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Haemorrhagic Fevers in Africa: Narratives, Politics and Pathways of Disease and Response

Melissa Leach

Ebola

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Haemorrhagic fevers have, par excellence, captured popular and media imagination as deadly diseases to come 'out of Africa'. 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 hotspots of origin and threat of global spread. Outbreak narratives have justified rapid and sometimes draconian international policy responses and control measures. Yet there is a variety of other ways of framing haemorrhagic fevers. There present different views concerning who is at risk, and how? Is the 'system' of interacting social-disease ecological processes a local or a global one, and how do scales intersect? Should haemorrhagic fevers be understood in terms of short-term outbreaks, or as part of more 'structural', long-term social-disease-ecological interactions? 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 short time scales? This paper contrasts global outbreak narratives with three others which consider haemorrhagic fevers as deadly local disease events, in terms of culture and context, and in terms of long-term social and environmental dynamics. It considers the pathways of disease response associated with each, and how they might be better integrated to deal with haemorrhagic fevers in more effective, Sustainable and socially just ways.

About the Author

Since 2006, **Melissa Leach** has directed the ESRC STEPS (Social, Technological and Environmental Pathways to Sustainability) Centre. Professorial Fellow at IDS and leader of the Knowledge, Technology and Society (KNOTS) team, she originally trained as a geographer (MA Cambridge) and social anthropologist (PhD London). Over the last twenty years she has been closely involved both in ethnographic fieldwork, speaking four African languages, and in extensive interdisciplinary research. This has engaged anthropology with historical, ecological and science and technology studies approaches, as well as working with foresters, agricultural and medical scientists.

Melissa's recent work has explored the politics of science and knowledge in policy processes linked to environment and health; addressing vaccine controversies, scientific uncertainties, citizenship and public engagement; cultural and political dimensions of vaccine delivery; medical research trials, emerging infectious diseases, and ecology-health linkages.

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INTRODUCTION

Haemorrhagic fevers have, par excellence, captured popular and media imagination as deadly diseases to come 'out of Africa'. 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 hotspots of origin (Jones et al 2008), and threat of global spread. Outbreaks have been foci for rapid and sometimes draconian international policy responses and control measures. This is a disease-specific version of what Wald (2008) has called 'the outbreak narrative'.

Yet alongside and sometimes intersecting with this epidemiologically-shaped view of deadly outbreak requiring rapid external response are a variety of other ways of 'framing' haemorrhagic fevers. To different extents and in different ways, such framings pose and respond to a range of questions. Who is at risk, and how? Is the 'system' of interacting social-disease ecological processes a local or a global one, and how do scales intersect? Should haemorrhagic fevers be understood in terms of short-term outbreaks, or as part of more 'structural', long-term social-disease-ecological interactions? What of the perspectives of people living with the diseases in African settings? What of uncertainties about disease dynamics, over longer as well as short time scales?

Such questions are addressed – and responded to – in very different ways by the different actors and institutions involved with haemorrhagic fevers, ranging from international organisations and the scientific and disciplinary institutions that inform them, to media and popular culture, through to health workers and people living in disease affected areas. Whether implicitly or explicitly, such actors often articulate their views in the form of narratives or storylines which describe the nature of the problem, the relevant factors involved and what to do about it. Such narratives are evident - and can be identified - in people's voiced opinions and in writing and documentation, but also in their practices and the assumptions that inform them. Narratives are important not just because they reflect and serve to organise particular understandings of disease. They also serve to justify – and are sometimes co-constructed with – institutional and policy pathways for disease response. These have real material effects.

In the case of haemorrhagic fevers, four overarching narratives can be identified. In brief, these can be summarised as:

1. A global threat: tackling the emerging plague out-of-Africa
2. Deadly local disease events: the building of universal rapid response
3. Culture and context: building positively on local knowledge
4. Mysteries and mobility: taking long-term ecological and social dynamics seriously

The sections of this paper deal with each of these broad narratives in turn, as well as with some of the key variants within each. For each narrative, a number of dimensions are of interest (see Leach et al 2007, STEPS 2008). First, who is articulating the narrative – which actors and institutions are producing it, and where are they located? Second, how is the 'system' of concern conceived of and bounded? Broadly, each narrative envisages a system involving social, virological, epidemiological, ecological and technological processes, recognising that these are interlinked. Yet important distinctions emerge in how boundaries are drawn, the spatial and temporal scales deemed relevant, what particular system elements and linkages are prioritised, and what languages of connectedness or inequality are used. Third, what goals and priorities are

emphasised? At one level, minimising suffering from haemorrhagic fevers is a broad, shared goal within all narratives. Yet there are differences in the relative priority given to global vs. local populations, and to narrowly-defined qualities focused on mortality vs. other qualities such as community solidarity and maintaining valued lifestyles. Fourth, how does the narrative deal with questions of knowledge and incertitude – what types, sources, combinations and hybrids of knowledge are valorised, drawn on, or rejected? Is the problem constructed in terms of knowable risk, or are deeper uncertainties, ambiguities and possibilities of surprise also addressed and accommodated? Finally – moving from knowledge to action and intervention – narratives conceive in different ways the dynamics of disease, and ways to deal with them. Thus we may ask, are the narrative and the responses co-constructed with it focused on maintaining stability and durability in the face of internal disruptions? Or are the effects of external dynamics, requiring more adaptive response, recognised? Are such dynamics seen mainly in terms of short-term shocks requiring resilience, or are longer-term shifts in the trajectory of disease/social dynamics recognised, and so the need for strategies that are open to enduring change (robustness?) How, in all this, is responsibility attributed – whose ways have to be amended? All these elements contribute to the particular pathway - or self-reinforcing trajectory for agency and change – associated with and justified by the narrative. In each case, the section will indicate who gains and who loses from this, and key questions and issues which are left begging.

The four haemorrhagic fever narratives considered in this paper 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 while some narratives and associated pathways dominate, others are less clear and coherent, or receive less attention and resources. There are institutional reasons why what I shall identify as more recent, progressive narratives are not always manifested in disease control strategies. In attempting to 'map' a range of narratives that have emerged around haemorrhagic fevers in African settings, this paper therefore also reflects on the politics of such pathways. And it draws attention to issues and questions requiring further research if key insights in 'alternative' narratives are to be developed towards effective and appropriate pathways of disease response. Effective and appropriate responses, it is suggested, need to be sustainable in the face of ongoing social-ecological disease dynamics, and Sustainable (see Leach et al 2007) in the normative sense of meeting the priorities, needs and justice concerns of vulnerable groups – in this case, people living in haemorrhagic fever-prone African settings.

This paper offers only a preliminary mapping of narratives, based as it is on literature, web-based sources and a set of interviews conducted with only one – albeit major - policy player, the World Health Organisation. Nevertheless, this is sufficient to suggest that in relation to other cases, haemorrhagic fevers – and Ebola in particular - may offer some positive lessons. A key overall story running through this paper concerns the shift from global scare stories to focused local responses in African settings, and then, to responses that integrate local people's own system framings, Sustainability goals and knowledge – becoming more effective, stable and resilient as a result. The work of Hewlett and Hewlett (2008) has been crucial in this shift, and centrally informs this paper. Thus in Gabon in 1995-6, American and French Ebola control measures were perceived as so inappropriate by local people in the context of their own framings that they aroused deep suspicion, to the extent that international responses to a further outbreak in 2001 met with fierce local armed resistance. Such experiences have stimulated new institutional experiments with integrated approaches that blend local and scientific knowledge in handling Ebola – with potential applicability to other epidemics (as popularised by Abraham 2007). Yet I will also argue that these responses do not address longer-term ecological and social dynamics and more structural shifts that may be impinging on the nature and frequency of Ebola

outbreaks, and on regional vulnerability to them. What are the implications of this fourth narrative for institutions and strategies, and for further research?

BACKGROUND

This paper focuses in particular on Ebola and lassa fever. This is partly because these are the two epidemiologically most significant haemorrhagic fevers in the African context, but also because they offer significant and interesting contrasts. To some, these contrasts might appear too great for them to be treated in a single paper – but I suggest that this is warranted because as we shall see, lassa more easily illustrates some key issues concerning long-term dynamics which have been underplayed in the case of Ebola, which lends itself so easily to 'archetype' outbreak narratives.

Ebola haemorrhagic fever is a fierce and extremely 'rapid killing' viral disease that causes death in 50-90% 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 which 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 DR Congo (then Zaire), near the Ebola river from which the virus takes its name. There are four species of Ebola: Zaire (the most virulent, with an 80-90% case mortality rate, and occurring in tropical forest areas), Sudan (40-50% mortality rate, occurring in mixed savanna-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) (Hewlett and Hewlett 2008).

Table 1 shows the locations of the primary African outbreaks of filovirus (Ebola-Zaire, Ebola-Sudan and Marburg), together with the number of cases.

Table 1: African Ebola outbreaks

	Location and number of cases per outbreak					
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			Unknown		Unknown	
2008			Unknown			

(Source: adapted and extended from Hewlett and Hewlett 2008: 5)

Several points are of note. First, following the first three known outbreaks in 1976-79 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 50 and 90%, and over 75% 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 (the 'multimammate' rat). People become infected through direct exposure to the excreta of infected rats, or by transmission from person to person via body fluids. Lassa infection is asymptomatic in about 80% 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% 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%, rising to 15% of hospitalised 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); while 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 scale of western media attention. In the following sections, I reflect on some of the reasons and processes which have underlain this greater sensationalisation of Ebola, as well as the consequences of this. This may relate partly to the inherently more

'sensational' rapid-killing nature of Ebola, as well as to the greater mystery surrounding it. In the sections of the paper, I show how these twin characteristics – deadly and mysterious – as well as others are selectively elaborated in the narratives of different actors as they attempt to explain and respond to the dynamics of haemorrhagic fevers.

A GLOBAL THREAT: TACKLING THE EMERGING PLAGUE OUT-OF-AFRICA

Wald (2008) uses the term 'the outbreak narrative' to describe what she sees as 'a paradigmatic story about newly emerging infections'. This has scientific, media and fictional incarnations, but follows a standard, formulaic plot:

> [this] begins with the identification of an emerging infection, includes discussion of the global networks throughout which it travels, and chronicles the epidemiological work that ends with its containment. As epidemiologists trace the routes of the microbes, they catalogue the spaces and interactions of global modernity. Microbes, spaces, and interactions blend together as they animate the landscape and motivate the plot of the outbreak narrative: a contradictory but compelling story of the perils of human interdependence and the triumph of human connection and cooperation, scientific authority and the evolutionary advantages of the microbe, ecological balance and impending disaster (Wald 2008: 2).

This paradigmatic outbreak narrative – which, Wald suggests, followed the identification of HIV – find echoes in many further outbreak narratives focused on specific diseases. For haemorrhagic fevers these follow the contours of the original rather closely.

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: 73). Tropical disease expert Dr. John Frame, nurse Pinneo and laboratory scientist Jordi Casals in New York played central roles in the identification of the 'mystery virus' as new – distinct from the already-known Marburg virus – 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 CDC investigators, 'solved the lassa mystery' (Garrett 1994: 90) 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, via a period spent investigating Ebola outbreaks in central Africa en route.

The Ebola discovery story begins in Yambuku, 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: 103). Dr. William Close, an American doctor based in Kinshasa, was called to help by the Zairean Minister of health, and called 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, and determine how and why it had appeared (Garrett 1994: 116). 'Almost overnight, events would snowball into an effort necessitating over 500 skilled investigators, and mobilising the resource of numerous European and American institutions, all at an indirect cost of over $10 million' (1994: 116). 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 popularise the haemorrhagic fever outbreak narrative in the mid 1990s. Ebola was the focus of Richard Preston's *The Hot Zone*, 1994, the box office hit film of 1995, *Outbreak* (1995), and much related popular writing and debate at the time.[1] Such works sensationalised not just the virus's heroic discovery and its deadly nature, but also constructed it as a threat to global populations, spread by globalised 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).

The notion of a predatorial virus – a virus that is not just deadly but has agency – is emphasised in microbiologist Dorothy Crawford's pop-scientific *Deadly Companions: How Microbes Shaped our History* (2007). Thus she writes of:

> ...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 (2007: 17).

In Crawford's contribution to the outbreak narrative, a variety of microbes have historically 'gone global' through 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 (2007: 138).

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.

While the notion of an emerging plague that could 'infect us all' suggests concern for a global public, on closer inspection many media and fictionalised accounts of Ebola and lassa prove to

[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).

emphasise the threat to – and the need to protect - Northern populations. Thus for example analysis of the approximately 60 newspaper articles about Ebola that appeared in 1995/6 in Britain found that they all portrayed Ebola – in more or less sensationalised terms - as an emerging, and horrifying, disease 'out of Africa' that threatens Europe and North America (Joffe and Haarhoff 2002: 10-11). 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 (Sun, 12/05/95).
>
> Thee 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 (Sun, 20/5/95).
>
> Such infections could affect travellers and, in the era of air travel, an infected individual could import the disease into the United States (Guardian, 23/05/95).

However Joffe and Haarhoff (2002) suggest that alongside these images appeared those 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, associated with African practices – 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: 9).

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 globalise, lay publics thus felt detached from these dimensions, tending to treat these as science fiction - perhaps encouraged in this by the science fiction works at the time which did indeed elaborate on the outbreak narrative theme.

This politics of fear and the representation of threat around Ebola shaped not just public views but also international policy responses. Thus the 1995 outbreak in Kikwit, Zaire, is reported as a key trigger in the processes leading to the creation by the WHO of a revised set of International Health Regulations (IHR) in 2005 (Heymann et al 1999).[2] These regulations represented a specific institutional response within a broader discourse of global health security which has been gaining rapid ground in recent years (e.g. WHO 2007). It was seemingly the 'perception that the Kikwit outbreak was going to spread to the rest of the world' (interview, WHO, July 8 2008) rather than any evidence of this, as well as concerns by the US military, and fear amongst (mainly northern) governments and policy-makers, that gave momentum to the IHR revision process. Kikwit was the first in a series of disease-related and security events (including a 1998 Meningitis outbreak , September 11 2001, Sudanese smallpox, SARS and avian influenza) in which fear of spread was 'key to building political momentum'.

[2] Media interview with Guenal Rodier, Director of International Health Regulations Co-ordination, www.who.int/bulletin/volumes/85/6/07-100607/en/index.html, accessed July 2008.

The new IHR move beyond a focus on specific diseases to require countries to notify international authorities of any 'public health event of international importance'. While certain diseases (e.g. avian influenza, SARS) always require notification, haemorrhagic fevers fall into a second category where notification is required where there is international threat. The new IHR move from the 'fortress containment' approach, through international border controls of their predecessors, to an emphasis on building capacity to contain outbreaks at source, through a well-defined process. There is claimed to be no tension between these global ground rules and the needs and measures of outbreak control in local settings (interview, WHO, July 8 2008), as explored in the next section. However major tensions have emerged with national and military security concerns and their respective ministries in some developing countries, which suspect the US to be using the IHR as a surrogate military security surveillance apparatus. Meanwhile, some national governments have resented the imposition of the IHR which they perceive as designed to protect the rich in the global North. Indeed, it was precisely this aspect of the Ebola threat that gave such impetus to the creation of the IHR in the first place. With Kikwit 1995, the perception that the Ebola virus might spread rapidly in a world of interconnected people and rapid travel transformed haemorrhagic fevers from diseases of Africa, to diseases that threatened to emerge from Africa to infect others elsewhere.

DEADLY LOCAL DISEASE EVENTS: THE BUILDING OF UNIVERSAL RAPID RESPONSE

A focus on haemorrhagic fevers in their African settings – rather than as global disease threats - is central to the second dominant policy narrative. This takes a more local focus, constructing haemorrhagic fevers as devastating disease events which require to be contained because of their impact on local populations. Overlap with the first narrative exists however both in an emphasis on disease containment at source, and the view that this can be achieved through a universal kind of rapid response by external agencies. This aims at controlling disease progress at local scale and over the short term, whether framed as responding to 'outbreaks' (Ebola) or to cases as they arise in an endemic situation (lassa).

Thus the outbreak alert and response programmes to Ebola of the WHO and CDC from the 1990s established a standardised 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; providing health education to inform the public of symptoms and modes of transmission; identifying individuals who had contact with infected individuals (contact cases) 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: 5).

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 throwing up particular cases, rather than in terms of specific outbreaks. Yet lassa is also associated with particular 'hotspots' of peculiarly high prevalence. These locales include the forests and forest-savanna transition zone of Sierra Leone, Liberia and Guinea, which are referred to as places of lassa fever 'hyperendemism'. It is these hyperendemic centres that have been the focus for research, observation, commentary and control measures (Bausch 2001). The term carves a distinction from a 'normal' state of epidemiological affairs in a parallel way to the term 'epidemic'; less by time (an epidemic as a temporary interruption to a normal state of affairs) than by space (a hyperendemic place as distinct from surrounding low or moderate prevalence). Here, a standardised set of strategies to contain the disease has emerged. These include 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 anti-viral 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 PCR equipment that could rapidly confirm the presence of the virus are lacking (Birmingham and Kenyon 2001). Thus although around 16% of people admitted to hospitals in Sierra Leone and Liberia are estimated to have lassa fever, doctors must rely on diagnosis by elimination, excluding other conditions such as TB and malaria before presuming lassa. It can then be treated with anti-viral drug Ribavarin.

In this narrative, then, the goal is quite narrowly defined as around limiting disease mortality – with the focus on vulnerable local African populations. The focus is relatively short-term – dealing with haemorrhagic fever disease events as shocks (outbreaks, cases) as they arise. Within this narrative, uncertainty is acknowledged in the sense that outbreaks and cases are seen as likely to arise, but in ways that cannot be predicted or calculated in terms of true risk probabilities. Hence the emphasis is on having institutional arrangements available that can be rapidly mobilised as actual outbreaks and cases arise. This can be seen as a strategy for resilience.

Within this narrative of 'external control of local disease', vaccination is potentially a highly effective measure. Yet pharmaceutical companies are seen to have little interest in funding vaccines for a disease of poor African populations. To date they have not attracted the interest of global philanthropists and public-private partnerships – presumably because their mortality rates are so much lower than the 'big three' diseases of malaria, HIV and TB. To the extent that vaccine development for haemorrhagic fevers is moving, this is within military contexts, driven by fear of bioweapons. One challenge lies in moving this vaccine development to civilian contexts and in designing and conducting trials in real epidemic situations (Interview, Geneva, July 8 2008). Filoviruses and RNA viruses offer particularly complex scientific challenges, and there are uncertainties about vaccine efficacy and side-effects in these disease contexts. A vaccine for lassa developed in Texas showed success in non-human primates (Fisher-Hoch 2000) but trials were stopped when it was found that people with HIV infection could develop vaccinia infection from the attenuated strain of vaccinia used to carry the virus. Research into alternatives, such as including lassa vaccine in a yellow fever vector, have been constrained by lack of funds (Merlin 2000).

This narrative, like the first, is co-constructed with notions of scientific authority. Epidemiology, virology and clinical medicine are the dominant forms of knowledge seen as central to disease

response and control. For haemorrhagic fevers, as emphasised at WHO (interview, Geneva, July 8 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 much consideration of - and research into - '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). In the case of Ebola, research in Gabon around 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 unsterilised knives and applying blood to the skin (Kunii et al 2001). That in a village suffering from an Ebola outbreak, only two thirds of the population 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) is seen as evidence of local ignorance (Kunii et al 2001).

In this, local communities and their 'culture' are attributed agency and responsibility in spreading disease. 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 proved unstable however. In particular, in several instances they have faced resistance from local populations. In the case of lassa, 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: 1274).

In the case of Ebola in Gabon in 1995-6, for example, American and French control measures were perceived as so inappropriate and offensive by villagers that they aroused deep suspicion, and international responses to a further outbreak there in 2001 met with fierce local armed resistance (Milleliri et al 2004). 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, this period of the late 1990s - early 2000s coincided with a move towards an even greater globalisation and application of outbreak alert and response strategies by the international community. As the WHO argued, the outbreak in Kikwit, DRC triggered not just the IHR debates but also:

> ...signalled a need for stronger infectious disease surveillance and control worldwide, for improved international preparedness to provide support when similar outbreaks occur, and for accommodating the needs of the press in providing valid information. A need for more broad-based international health regulations and electronic information systems within the World Health Organization also became evident, as did the realisation that there are new and more diverse partners able to rapidly respond to international outbreaks' (Heymann et al 1999: S283).

Thus was institutionalised 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, July 8 2008) in adapting to specific outbreak conditions. Nevertheless it is emphasised that 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, and timing and place, cannot be predicted (Heymann, interview, July 8 2008). A flexible response network that can be mobilised as and when needed can, in this context, be seen as a strategy for resilience.

WHO staff recognise that it is relatively 'easy to get the boy scouts in' to the drama of dealing with an outbreak (interview, Geneva, July 8 2008). However persuading institutions geared up for short-term rapid response to stay in a region, and thus be available for the next outbreak that might occur, is more difficult. 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 for instance to 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, as in Angola, effective use has been made of the surveillance infrastructure established for the global polio eradication campaign (Heymann et al 2008). 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 was being quietly ignored. With its lower death rates and less outbreak-like nature, it had always fitted this increasingly-established outbreak 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'. Moreover, from 1991 lassa fever's hotspots 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 lassa research centre in Kenema, Sierra Leone was closed, and the disease lost the limelight in the face of more immediate concerns amongst both local populations and international agencies. Lassa already had a lower international profile because of its less dramatic, non-outbreak-like character – hyperendemic, not epidemic. That these hyperendemic centres were also places of extreme long-term poverty, marginalisation and vulnerability to conflict - such as erupted from 1991 - found little foothold within the 'deadly local disease event' narrative.

CULTURE AND CONTEXT: BUILDING POSITIVELY ON LOCAL KNOWLEDGE

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 can, so the argument goes, inform and become part of 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 realisation that 'culture matters' (in a positive sense, rather than the negative sense of the previous narrative) emerged through direct field experience 'on the ground'. Thus one recalled evocatively the encounters that helped him and his colleagues to realise 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 isolated suit I was either God or the devil.

In this field-experience view, a set of realisations 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 to bury 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 'appreciation of cultural logics', and seeing that local practices that appeared bizarre were actually rational to their performers, proved important (interviews, Geneva, 8 July 2008).

In elaborating these realisations 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. The Hewletts document how this came about: when coincidental presence at the 1996 Gabon outbreak proved enlightening and helpful, Hewlett subsequently persuaded WHO through personal contacts to invite him onto response teams for Uganda 2000-2001 and Congo 2003. Subsequently, the inclusion of anthropological perspectives has also been championed by Pierre Fomenty, Katia Roth and others.

As Hewlett and Hewlett (2008) have shown, anthropological perspectives help identify valuable, health enhancing local knowledge and cultural categories which can be blended productively

with scientific knowledge. The focus in this respect is on local framings of disease dynamics. In Uganda, for example, these included the coexistence of both endemic and epidemic ('*gemo*') models of disease. As an Ebola outbreak progressed, the shift in local understandings to their *gemo* framing triggered elaborate social protocols to control the disease, and these were successfully integrated into responses. The incorporation of medical anthropological concepts and tools enabled local knowledge and framings of system dynamics to be elucidated and re-valued. Thus, for instance, explanations of Ebola origins in terms of sorcery, once dismissed, could be shown to make sense in political context. During a Marburg outbreak in Angola, 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 scores. This is a well-recognised phenomenon (Interview, Geneva, July 8 2008), but social science work can nevertheless help elucidate the nuances of particular cases. Anthropological perspectives prove helpful in illuminating how particular aspects of technological/medical/bodily practices intersect with people's views and experiences of wider politics (see Leach and Fairhead 2007).

This narrative underlies an argument for communication and education approaches that take account of, and work with, local framings. Thus non-governmental organisations 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. Hewlett and Hewlett (2008) show how anthropology can help identify local knowledge and practices and their health effects, guiding responses to harness those aspects that are health enhancing, while educating to avoid those that are health-reducing.

Notably, in contrast with the first two narratives, dimensions of knowledge in this narrative include incorporation of anthropological knowledge, and positive valuation of local knowledge. However the latter is usually selectively evaluated according to the tenets of science. Nevertheless Hewlett (2008) reports how local knowledge of Ebola – as in Uganda – adopts plural framings, moving between biomedical and cultural/sorcery based, and epidemic and endemic models. Responses, in this narrative, were able to address this and work with it.

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 emphasises humility and respect for local norms and 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 haemorrhagic fever has to be balanced alongside disease control aims (see also Jeppsson 2002). In this respect, there is a strong emphasis on social justice as a goal in pathways of disease response.

Overall, as highlighted by this narrative, is the need for responses to be locally contextualised and adapted to local circumstances. Context matters and technologies and practices suited to limiting contagion in 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. 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 cause, and are there moments at which something that might correspond to lassa is suspected? How and when do which people decide to go to hospital? Which aspects of hospitals are feared? Within the terms of the 'culture and context' narrative, addressing questions such as these could be critical in facilitating effective responses.

By 2008 Hewlett (pers. comm.) viewed the incorporation of anthropologists into integrated outbreak response teams as institutionalised routine, at least within WHO. This was echoed by the Director of Outbreak Alert and Response Operations (Interview, Geneva, 8 July 2008), who 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 WHO also implied an intriguing 'Ebola exceptionalism' in this respect. They suggested that for no other disease is anthropological knowledge regarded as so important. It could be argued that such apparent exceptionalism may simply reflect institutionalised experience; if a quite different disease had been the focus for Hewlett's pioneering anthropological outbreak intervention, for instance, then this might have become the iconic example in celebrating the significance of anthropology. Apparent Ebola exceptionalism also overlooks the many instances in which anthropologists have been involved productively in understanding and responding to other diseases – from malaria and HIV to onchocerciasis and schistosomiasis. However, the tone of remarks at WHO also dwelt on the 'exotic' nature/culture 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 characteriser.

In this vein, anthropology is constructed as inappropriate or unnecessary for dealing with haemorrhagic fever outbreaks that occur in urban and peri-urban settings – the location of several recent outbreaks, and arguably a prime hotspot for more. Overlooking the early example of successful anthropological engagement with an urban outbreak in Gulu, Uganda (Hewlett and Hewlett 2007) it is suggested that in urban areas 'tradition' has broken down and cultures are fragmented; and - perhaps most significantly - response teams have little difficulty 'getting in'. Equally, anthropology is seen as unnecessary for diseases such as avian influenza and SARS which have taken place in 'globalised cultures' (interview, Geneva, July 8 2008). For such epidemics and settings, instead, it is argued, 'social mobilisation' is sufficient.

WHO staff 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 institutionalised 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. 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.

Evidence that Ebola outbreaks are increasing in frequency and severity underlines the relevance of such longer-term perspectives. Some virologists now argue that identifying and addressing the underlying causes of the emergence of infectious diseases is vital to interrupt potentially dangerous cycles of viral-animal-human co-evolution. Thus 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, as well as on the development of vaccines and antiviral agents, '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'.

As the WHO Director of Alert and Response Operations put it (interview, July 8 2008), with infectious diseases including haemorrhagic fevers, large socio-ecological changes mean 'there is a constant ecological frontline, with the virus exploiting new niches'. One response to the 'potentially infinite number of filoviruses that may be out there', their possible multiplication in a dynamic world, and the uncertainty that this creates, is simply to deploy the outbreak-focused pathways of disease response suggested by narratives 1-3. In this view, addressing each outbreak as it occurs, at source, is what will deter the big, long-term threat that haemorrhagic fevers 'cross a rubicon' to become a major endemic. Thus 'if we had treated HIV like we treated SARS, we might not have what we have now'. This is the dominant perspective in WHO and other major policy agencies. It emphasises strategies of control aimed at stability, and established strategies of response 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 that constitute genuine surprises? Questions also need to be raised about the sustainability and appropriateness of 'rapid response' mobilisation for ever-shifting, more frequent outbreaks, including the strain this may put on institutions and resources. The long-term narrative also points to pathways of research and response that identify and address social and ecological causes of disease and vulnerability, and the longer-term stresses in play.

Within an overall narrative that takes long-term dynamics seriously, narrative variants focus on two particular clusters of underlying causes. As the following sub-sections briefly summarise, these emphasise first, the interactions between poverty, inequality, conflict and the state of health services; and second, the interactions between environmental (including climate) change, land use and society.

(a) Structural violence and health systems

Within a narrative of long-term dynamics, one line of argument focuses on the poverty, inequality and 'structural violence' (Farmer 2003) in regions where haemorrhagic fevers are rife.

In this view, it is no coincidence that outbreaks have been concentrated in places such as the Democratic Republic of Congo, with their experiences of long-term, pervasive and deep poverty and conflict. Declining health systems and overcrowded hospitals in which viruses multiply are one particular manifestation of such conditions. Indeed the notion that 'poor hospitals are key amplifiers' (interview, Geneva, July 8 2008) has long been a central tenet of understanding of the dynamics of Ebola. Conflict is another, as in West Africa where a decade of civil war closed the lassa research unit in Kenema, Sierra Leone and halted regional co-operation in the Mano River Union countries – only recently being rebuilt.

Processes of migration and urbanisation pose particular challenges for addressing haemorrhagic fevers given their capacity to spread very rapidly amongst crowded peri-urban populations. For infectious diseases to 'go loose' in large developing country cities is another of the major 'rubicons' which policy-makers emphasise the need to avoid at all costs. Yet to date, their 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 is needed, towards effective disease responses amidst inevitable mobility.

In this view, tackling haemorrhagic fevers cannot be separated from tackling poverty, conflict and their 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, July 8 2008).

(b) Ecosystem dynamics and climate change

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 that relate zoonotic infectious diseases to long-term environmental dynamics. Thus Jones et al 2008 show that EIDs are increasing, that the majority (60%) are zoonoses, and that of these, 72% 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 hotspots, the forest fringes of West and Central Africa appear.

Such work 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 etc) 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 finds support 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, 2008). 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 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 appear to signal a re-run of 'fortress'

conservation measures, widely recognised 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 2008). Poverty, unemployment, conflict, hunting technologies, the opening of access through logging and extractive industries, and the growth of urban markets for bushmeat are recognised 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, emphasising the expansion of increased securitization of protected areas, the criminalization of hunting and trade, and restrictions on wildlife and human movement. As Hardin (2008) 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 they 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 third factor that has 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 characterised 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, July 8 2008): there are weather or climate 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 and 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, 'outbreak narrative' discussed in this paper.

Yet other strands of work contest and complicate this top-down disease-environment framing, opening up alternative lines of inquiry, the relevance of alternative knowledges, and the possibility of alternative pathways of ecosystem-disease response.

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 1998, Hardin 2008). Research in environmental and climate history suggests far more dramatic responses to past climate changes than has been

appreciated, implying possibly more dramatic future shifts (Maley 2001, 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). Microbiologist Crawford argues further that 'its natural animal host is still unknown and it is imperative that we find it and stop these outbreaks because each new one gives the virus an opportunity to evolve more efficient ways of spreading between people and infecting a larger population' (2007: 188). 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 long persistent at each outbreak locality (Walsh et al 2005). Pinzon et al (2004), using satellite data, showed that the majority of Ebola outbreak events were 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 might provide specific directions to help understand the enviro-climatic coupling of Ebola outbreaks, which might help with 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 which shape people's contact with animals (see Lambin 2008). Here too many questions remain unresolved, and causative patterns are uncertain. The rarity of outbreaks suggests the presence of a rare animal reservoir having few contacts with people. The multiplication of contacts could occur through agriculture or logging, which bring people into closer contact with forest and lead to movement and modification of forest fauna. Yet 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 by dominant narratives and policy convictions of forest loss, 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 'ecotone' where forest meets savanna, where landscapes often comprise mosaics of both kinds of vegetation. 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 leads 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. 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 pathways might be constructed for haemorrhagic fevers.

Investigating these social-land-use-ecosystem interactions requires multi-disciplinary approaches that draw in forms of knowledge and understanding not included in 'outbreak narratives'. The relevant conceptual terrain thus comes to combine environmental science (ecology, natural history, climate science) with social science (anthropology, history) in new, transciplinary approaches. Thus Hardin (2008) combines historical ecology and cultural economy in what she and contributors to a volume on forest viruses term 'socioemergence'. The term is intended to convey viral disease as a socially-emergent phenomenon, intimately entwined with the links between environment and health, and shaped by social actions and ideas that can influence or mediate the details of disease emergence and spread.

There are also key roles for local and popular knowledge – not just of the body as in narrative three, but here, local ecological and historical knowledge, in elucidating long-term dynamics. 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 conceptualise vectors and their interactions, and what metaphors are used 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. Leach and Mearns 1996), and from the 'culture matters' narrative of disease outbreaks outlined earlier. Combining these could yield alternative, locally relevant ecohealth narratives that in turn could underlie appropriate responses, suited to local Sustainability goals.

To the extent that scientific research and international discussion focuses on long-term socio-environmental dynamics, most attempts to pin them down, to shift from ignorance to uncertainty and then to risk and to bring long-term shifts into a realm where they can be understood and controlled. Thus as a medical scientist in WHO put it, 'there is value in putting a risk index on this shifting situation; science is needed, and scenarios'. In other words, the image is of a gradual movement from ignorance to uncertainty and risk. The assumption is that ignorance can be reduced, 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 more flexible, adaptive responses; on robustness (flexible, adaptive response to long-term shifts) as a complement to the resilience to short term shocks already provided by narrative 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 an epidemics focus 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.

Policy narratives about epidemics and emerging diseases are always multiple, and they vary in how they address risk, uncertainty and surprise. Yet in practice, there are several problematic tendencies. First, selective narratives can omit crucial factors and elements of dynamics that are essential to effective and sustainable responses. Second, diverse narratives can contradict each other, in ways that – unless the trade-offs are recognised and addressed - lead to practical problems in implementation. Third, in practice a few narratives tend to dominate, to the exclusion of others. Not surprisingly, these tend to be the narratives of powerful actors – very often to the exclusion of those narratives voiced by or representing the perspectives of marginalised groups.

All these tendencies can be seen in the case of haemorrhagic fevers. Elements of each of the narratives outlined in this paper will undoubtedly have roles to play in the vital task of addressing haemorrhagic fevers in the decades to come, underlining the need for further elaboration of the understandings and strategies implied by each narrative. A deeper understanding of where such diverse narratives have come from, and of the institutional and cognitive pressures and power relations involved in creating and sustaining them, is also needed. This in turn can inform identification of the conflicts, as well as potential complementarities, between different narratives, and ways to address these. For instance, we have seen how outbreak narratives and their central medical and epidemiological precepts have dominated the powerful international apparatus that orchestrates Ebola 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 recognising that 'culture matters' in a positive sense 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 push further towards top-down, globally and security-framed outbreak responses. Integrating across spatial scales is key here, finding ways – in research and policy – to address haemorrhagic fevers as both part of the globally-constituted systems of narrative one and the local systems of narratives two and three. Major challenges also concern how to identify and integrate local narratives when disease dynamics are unfolding in rapidly-changing, apparently more globalised urban and peri-urban settings, not so obviously amenable to 'classic' anthropological approaches.

We have also seen the disjuncture between outbreak narratives that focus on short-term disease risks, aiming 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 fundamental 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 approaches to development and health system-building, as well as 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 'culture matters' narrative, with its emphasis on local knowledge, culture and context, 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 threatening new forms of globally-driven intervention riding roughshod over local concerns. When locally grounded, understandings and interventions tend to be dominated by the formal science disciplines of epidemiology and ecology. Drawing insights from longstanding work on cultural ecology and ethno-ecology, and drawing a concern with local framings more firmly into the emerging field of ecohealth, may offer ways forward for more inclusive/acceptable AND adaptive/robust approaches to dealing with haemorrhagic fevers in dynamic social-ecological worlds.

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