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Biosecurity and globalising economic spaces

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Abstract
This chapter is concerned with the global regulation of animal health. Our case is a recent outbreak of avian influenza in South Africa's ostrich industry. The analysis confirms an important theme in the emerging social sciences literature on biosecurity, i.e. the paradox of control methods that are rigid and inflexible, and diseases that are indeterminate. We also examine a second approach to the outbreak that relied on local experience and knowledge. Our chapter explores the complex ways in which globalizing economic spaces are integrated into new global regulatory regimes, with important implications for economic, social and geographical processes.

Key words: biosecurity, infectious diseases, globalisation, South Africa

Introduction

"Humanity faces many challenges that require global solutions" (FAO, 2008a, 5). This is the opening sentence of a recent policy document aimed at finding an effective framework for reducing the risk of infectious diseases at the animal-human-ecosystem interface. The report is a joint publication of several prominent multilateral agencies including the Food and Agriculture Organisation, the World Organisation for Animal Health (OIE) and the World Health Organisation (FAO, 2008a). The need for a global solution to the problem of emerging infectious diseases like avian influenza is based on the risk they pose to humans and farmed animals around the world. A global response is also seen as necessary given the ease with which viruses are able to cross international boundaries. For these agencies, a global and coordinated response thus represents "an international public good" (FAO, 2008a, 6).

The coordinated and global response to emerging infectious diseases has taken a specific form. The idea and practice of *biosecurity* has quickly become the standard approach to reducing the risk of infection and the method of eradicating diseases from livestock populations (Hinchliffe *et al.,* 2008). Biosecurity in practice is based on establishing barriers to prevent infected animals and other things from entering spaces and coming into contact with livestock that are clean and disease-free. Regulating the movement of the many objects that can carry viruses is therefore central to maintaining a bio-secure environment. When the barriers are breached and infections take root, biosecurity demands the eradication of the virus usually through a stamping out policy and disinfection. Post-infection surveillance is then employed to ensure that the virus has been eradicated. As Bingham and Hinchliffe (2008, 174) have argued this approach to infectious diseases has become "the basis for a standard, worldwide approach to dealing with 'out of place' biological agencies of various kinds".

Through their work on a recent outbreak of highly pathogenic avian influenza (HPAI) in Egypt Bingham and Hinchliffe (2008) have explored the risks of what they call a 'one size fits all culture of biosecurity'. The Egypt case allows them to draw several lessons about biosecurity including how diseases are problematized, the existence of different modes of securing the biological, the difficulties associated with 'biosecuring' livestock from infectious diseases and the interaction between biosecurity and other ecologies of practice. They conclude by suggesting that despite the promises of biosecurity, the international system is vulnerable and prone to breakdown (also see Law 2006).

Bingham and Hinchliffe's (2008) work highlights an important theme in an emerging critical social sciences literature on biosecurity (Donaldson and Wood 2004; Enticott 2008; Hinchliffe and Bingham 2009; Enticott and Franklin 2009). Livestock diseases are difficult to control because they are situated in complex social and economic systems. Yet the mode of controlling diseases is global and premised on a simplified idea of how viruses affect farmed animals and move through commercial farming regions. The problem is best illustrated by the FAO's (2008b) approach to a disease outbreak: "find it fast, kill it quickly, and disinfect". The assumption is that finding a virus, killing it and then disinfecting the livestock production unit is a straightforward and simple task. The experience of veterinarians and animal health experts in attempting to control avian influenza and other emerging infectious diseases suggests that this is rarely the case (Law 2006; Law and Mol 2008). Indeed, the difficulty of controlling avian influenza in Asia has led one prominent veterinary to suggest that we need to find ways of 'learning to live with H5N1' (Sims, 2007).

Through our case study of a recent outbreak of avian influenza in South Africa's commercial ostrich industry we hope to build on this important theme in the literature on biosecurity. The ostrich case confirms the paradox of control methods that are rigid and seemingly inflexible, and diseases that are indeterminate. At the same time, the ostrich case reveals the potential for alternative approaches to disease control that draw on local experience. In this way, the paper responds to Kezia Barker's (2008, 1611) call to highlight approaches to biosecurity that are "more mobile, flexible, complex, and decentred".

The paper unfolds in two sections. In the first section, we discuss the outbreak of avian influenza in South Africa's ostrich sector and we describe the efforts by the National Department of Agriculture (NDA) to control and eradicate the disease. A key theme in this section is the extent to which the NDA followed international protocols for disease control and eradication. At first glance, the eradication of the disease suggests the successful implementation of the global strategy: it seems show how it is possible to meet the international goal of "embedding global concerns within a local context" (FAO, 2008a, 6). The second section of the paper suggests a more complex interpretation. In this section we provide a more detailed analysis of avian influenza in ostriches and the progress of this disease outbreak to confirm the problem of a global, one size fits all strategy to disease control. We also explore an alternative mode of control that is more in tune with local knowledges and concerns.

This chapter draws on scientific writing on avian influenza in ostriches and interviews with veterinarians, Department of Agriculture officials, and ostrich farmers in the Eastern and Western Cape, South Africa. The chapter hopes to contribute to this volume by examining the complex ways in which globalizing economic spaces are also integrated into new global regulatory regimes, with important implications for economic, social and geographical processes.

Eradicating avian influenza 'by the book'

In August 2004 South Africa reported its first outbreak of highly pathogenic avian influenza. The outbreak was not located in the country's large and industrialized chicken industry, but in the more specialized commercial ostrich sector. South Africa's ostrich industry has existed for over a century and is a dominant player in the global trade of feathers, high quality leather and low fat ostrich meat. The traditional heartland of the industry is in the Western Cape around the town of Oudtshoorn, but since the mid-1990s farming and processing has spread to the Eastern Cape and Northern Cape provinces (Figure 1). Despite the spread of ostrich farming to these two provinces, the Western Cape has retained its dominant position in terms of ostrich production and processing. The 2004 outbreak of avian influenza was first detected in the Eastern Cape, the second most important province for the production of ostrich products.

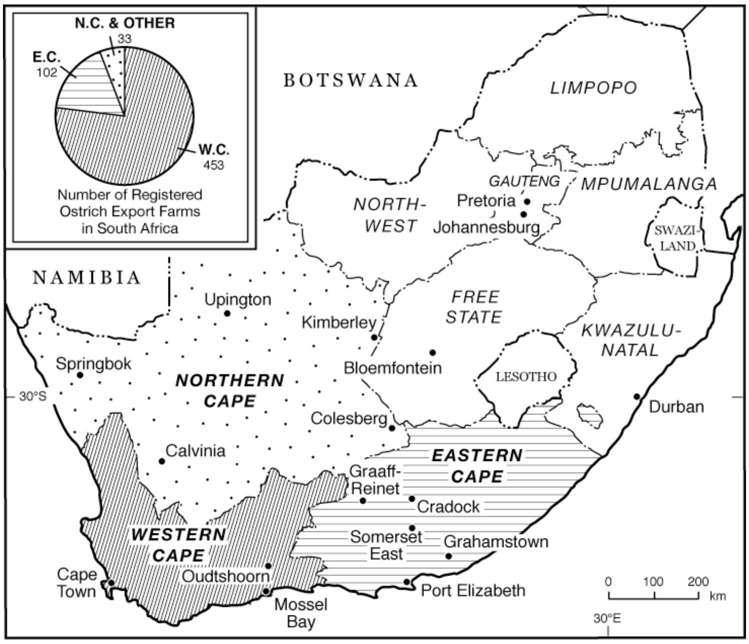

Figure 1: Registered ostrich farms in South Africa.

The response of the NDA to the outbreak in the Eastern Cape was strictly in line with international guidelines and protocols. International best practice in disease control requires the establishment of a local disease control centre. Several days after the outbreak was confirmed the NDA set up a Joint Operations Centre (JOC) in Somerset East, close to the location of the farm where the disease was first detected. Three concentric zones were drawn around this farm: a 5 kilometre infection zone, a 10 kilometre quarantine zone and a 30 kilometre surveillance zone. Roadblocks were set up to prevent infected ostriches from moving outside the surveillance zone and spreading infection. Within the zone all ostriches were tested for signs of infection, either through blood samples or tracheal swabs. Sampling for evidence of infection was not restricted to ostriches: the JOC was concerned about the potential spread of the H5N2 virus to other species and so blood and swab samples were taken from chickens, turkeys and geese in commercial and backyard flocks. Wild birds –when they could be found or shot – were also tested or autopsied for evidence of infection. On farms where there was evidence of infection ostriches were culled and buried in large pits on the farm. By the end of December 2005 the JOC had arranged for the destruction of almost 30,000 ostriches.

While there is currently debate within the veterinary community about whether culling is the most effective means of controlling livestock diseases, there seems to have been little discussion within the NDA on the appropriate method of controlling this outbreak. For the NDA this was a serious disease outbreak with potentially devastating risks to humans and other livestock farming industries in South Africa; as such it required a decisive response. The NDA was also concerned that the virus might lead to an outbreak of avian influenza in South Africa's industrial chicken sector. While the science on the transmission of avian influenza from ostriches to chickens is uncertain, the commercial chicken industry is the largest of the country's agri-food sectors with significant linkages into grain production and retailers (fast food outlets and supermarket chains). It is also a supplier of cheap protein to poor South Africans and the industry makes much of the role it plays in food security. Protecting the interests of the large industrial chicken producers was an important priority for the NDA. Indeed, during the culling operation the large industrial poultry companies congratulated the Department on their 'decisive approach' to the disease.

But perhaps the most important factor in the Department's decision to cull was the World Organisation for Animal Health's rules on how a country can re-establish disease free status and resume exports. When a country reports an avian influenza outbreak it can resume exports "3 months after a *stamping out policy* (including disinfection of all affected establishments) is applied, providing that surveillance has been carried out during that three-month period" (OIE, 2008). The implication of this policy is clear: the quickest way of re-establishing exports is to cull infected animals, disinfect farms and demonstrate through surveillance that the disease has been eradicated. Any other approach involves a much longer period of isolation from export markets with a correspondingly more serious impact on agri-food exporters.

In late 2005, just over a year after the outbreak was first discovered, the NDA was able meet the OIE's criteria for disease free status and ostrich exports resumed. A national surveillance programme showed no signs of infection and the Department concluded that the disease had been eradicated. Their official statement reflected the difficulties of managing emerging infectious diseases: the avian influenza outbreak had been eradicated making "South Africa one of the few countries in the world to have ever achieved this tremendous feat" (Department of Agriculture 2005).

The control of avian influenza in South Africa's ostrich industry seemed to vindicate the use of standard operating procedures. It appeared to suggest that by following the global strategy of 'embedding global concerns within a local context', the NDA had been able to eradicate a potentially serious zoonotic disease. Yet a closer examination of the outbreak reveals a more complicated story, which raises questions about the effectiveness of the one-size-fits all approach to animal health.

A messy and complicated disease

In this section of the paper, we provide a different perspective on the avian influenza outbreak in ostriches to support our two key arguments. These are: a) disease outbreaks in livestock sectors are usually complicated and messy and very often cannot be controlled through a straightforward 'find it fast and kill it quickly' approach; and b) that the potential exists for alternative disease control methods. The remainder of this section examines these two themes in turn.

Avian influenza in ostriches

The 2004 outbreak of highly pathogenic avian influenza in South Africa's ostrich sector was the first time the industry had been affected by a notifiable disease. It was not, however, the industry's first experience with avian influenza. Ostrich farmers have considerable experience with a disease that has affected their flocks since at least the early 1980s (Allwright *et al.*, 1993). Ostriches affected by this syndrome suffered from respiratory difficulties, excretions of mucus from the nose and eyes, and green urine. Infections tended to occur in late winter and were more severe with colder and wetter weather. Ostriches could, and did, die from the disease. But in many cases these large birds were able to recover from an infection. In some cases the impact of the disease was so mild that the infection was discovered through routine surveys rather than through farmers reporting sick and dying birds. There was also a strong age factor associated with mortality: younger birds were far more likely to succumb to an infection while older breeder birds rarely died from the disease.

Environmental factors played a very important role on the impact of the disease. Flocks that were under stress due to overstocking or poor feed regimes usually had a much higher mortalities rates than was the case for flocks that were better managed. The impact of management practices on bird mortality during an infection explains why one response to the disease involved isolating sick birds from the flock and providing them with extra feed and a stress free environment in the hope that they would fight off the infection.

In the early 1990s the disease that ostrich farmers associated with respiratory problems and green urine was identified as low pathogenic avian influenza. Subsequent infections in the 1990s and 2000s led to the isolation of a wide range of low pathogenic avian influenza viruses including H7N2, H5N9, H5N2, H6N8, and H10N1 (Olivier, 2006).

Scientific writing on avian influenza in ostriches since the late 1990s has confirmed ostrich farmers' experience with the virus. In one laboratory experiment, ostriches challenged with highly pathogenic avian influenza became infected with the virus but showed no symptoms of the disease (Manvell *et al.*, 1998). A more recent report of an outbreak of highly pathogenic avian influenza in ostriches in Italy has confirmed that the birds have some immunity to highly pathogenic avian influenza (Capua *et al.,* 2000; Clavijo *et al.,* 2003; Mutinelli *et al.,* 2003). The Italian case also confirmed that mature birds are less likely to succumb to the virus. The scientific evidence combined with the ostrich farmers' experience strongly suggests that ostriches respond in complex ways to a challenge from an avian influenza virus. Significantly, the research also suggests that the current distinction between high and low pathogenic avian influenza viruses is not applicable to this large poultry species.

The 2004 avian influenza outbreak was the first recorded outbreak of highly pathogenic notifiable avian influenza. It had led to the closing of export markets with significant loss of revenue for the industry. Yet in many ways its impact on ostrich farms was very similar to previous outbreaks of low pathogenic avian influenza. Mortality rates were very high on the farm where the outbreak was first detected, but this was also a farm where management practices were poor and where the farmer had recently introduced a new (and lower quality) feed mixture. The birds were kept in feedlots in very high densities, which would have increased the stress of ostriches and increased their susceptibility to the virus. On other ostrich farms where the management practices were better mortality rates were far lower. And on several other farms, there were no mortalities at all and no signs of infection despite positive test results from local veterinary laboratories. Finally, mortality rates showed a familiar age pattern. While mature birds were largely unaffected by the disease, mortality rates were higher amongst younger birds and chicks. As was the case in previous avian influenza infections, environmental and management factors played a key role in the disease's impact.

The complexity of the disease created significant problems for the JOC, which was committed to eradicating the disease according to standard operating procedures. For example, they had a very difficult time convincing farmers that ostriches with no clinical symptoms had tested positive for highly pathogenic avian influenza and needed to be destroyed. They also faced the challenge of convincing farmers on the need to cull older breeder birds, when past experience (and scientific evidence) suggested that they rarely succumb to the disease. The JOC's problems were compounded by inconsistent and confusing laboratory results. In some cases sick and dying birds tested negative for avian influenza while birds that seemed healthy showed clinical signs of having been exposed to the virus. In other cases tests from one laboratory suggesting and infection were contradicted by another laboratory, which found no signs of infection. Finally, and most worryingly for the JOC, in late December 2004 there was growing evidence that the virus had spread to the Western Cape, the heartland of the country's ostrich industry. The outbreak was proving more resilient than they had expected and their efforts to bring the disease under control and eradicate it within the Eastern Cape had failed.

The problems facing the JOC are not unique to this outbreak of avian influenza in ostriches; they are, on the contrary, common to most efforts to control viruses that progress through livestock populations. The 'one size fits all culture of biosecurity' clearly underestimates the complexity of viruses and their relationship to farmed animals and local production systems. In a very real sense, the 'find it fast, kill it quickly' approach to emerging infectious disease sets up false promises of what is possible in disease control and eradication.

Alternatives

In December 2004 the NDA confirmed that the virus had spread to the Western Cape, the centre of South Africa's ostrich industry. While it seemed logical that the NDA establish a new local disease centre in the Western Cape, the provincial veterinary service decided to manage the disease on its own; significantly, their approach to the virus outbreak was different.

The approach to the avian influenza infection in the Eastern Cape involved the standard approach of eradicating the virus around a central point and then surveying farms in the immediate vicinity for signs of infection. All ostriches that had been exposed to the virus were culled. In the Western Cape, in contrast, the approach was to quarantine farms where laboratory tests indicated an infection. If the disease persisted on the farm and there were high mortalities, the birds were slaughtered. However, if there was evidence that the virus was running its course, the birds were not culled and were given time to recover from the infection. When birds were culled, this was done in a selective way. Rather than culling all of the birds on a farm, the culling was restricted to animals that were being raised for their meat and skins. The larger breeder birds, which are very important to the sustainability of the farm and indeed the broader ostrich industry, were not destroyed.

The Western Cape's approach was clearly based on their previous experience with avian influenza in the ostrich industry. From their perspective, there was nothing to suggest that this apparently more virulent strain was affecting industry any differently. As such, it could be managed in the same way as previous infections – through quarantines and restrictions of movement and by culling on farms where the virus was not running its course. The decision not to cull the large breeder birds was based on their importance to the industry and previous experience with the disease that showed they were largely immune to the virus.

What allowed the Western Cape to manage the disease differently? Although the NDA is responsible for managing infectious diseases, they rely on provincial structures to do the eradicating. This was what happened in the Eastern Cape's ostrich industry between August and December 2004. The NDA established a JOC, but the responsibility for eradicating the disease and coordinating the subsequent tasks of disinfection and surveillance was left to the provincial veterinary services. The prominent role of provincial veterinary services in disease eradication was an outcome of South Africa’s post apartheid constitutional process. During apartheid there was one centralised veterinary service. In the mid-1990s, however, the country’s veterinary infrastructure was restructured and nine new provincial veterinary services were established. These nine veterinary services are funded through budgets that are determined by the provinces themselves. In practice, this has meant that veterinary services at the provincial level vary considerably in terms of their capacity to manage livestock diseases. In the Western Cape agriculture is a very important economic sector, and as a relatively prosperous province, the veterinary service is comparatively strong and well-funded. The existence of a strong and decentralised veterinary service was the key factor in allowing the Western Cape province to manage the disease differently.

The different approach to the disease by the Western Cape veterinary service caused consternation amongst Eastern Cape ostrich farmers. Those that had lost birds through the culling process were justifiable aggrieved that the infection was managed less bluntly in the Western Cape. They were particularly upset that Western Cape farmers had been able to retain their breeder birds, which represent an important genetic resource and are also vital in terms of the sustainability of the industry.

The different approach to the avian influenza outbreak in the Eastern and Western Cape provinces highlights the problem we have identified in the global response to emerging infectious diseases. In the Eastern Cape the approach to avian influenza was strictly according to international standard operating procedures. The NDA established a local disease control centre to find the disease quickly, eradicate it and disinfect farms to allow production and exports to resume. By following this method the NDA hoped that the outbreak would have only a limited impact on this export dependent industry. The disease proved to be more complex than they had expected: the virus affects ostriches in ways that were surprising to the JOC, but largely in line with farmers’ previous experience and scientific research. It also proved difficult to contain the disease and three months after the initial infection was discovered in the Eastern Cape, the virus had spread to the Western Cape.

Rather than eradicate the disease according to international guidelines, the Western Cape veterinary service managed the outbreak in a way that was consistent with their local previous experience of avian influenza. This was a disease that affects ostriches in complex ways and its impact is shaped by environmental and management practices. Approaching the diseases differently was, however, costly for the industry. As noted earlier, the quickest way back into international markets following an outbreak of avian influenza involves stamping the disease out, followed by disinfection and surveillance. Allowing the disease to run its course in the Western Cape resulted in a longer period of exclusion from export markets. But from the perspective of Western Cape ostrich farmers this may have been an acceptable cost as this approach allowed them to retain their valuable breeder birds.

Conclusion

The focus of this chapter has been on an emerging regime aimed at regulating animal health in globalised livestock spaces. This new regime privileges a particular approach to animal health centred on the practices and techniques associated with the idea of biosecurity. Our argument is that this ‘one size fits all culture of biosecurity’ (Bingham and Hinchliffe 2008) underestimates the complexity of livestock diseases.

The viruses responsible for emerging infectious diseases reproduce and spread in a wide range of environments with different management practices, which in turn shapes infection patterns and ultimately raises questions about the likely effectiveness of a ‘find it fast, kill it quickly’ approach to disease outbreaks. The 2004 outbreak of avian influenza in the Eastern and Western Cape provides a convincing case for this argument.

The single solution to emerging infectious diseases depends on a centralised veterinary structure. In South Africa the veterinary structure was decentralised with provinces taking responsibility for the management of livestock diseases. This explains the difference between the Eastern Cape and Western Cape approaches to the avian influenza outbreak in ostriches. While the approach to the disease in the Eastern Cape followed international best practice, the Western Cape veterinary service managed the disease differently. Rather than cull animals on and around infected farms, they quarantined ostrich farms hoping that the disease would run its course. Culling was an option of last resort in cases where the infection persisted and where mortalities were high. The Western Cape’s approach to the disease was informed by local experiences with avian influenza in ostriches (and is also supported by scientific research).

What are the implications of this case for the management of emerging infectious diseases in an increasingly globalised world? An obvious conclusion is the question it raises over the one size fits all approach. Livestock diseases are complex and are shaped by local contexts. Control efforts should, therefore, draw on local knowledge and experience. Yet the large multilateral organisations pushing towards a global and coordinated approach are strongly opposed to methods that are informed by local experience and practice. And they are able to enforce their position through a set of regulations that effectively punish agri-food exporters attempting anything other than the standard approach to disease management. The space for questioning these global regulatory regimes does, however, exist and is located mainly within the community of veterinarians who have hands on experience in attempting to manage livestock diseases in context.

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