and social dynamics seriously

For all their contrasts, these narratives share a focus on short-term responses to haemorrhagic fevers, conceiving of these as short-term shocks, be they outbreaks or cases to be dealt with as they arise. Different again is a fourth narrative that turns attention to longer-term ecological and social dynamics and more structural shifts that may be impinging on the nature and frequency of outbreaks, and on local and regional vulnerability to them. However effective the integrated teams of narrative three may be in dealing with particular outbreaks, they leave begging a number of questions about dynamics of response if the system is framed over larger temporal and spatial scales.

The relevance of such longer-term and broader-scale perspectives is underlined by evidence of an increase in frequency and severity of Ebola outbreaks, and of the highly uneven patterning of severity in Lassa fever's endemism across West Africa and over time. Some virologists now argue that identifying and addressing the underlying causes of the emergence and spread of infectious diseases is vital to interrupt potentially dangerous cycles of viral–animal–human co-evolution. As the WHO Director of Outbreak Alert and Response Operations put it (interview, 8 July 2008), with haemorrhagic fevers large socio-ecological changes mean 'there is a constant ecological frontline, with the virus exploiting new niches'. One response to such a situation is simply to deploy the outbreak-focused pathways of disease response suggested by the three narratives above, addressing each outbreak as it occurs, at source. This is the dominant perspective in WHO and other major policy agencies. It emphasizes strategies of control aimed at stability, and established responses aimed at resilience, in the face

of 'known' short-term shocks. But what if viral–ecological–social dynamics, perhaps over longer timescales, throw up new kinds of viral mutation and dynamics? Questions also need to be raised about the sustainability and appropriateness of 'rapid response' mobilization for ever-shifting, more frequent outbreaks, including the strain this may put on institutions and resources. Virologists Kuiken et al (2003) argue that while to date research efforts have concentrated on improved surveillance and diagnostic capabilities to pick up and respond to outbreaks, 'more attention needs to be given to the identification of the underlying causes for the emergence of infectious diseases, which are often related to anthropogenic social and environmental changes. Addressing these factors might help decrease the rate of emergence of infectious diseases and allow the transition to a more sustainable society' (p641).

From a range of origins and perspectives, a nascent – and as yet fragmented – narrative is therefore emerging. This highlights the social and environmental dynamics of haemorrhagic fevers and vulnerability to them, and the longer term stresses in play, as well as pathways of research and response required to understand and address these.

One line of argument, forwarded particularly by those social scientists, international agencies and NGOs interested in health systems, focuses on the poverty, inequality and 'structural violence' (Farmer, 1999a) in regions where haemorrhagic fevers are rife. Declining health systems and overcrowded hospitals in which viruses multiply are one manifestation of this. Indeed the notion that 'poor hospitals are key amplifiers' (interview, Geneva, 8 July 2008) has long been a central tenet of understanding of the dynamics of Ebola. Overcrowded and poorly constructed settlements associated with impoverished and conflict-affected communities also provide ideal conditions for viral spread, and in the case of Lassa fever, for exposure to vectors. *Mastomys natalensis* rats congregate in domestic rice stores and people are particularly vulnerable where these are poorly built or inside their dwellings. Temporary mining camps are a particular hot spot (interview, Kenema, April 2009). Processes of migration and urbanization pose particular challenges for addressing haemorrhagic fevers given their capacity to spread very rapidly amongst crowded urban and peri-urban populations. Yet to date, there appears to be rather little analysis either of the dynamics involved, or of possible responses that address them – beyond the application of narrative two-like outbreak control measures. This is an area where further research and thinking are needed, towards effective disease responses amidst inevitable mobility.

Whatever the precise dynamics, this line of argument suggests that tackling haemorrhagic fevers cannot be separated from tackling poverty and its causes, and building accessible and equitable health systems. Pathways of

disease response thus involve moving from 'reactive to sustainable control' in which the training and funding of frontline health workers, and integration of strategies with the broader building of health systems, is key (interview, Geneva, 8 July 2008).

This narrative can also focus on long-term environmental and socio-ecological dynamics. Thus deforestation through agriculture and logging, and its political, economic and poverty-related causes has been assumed to contribute to haemorrhagic fevers, by bringing populations closer to their forest animal viral reservoirs and secondary vectors. Haemorrhagic fevers in this respect exemplify broader narratives, put forward by certain epidemiologists and environmental scientists, that relate zoonotic infectious diseases to long-term environmental dynamics. Thus Jones et al (2008) show that emerging infectious diseases (EIDs) are increasing, that the majority (60 per cent) are zoonoses, and that of these, 72 per cent originate in wildlife. They find that 'wildlife host species richness' is a significant predictor for the emergence of zoonotic EIDs with a wildlife origin. In the identification of EID hot spots, the forest fringes of West and Central Africa appear prominent.

Such research focuses attention on factors that bring people into contact with wildlife. In particular, deforestation on the 'forest frontier' is given attention – people's encroachment into forests, and their greater contact with forest wildlife (bats, rodents and so on) that are animal reservoirs for disease, or vectors (e.g. apes). In such narratives, forest ecosystems frequently appear in one of two popular guises, each of which figures large in the work of disturbance ecologists and conservationists. The forest is either 'virgin', a pristine ecosystem in need of protection, or 'viral', a place within which lurk dangerous pathogens in need of containment (see Hardin and Froment, forthcoming). In policy terms, these dual images combine in prescriptions that focus on reducing contact between people and wildlife – separating people from the virgin/viral forest through protected areas or resettlement. For instance Jones et al (2008) suggest that 'efforts to conserve areas rich in wildlife diversity by reducing anthropic activity may have added value in reducing the likelihood of future zoonotic disease emergence'. In this respect, arguments about forest ecosystems and emerging infectious disease resemble 'fortress' conservation measures, which have been widely recognized as having negative effects on the rights and livelihoods of people living in forest areas (see for example Fairhead and Leach, 1998).

The 'bushmeat crisis' is also prominent in long-term socio-environmental narratives about haemorrhagic fevers (Hardin, forthcoming). Poverty, unemployment, conflict, hunting technologies, the opening of access through logging and extractive industries (e.g. gold and diamonds), and the growth of urban markets for bushmeat are recognized as contributory factors to the expansion of practices which bring hunters and bushmeat traders into

closer contact with disease-carrying animals. Here again, it is conservation-oriented responses that have found easiest alliance with disease control concerns, emphasizing the expansion and increased securitization of protected areas, the criminalization of hunting and trade, and restrictions on wildlife and human movement. As Hardin (forthcoming) notes, alternative narratives about the bushmeat trade – focusing on its contribution to livelihoods and food security (e.g. Brown, 2003) – have received far less attention in relation to disease issues. Yet these would suggest alternative response strategies, for instance aiming to reduce people's dependence on bushmeat whether through alternative sources of livelihood for traders or alternative sources of protein (such as fish and dried fish).

Climate change is a further factor to have been drawn into the forest–haemorrhagic fever calculus. The linkages between climate change and health have recently become a major topic of donor, research and policy concern. Infectious diseases are discussed in this context, with climatic variations and extreme weather events expected to have profound impacts both in accelerating deforestation, and on the distribution, reproduction and survival rates of pathogens and vectors (see Patz et al, 2005). While much of the current climate change/infectious disease debate is characterized by general statements and hype – given the political profile of climate change issues – others call for evidence of recent, specific climate change–disease interactions to inform policy responses. For instance, the WHO message in this area is described as 'very clear' (interview, Geneva, 8 July 2008): there are weather events that affect health, leading to a requirement for better vector control, for educating populations on the risks and for surveillance systems that can give a review of likely events.

Across these various versions of the long-term socio-environmental dynamics narrative, at least as manifest in mainstream, policy debates, three related features are striking. First, they often contain a somewhat linear view of the relationship between climate change, deforestation and encroachment on the forest frontier, wildlife contact and disease. Second, the envisaged policy responses tend to focus on control – of people–ecosystem interactions, trade and livelihood activities – frequently in ways that re-enact top-down conservation and disease control measures. Third, socio-ecological dynamics are presented as known, or at least as knowable; able to be represented and managed as risks. In these respects, this long-term environmental narrative has a great deal in common with the first, global outbreak narrative discussed in this chapter.

Yet other strands of work contest and complicate this top-down disease–environment framing, suggesting the possibility of alternative narratives that might support pathways of response oriented towards an ecosystem–disease focus. Thus research in historical ecology (e.g. Balee, 2002) questions a

linear framing of forest dynamics, along with dominant views of the impacts of climate change on forest ecosystems. West and Central African forests are not 'virgin' ecosystems undergoing new disturbance, but have been shaped by interacting and non-linear anthropogenic and climatic influences over centuries and millennia (Fairhead and Leach, 1996, 1998; Hardin, forthcoming). Research in environmental and climate history suggests far more dramatic responses to past climate changes than have been appreciated, implying possibly more dramatic future shifts (Maley, 2002; Fairhead, 2008); yet the implications of this for haemorrhagic fever dynamics have yet to be spelt out.

Ecological research raises unanswered questions about the relationship between forest ecosystem change and animal habitats and behaviour, and thus reservoir and vector prevalence. In the case of Ebola, the natural reservoirs and transmission cycle remain ambiguous, with competing theories – centred on bats and rodents – in play. Ebola's natural transmission cycle, the nature of its reservoirs and means of transmission remain 'an enigma' (Morvan et al, 2000). Disease dynamics may also respond to ecosystem dynamics in non-linear ways. Thus researchers at the Max-Planck Institute suggest that outbreaks of the Zaire strain of the Ebola virus are epidemiologically and ancestrally linked, and that the virus has recently spread across the region in waves rather than being persistent for long periods of time at each outbreak locality (Walsh et al, 2005). Pinzon et al (2004), using satellite data, have shown that the majority of Ebola outbreak events are associated with sharply drier conditions at the end of the rainy season, which they suggest may act as trigger events to enhance transmission of the virus from its cryptic reservoir to humans. They suggest that this link might help unravel the enviro-climatic coupling of Ebola outbreaks, which might in turn help lead to the development of early warning systems.

Detailed research informed by perspectives in cultural and political ecology highlights how links between ecosystem change, vector dynamics and disease are mediated by patterns of land use that shape people's contact with animals (see Lambin, 2008). Here, too, many questions remain unresolved, and causative patterns are uncertain. As research in landscape history and oral testimony has shown, forest–population–land-use dynamics in West and Central Africa are not all one-way. The interactions of settlement, soil use, farming, fire, animals and local institutional arrangements have led to processes of forest advance and biodiversity enrichment as well as decline, over overlapping temporal and spatial scales (see Fairhead and Leach, 1996, 1998). These land-use dynamics, often overlooked and obscured within scientific and policy convictions that one-way deforestation is under way, raise new and as yet little-researched questions about interactions with disease and vector ecology.

For instance, both Ebola and Lassa are most common in the forest-savanna ecotone. Denys et al (2005) in Guinea find that the rat species causing Lassa (*Mastomys natalensis*) is found only in houses in the southern part of the forest-savanna ecotone, but in all habitats in the northern part. The south is associated with higher Lassa incidence. They relate this to the fact that *natalensis* cannot survive in forest so in forest villages there is more intense circulation of viral loads. In contrast in the north *natalensis* is more dispersed across savanna landscapes and also competes with a second, non-Lassa carrying species, *Mastomys erythroleucus*. If, as landscape history studies would suggest, population growth and increased intensity of farming in the forest-savanna ecotone lead to extension of woody vegetation in savanna and the expansion of forest 'islands' around villages (Fairhead and Leach, 1996), then this could over time lead to reduced competition and an increase in *Mastomys natalensis* and Lassa viral load in villages further north.

Identifying such ecosystem–disease interactions more precisely could, in turn, inform ecosystem-based interventions to address disease. This research has the possibility to dissolve the separation between a disease, such as Ebola, that has been predominantly viewed as intermittently epidemic, and one such as Lassa, that has come to be seen as endemic, by providing tools for assessing both the short- and long-term drivers of disease within the same social-ecological frame. Notions of 'integrated vector management' and of habitat ecology interventions to address malaria are of this kind, and form part of a growing body of work on ecohealth (Lebel, 2003). However, to date the research has not been done to inform how such interventions might be constructed for haemorrhagic fevers.

Investigating these social–land-use–ecosystem interactions requires multi-disciplinary approaches that draw on forms of knowledge and understanding not included in any of the three narratives we considered earlier. The relevant conceptual terrain thus comes to combine environmental science (ecology, natural history, climate science) with social science (anthropology, history) in new transdisciplinary approaches.

There are also key roles for local and popular knowledge in elucidating long-term dynamics, not just of the body and of disease as in narrative three, but of local ecology and history. Rather than rely on expert-led assessments of socio-environmental dynamics, one might ask, for instance, how people living in haemorrhagic fever-prone areas themselves frame processes of ecological and land-use change, and their interactions with human health; how they conceptualize vectors and their interactions, and what metaphors they use in understanding these. Going further than the 'community participation' urged in many ecohealth approaches (e.g. Lebel, 2003), such work could take inspiration both from studies of local environmental knowledge and its challenging of dominant scientific narratives

of landscape change (e.g. Fairhead and Leach, 1996; Leach and Mearns, 1996), and from the 'local culture matters' narrative of disease outbreaks outlined earlier. Combining these could yield alternative, locally relevant ecology–disease narratives that could in turn support response pathways geared to local sustainability goals.

To the extent that scientific research and international discussion focus on long-term socio-environmental dynamics, most work attempts to pin them down: to bring long-term shifts into a realm where they can be understood and controlled. Thus as a medical scientist in the WHO put it, 'there is value in putting a risk index on this shifting situation; science is needed, and scenarios' (interview, Geneva, July 2008). The assumption is that ignorance can be transformed into more calculable and manageable forms of uncertainty and risk, and with this, greater control achieved.

But in some areas, at least, ongoing ignorance may be the reality. Full predictability and control of non-linear ecosystem shifts and people's interactions may be an illusory goal, with the possibility of surprise ever present. Strategies may therefore need to focus on robustness – designing flexible adaptive response to long-term shifts as a complement to the resilience to short-term shocks already provided by narratives two and three's strategies. Devising such strategies for robustness around ecosystem–health dynamics currently represents a frontier area. Possible elements might include what Kilbourne (1996) terms 'holistic epidemiology' – widened to include historical ecology, cultural economy and local knowledge – and institutional arrangements to link it with strategies that enable communities to adapt and adjust land use. They include conceiving of policy and response over a larger temporal and spatial scale than 'the outbreak', to track and be positioned to respond to processes that increase threat and vulnerability. It also requires a broader set of actors and networks, linking those with a focus on epidemics alone to those involved with broader environment, development and health systems processes. What is envisaged, then, may not be a major new, enlarged global infrastructure aimed at 'controlling' long-term dynamics, but a network of actors who can address these in a more flexible, inclusive and participatory way.

Conclusions

Each of these narratives – of global outbreak, of local disease event requiring external response, of local knowledge and cultural logics, and of long-term socio-environmental dynamics – thus constructs haemorrhagic fevers in different ways. They pick out different temporal and spatial scales; they use and validate different kinds of knowledge, and they assign cause, blame

and vulnerability differently. Each suggests somewhat different pathways of response, involving different combinations of actors.

Elements of each of the narratives outlined in this chapter must undoubtedly contribute to the vital task of addressing haemorrhagic fevers in the decades to come, underlining the need for further elaboration of the kind of understanding and strategy implied by each. Yet this chapter has also highlighted problematic conflicts between them, shaped by institutional and political pressures, and by the operation of power. The differences in the framing of Ebola and Lassa fevers, as respectively epidemic and endemic, highlight the effects of a bias at the global institutional level towards identifying and responding to short-term shocks as opposed to long-term drivers. Thus global and rapid response outbreak narratives, and their central biomedical and epidemiological precepts, have dominated the powerful international apparatus that orchestrates haemorrhagic fever responses. These have often conflicted with the narratives of people living with the disease, resulting in perceived abuses of rights and local resistance that has undermined responses. Yet field experience also shows the potential for narratives recognizing that local knowledge and perspectives matter to be drawn into responses, shaping approaches, goals and technology use so as to render them more effective, sustainable and socially just. A key challenge for the future is to ensure that these complementarities and forms of integration are sustained, even as institutional pressures favour top-down, globally and security-framed outbreak responses.

We have also seen the disjuncture between outbreak narratives that focus on short-term disease risks, aimed at building stable and resilient responses to them, and the kind of long-term environmental and social dynamics highlighted by the fourth narrative. Taking the latter seriously has implications for programme appraisal and design, suggesting the need to move beyond a reliance on risk assessment and rapid response to a more strategic adaptive learning approach. It has implications for response mechanisms and their entry points – suggesting alternatives grounded in broader health system-building, or via ecosystems and land management. It has implications for monitoring and indicators of success, suggesting the need to understand long-term drivers of change in context and to link development interventions more broadly to improving the resilience/robustness of people and places to both existing and potential vulnerabilities to haemorrhagic fevers. And there are implications for surveillance – especially towards rethinking approaches to be more inclusive, adaptive and responsive in the increasingly likely conditions of disease persistence, multiplying 'hot spots' and increased frequency of outbreaks.

Finally, a key challenge involves connecting the insights and implications of the 'local knowledge and culture matters' narrative, with narratives

focused on long-term socio-ecological dynamics. Thus far, the latter have, as we have seen, tended to be top-down – with current discourses around climate change and infectious disease featuring in new forms of globally driven intervention that threaten to ride roughshod over local concerns. When locally grounded, understandings and interventions tend to be dominated by the formal science disciplines of epidemiology and ecology. Including insights from long-standing work on cultural ecology and ethno-ecology, and placing a concern with local framings more firmly within the emerging field of ecohealth, may help generate more inclusive, acceptable and robust approaches to dealing with haemorrhagic fevers in fast-changing social and ecological systems.

Notes

1 This in turn can be seen as part of a much longer-established tradition of 'plague writing' in English literature, extending back at least as far as Defoe's 1665 journal of the plague in London (Healy 2003).