

Climate change raises the disease threat

One of the unexpected effects of climate change may be an increase in new infectious diseases which could target native wildlife and stock, as well as humans. In September this year Australia's leading biosecurity managers and researchers met at a forum in Canberra's Parliament House to discuss the emerging threats.

Despite major medical advances over the last hundred years humans are still at the mercy of new infectious diseases. Australia has seen more than its fair share of emerging disease issues. Most incidents have been quickly controlled or have had limited impact, but some have been more critical. Recently, equine influenza was introduced with visiting racehorses, the Hendra virus killed three people in three distinct outbreaks after moving from bats into horses and humans, and the introduced chytrid fungus has also hit our frog populations hard.

Overseas there have been a series of incidents that serve as a warning of what may come. Hendra's relative – Nipah – has appeared around South-East Asia and is now reported to be spreading from human to human in Bangladesh; the sheep virus, bluetongue, has extended its range into northern Europe; and, another virus, chikungunya, has spread across the Indian Ocean infecting 30 per cent of the population of some islands and killing hundreds of people.

'On average, the past three decades have seen the emergence of one new disease a year,' says Dr Julie Hall, communicable diseases expert with the World Health Organization, 'but the incidence of new events is rising.'



And this is not just an outcome of increased awareness or reporting, says Dr Peter Daszak, Director of the Consortium for Conservation Medicine in the USA. Apparently climate change, along with increasing populations, overuse of antibiotics and global trade and travel, can affect both the likelihood of a new disease emerging and the opportunity for diseases to spread to new populations.

Emergence scenarios

The rate of new disease emergence is increasing as populations of both humans and livestock rise. New diseases are most likely to emerge where people are living in high density areas and in close contact with livestock, increasing the probability of transmission.

Dr Hall warns that the increasing prevalence of natural disasters associated with climate change also increases the risk of disease outbreaks associated with overcrowding, poor hygiene and poor health in disaster areas.

Spread risks

Large-scale movement of people, livestock and goods, as well as wildlife, means diseases can quickly travel from country to country and continent to continent.

One of Australia's major initiatives is to build the capacity of neighbouring countries to detect and manage infectious diseases. Here, the Australian Quarantine and Inspection Service trains Papua New Guinea authorities and beekeepers in surveillance for the varroa mite. Luke Halling, Australian Quarantine and Inspection Service

Diseases also spread without direct assistance from humans as climates alter. Increasing temperatures and changes to habitat caused by climate shifts are allowing the spread of pathogens, disease hosts and vectors (carriers) from current disease hotspots to other areas. New diseases may come to Australia as our climate changes.

At the forum, Dr Moira McKinnon, public health physician and member of the Australian Biosecurity Cooperative Research Centre (CRC) for Emerging Infectious Disease, highlighted the threat to Australia of chikungunya – a virus that has a surprisingly low profile given that it has infected millions of people and killed many hundreds. It occurs in Africa and South-East Asia and there has been one outbreak in southern Europe.

We don't have chikungunya in Australia, but we do have one of the host mosquitoes, *Aedes aegypti*. A recent single change in the

genetic makeup of the virus has increased the severity of the disease, enabling it to be carried by the Asian tiger mosquito, *A. albopictus*.

'Asian tiger mosquitoes are very aggressive and can also carry a number of other serious diseases such as yellow fever and dengue virus. They have been found in the Torres Strait, and with climate change they are likely to spread to the Australian mainland, potentially carrying chikungunya', reports Dr McKinnon.

Bluetongue is a viral disease carried by midges which bite and infect livestock, particularly sheep, causing haemorrhaging of the oral and nasal tissues and swelling of the mouth, thereby reducing feeding. According to Dr Martyn Jeggo, Director of CSIRO's Australian Animal Health Laboratory, its range has increased in the past two decades. 'This is a result of the warmer and milder winters of recent years which are more suitable for the survival of the midges that can transmit bluetongue virus.'

The disease was first found in midges in Australia in 1986, but we don't see cases of infections in sheep in Australia. This is primarily because the infected midges are found in warm and wet areas of north and north-eastern Australia while sheep are predominantly farmed in the hotter and dryer inland. But as temperatures in Australia rise, and rainfall patterns alter, we may find that the midges spread to where the sheep are.

Tackling disease threats

Many speakers at the Canberra forum emphasised the need to take a 'one health' approach, and treat diseases in livestock and wildlife with the same regard as we do human diseases. There are many links between diseases of humans, wildlife and livestock. In fact, three-quarters of new and emerging human diseases have links with animals and, surprisingly, many of them come from bats. So researching and managing animal diseases is an important component of the public health program.

Our approach to controlling infectious diseases must also be based on good science.

When avian influenza hit the news, the US Government approached it entirely the wrong way, says Dr Daszak. 'They focussed on the flight paths of migratory birds. Yet, scientific analysis by the Consortium for Conservation Medicine showed that migratory birds represented only two infection bird-days per year,' he says.

The research highlighted that a much



The Australian Animal Health Laboratory (AAHL) is a national centre of excellence in disease diagnosis, research and policy advice in animal health. CSIRO Livestock Industries



The dengue mosquito (*Aedes aegypti*) is found in Australia and can spread the chikungunya virus. Australian Biosecurity CRC & Paul Zborowski

greater risk of infection came from the poultry trade with Canada and Mexico because they were less rigorous than the USA in their trade with countries in which avian influenza had occurred. When the results were published in the *Proceedings of the National Academy of Science*, the US Government changed its surveillance focus for the virus.

Science can also be used in assessing risk and modelling future disease patterns, for example, as temperatures increase as a result of climate change.

Dr Stephen Prowse, CEO of the Australian Biosecurity CRC and host of the Canberra forum, says, 'It is not a lack of data that is the problem. Rather, we have so much information to sift through that it is difficult to manage.'

At the forum, Dr Prowse launched a new initiative, the Biosecurity Risk Intelligence Scanning Committee (BRISC), a panel of emerging disease experts who will scan reports from around the world and advise scientists, emergency managers and policy makers on emerging threats.

What, then, is the major emerging



Bats, such as this little red flying fox (*Pteropus scapulatus*), are the source of a number of emerging infectious disease agents such as Hendra virus. Australian Biosecurity CRC & Raina Plowright

infectious disease threat? The answer is the experts don't know – it could be an existing disease, or it could be something new.

What we have learned from previous outbreaks is to expect the unexpected. And that means building up our capacity, and the capacity of other countries in our region, to respond – to whatever arises. Fortunately, Australia has leading expertise to draw on in our preparations.

● Margie Beilharz

More information:

Australian Biosecurity CRC, <http://www1.abrc.org.au/>

CSIRO Australian Animal Health Laboratory, <http://www.csiro.au/places/AAHL.html>

Consortium for Conservation Medicine, <http://www.conservationmedicine.org/>