Changing and increasing biosecurity risks to food and nutrition security

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ABSTRACT

Australia's biosecurity system protects us and the things we care about – including agriculture and the economy, animal and plant health, the environment and social amenity, and human health – from invasive pests. The nature of the risk from invasive pests is constantly changing, and almost invariably increasing, so the biosecurity system becomes ever more important. But what is the system? How does it work, and will it work the same way in the future? What is our role in it – and how can we best support it? Surely, it's all someone else's problem? This overview presentation will review the current and future impacts of emerging biosecurity threats to plant and animal production and human health and biodiversity. The four speakers in this session will pull out trends in the emergence and spread of plant and zoonotic diseases and identify key factors that both promote and reduce disease spread. We will tease out the threats to food security, nutrition and human health that arise from inadequate biosecurity understanding and management, and show how phytosanitary control and best-practice management can materially reduce biosecurity risks for the land-manager and the landscape. The biosecurity system is no longer just AQIS standing steadfast at the border, and perhaps it never was really that simple. But we need to change the way we think about biosecurity as a system of organisations, as a regulatory framework, and as an outcome. The increasing interconnectedness of consumers and international markets means that we are now all stakeholders of and participants in the biosecurity system. Changing trade patterns, changing global alliances, and changing climate all press us to think and act today! How will we get there?

The giant African snail (Figure 1) grows up to a kilogram in weight and is 20 or maybe 30 centimetres in length. An hermaphrodite, it lays 1200 eggs after

Figure 1. Two giant African snails, *Achatina fulica*, cover an adult hand and wrist. *Photo: Scott Burton/AP.*

This record has been prepared from a transcript and the slides of the presentation.

mating, and is highly polyphagous, meaning it eats lots and lots of species of plants. I could add that its slime is highly corrosive and it spits venom 10 metres … but those are not true. However, it is a 'bastard', and we do not want it to get into the country because it is going to eat a lot of our highly valued crops and rainforests. For this talk, this is my example of the threat to biosecurity – the giant African snail.

In the old days I would talk also about zoonoses, familiar to us now. I would talk about bird flu, and swine flu, and Ebola, and mad cow disease, and so on, because to statisticians like me these are really riveting topics. I would finish with the grandparent of pandemic pulchritude, Spanish flu, H1N1, which infected half a billion people, killed 50 million, and laid waste to the world population about a hundred years ago. And I would invite the audience to think what would we do if one of those came around today.

And now we know: we would sit in our homes, and we would Zoom! And we would get vaccinated. ('Grandad, what did you do during the pandemic?' 'I sat at home, and I got vaccinated.')

This new threat, COVID, focuses the mind. It has changed the way we live on the globe and the way we interact. I am predicting that this change is permanent, and that this represents a watershed moment for us to think about what biosecurity means, and what it does for us and what it doesn't do for us, and who it does for and who it doesn't do for, and whether that matters – and if so, why? And I am going to claim that it does, and I am going to claim it is very material. I am going to use this whole exercise of 'what did we do during the pandemic?' as a framework for talking about biosecurity and why I think it matters, and what the key question is.

COVID shows us that the threats against which the biosecurity system is aligned are generational threats, definitional threats. With 500 million people infected, and more than five million people dead, and all of us in our bunkers, it is safe to say that this disease is going to stay with us.

Whether it is a zoonosis or not does not matter. It is a pathogen against which biosecurity could have done a better job protecting us. Not our biosecurity, but somebody's. Biosecurity is before everything we care about. Human health, environmental health, food safety, agricultural exports, conservation biology, our way of life: they are all predicated on biosecurity.

What is biosecurity?

What is biosecurity? This is not a trick question, yet, but I want to convince you that it is an extremely important question to ask, because the answer tells us not only something really important about biosecurity, but it also tells us something really important about ourselves, and it also tells us something really important about what we are doing.

First, why is it important? Threats are here, and threats are continually increasing. Supply chains are incredible organisational operational achievements of multiple multi-layered societies. They provide us with unmeasurable goods

and services, seamlessly and efficiently, but they are also unparalleled vectors for pests and diseases. Every success that we can pin to a supply chain is linked hand-in-hand with a threat. The images in Figure 2 show that there are very few places in the globe that are not connected to somewhere else quite intimately. And this is our vulnerability.

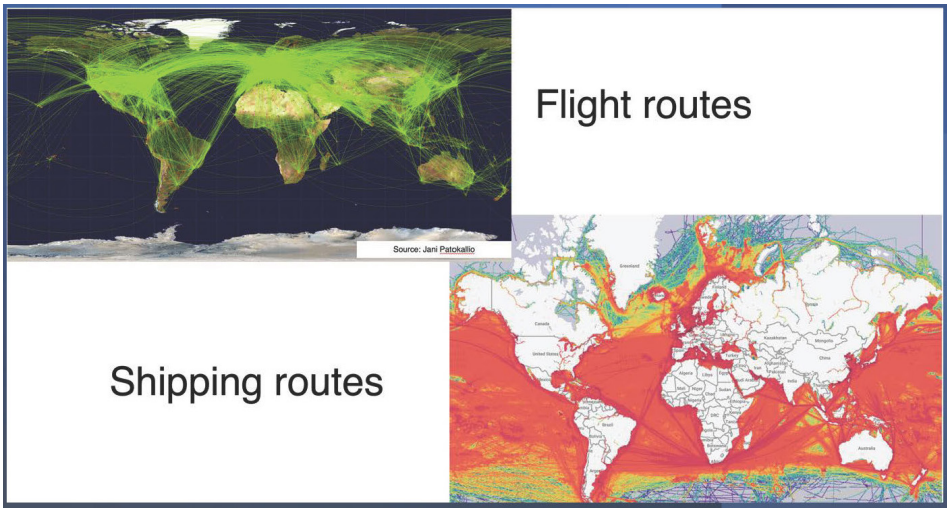

Figure 2.

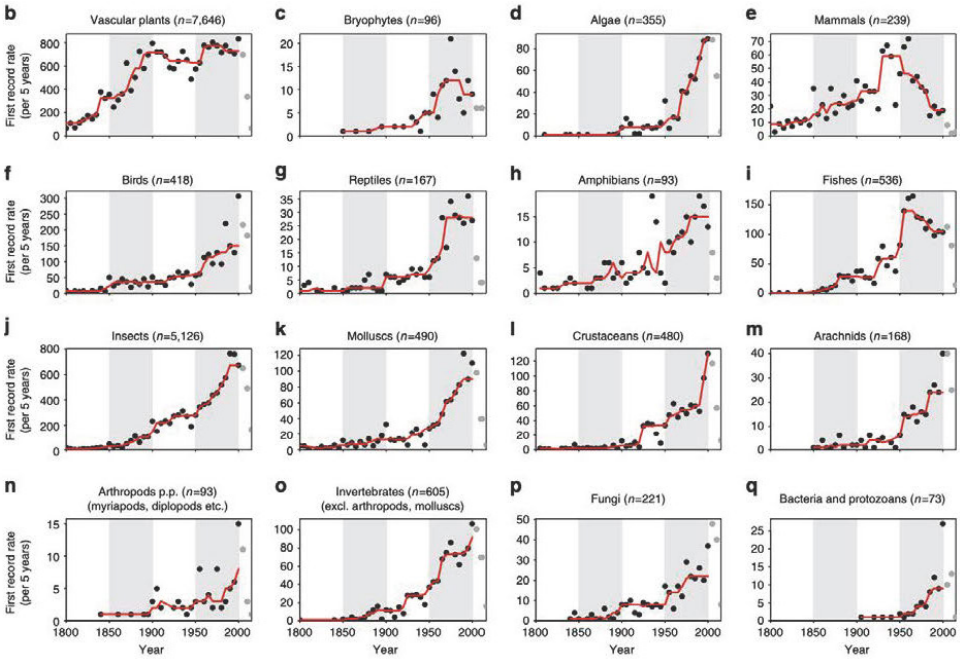

Figure 3. Numbers of various types of pests being intercepted at borders, or detected post-borders. *Source*: Seebens *et al.* (2017).

The vulnerabilities have material impact. The graphs in Figure 3 plot the numbers of different types of pests being intercepted at borders, or detected post-borders, and you'll notice that they are all shaped like hockey sticks; they are all accelerating, and it is all because of what we humans are doing. (Yes, there is some other 'noise' in the graphs: wind-blown or tide-carried stuff here and there, but they do not change the main picture.)

It is us. We are the big biosecurity threat: you and me.

I want to explore this question about biosecurity, and I will give three answers to it. There is a humdrum answer, and a popular answer, and the right answer!

The **humdrum answer**: according to the websites, biosecurity is the suite of activities undertaken by stakeholders to reduce the impacts of invasive species. Impacts of invasive species occur upon plant production, animal production, environmental health, human health, and social amenity, … .

Some of my team of statisticians and I decided that it was time to put a value on the biosecurity system, and in order to do that we had to figure out what are the values that biosecurity protects. We came up with 16 different values, 16 different dimensions of value that we were measuring the system for. Those listed just above are only five of these values, and there are another 11 as well.

The threats to some of those five values (Figure 4) have been pointed out already today. Plant production is affected by fall armyworm – it is here; and *Xylella fastidiosa* (which sounds like a Harry Potter spell!) is quite a material threat as Pablo Zarco-Tejada pointed out earlier. Animal production is impacted or threatened by foot-and-mouth disease, which is not here yet; high pathogenic avian influenza is here all the time. Environmental health is affected by myrtle rust; it is here, but not the bad one; the bad one is still on its way; and *Xylella* again. Human health is affected by COVID, Ebola, SARS. Social amenity is affected by red imported fire ant. And similar lists can be made for the 11 other values as well.

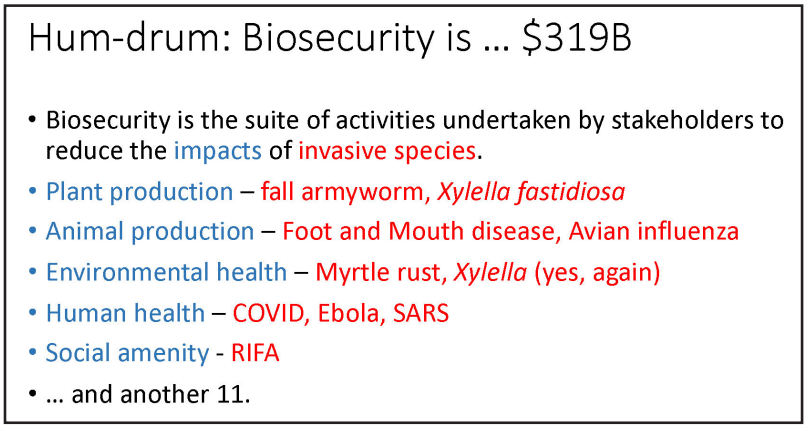

Figure 4. Threats (in red) already known to five (in blue) of 16 values being protected by biosecurity.

Figure 5. Steve Irwin was the face of AQIS advertising about border quarantine.

Therefore, the biosecurity system is starting to sound pretty good, because it is protecting all these amenities from all these threats. It is not giving total protection of course – that is impossible – but it is impeding them. We estimated the value of the biosecurity at around $319 billion over a 50-year timespan, and that the return on investment for biosecurity spend, just at the federal level, is around 30:1, and that the value of the goods and services being protected – just the environmental ones – is $6.5 trillion. This is a very material undertaking!

The problem with the humdrum definition, to my mind, is that it is trying to define the biosecurity system through its actions. That is not quite adequate.

My second definition is **the popular answer**: biosecurity is border quarantine. Many will remember Steve Irwin (Figure 5), the conservationist co-owner of Australia Zoo and a popular TV personality who died in 2006. Steve Irwin told us 20 years ago that if you try to bring stuff across the border you will get caught, and if you get caught there is a 'bloomin' big fine. He was advertising for AQIS [Australian Quarantine and Inspection Service], and it is still on YouTube. Like the Men of the Night's Watch in the more recent *Game of Thrones* television serial, the staff of AQIS were at our borders, protecting everyone from all the ills of other countries.

However, this popular answer is problematic as well. We cannot outsource biosecurity. We can arm the regulators, we can inform the stakeholders, and we can feed and house the scientists and give them regular distemper shots. But it takes more than border protection by AQIS (now renamed) to stop the pests. It takes more than the government. We need to do more.

The next three speakers will give you example after example of how biosecurity relies on a **community focus** and demands a mindset shift, not only from the community but also from the regulators. Irene will tell us about banana pathogen and the technical and behavioural strategies that are necessary to resist it. Chris is going to tell us what we need to do to support livelihoods at the regional level under attack from the fall armyworm; and Tarni is going to share

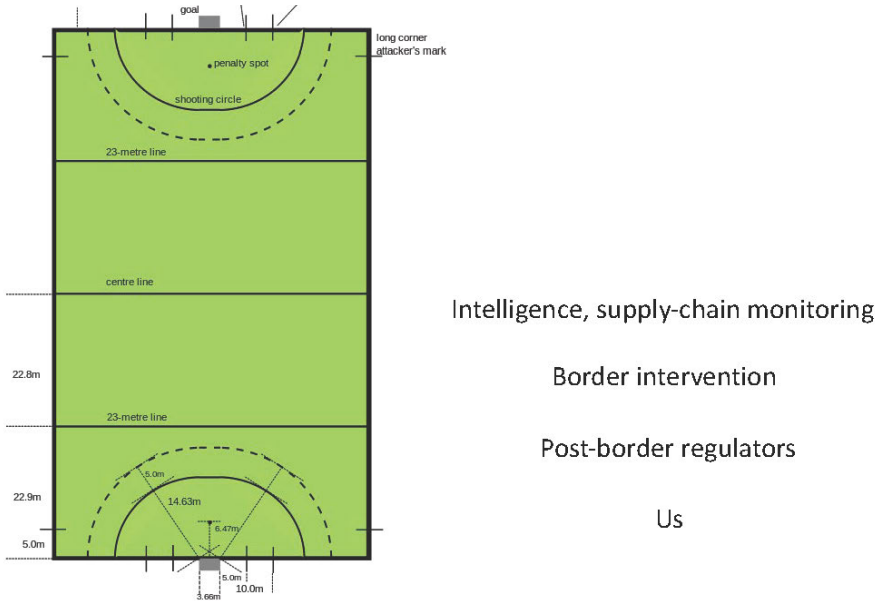

Figure 6. Effective biosecurity illustrated using a hockey field and team as analogy.

key insights into the global response to African swine fever. The common factor in all three presentations is people: people suffering, people planning, people doing things.

If we are going to activate and motivate the biosecurity system, we must get away from thinking there is an AQIS 'security blanket'. We are not protecting the stakeholders; we *are* stakeholders; and we need the stakeholders to understand what their active role needs to be, if they care about it. We assume they do, but we just run on that assumption. And is that right?

The right answer

My third answer is 'the right answer' for the biosecurity system, using the positions of the hockey field (Figure 6) as an analogy – not perfect, but instructive for thinking about the biosecurity system.

- There are the Forwards. In the biosecurity system, they are offshore; they are collecting information; they are helping harden supply chains; they are giving us what we need, to know what the environment is like.
- Then there's the Midfield, which is the Australian border. That is where AQIS (now the Department of Agriculture, Water and the Environment, DAWE) is working, in the midfield.
- The stakeholders, the jurisdictions are the Backs.
- And the Goalie is all of us, everybody.

The reason why this is a good analogy is, first, because we are all on the field. Everybody is 'on the field' in the biosecurity system. This is not you being protected by a system that is external to you. Instead, you are part of it.

Figure 7. All of us need to be engaged in best management practice (BMP) in biosecurity.

The other reason it is a great analogy is that the game does not end when a goal gets scored. You keep on playing. The analogy is not perfect, in that we do not have oranges at half time – or not while we are keeping citrus canker and huanglongbing out of the country! In short, to me, the biosecurity system is like a game of hockey, and we are in the goal. We are the last line of defence: all of us; not somebody else.

We can use that model to inform the activities that a biosecurity system, including us, could undertake in order to improve its performance (Figure 7).

- The Forwards could be tracking and predicting global pest movements:
  'Where are they now?
  Where are they going?
  Let's look at trade pathways; let's look at vulnerabilities; let's look at supply chains; let's make sure that no pest sneaks up on us.'
- The Midfield, DAWE, can manage pathway risks via regulation; not managing consignment risk, because that is impossible. They can be managing pathway risks and verifying such management by selective intervention at the border, because if you try to inspect everything you would simply bring the ports to complete stillness.
- The Defence, this is the states and territories, can study the imminent arrivals. We know that lumpy skin disease is in the region; we know that African horse sickness is in the region – in fact my team recently did a bit of work for the Commonwealth Veterinary Office, and we estimated that the probability that at least one significant animal pathogen threat will arrive in the next five years is about 40%. We have named them, and we can prepare for them, but we need to think about them.
- The Goalies – that is us – we can harden what we control, and we can watch what we can't control. And that is a two-way street. The stories that I have heard of the response of certain regulators to certain pathogens in certain areas in the north have been quite harrowing, and what farmers have gone on record saying I would not disclose again. And that is heartbreaking. It is also incredibly dangerous, because if that is the mindset that we are dealing with, then there's going to be goals scored against us every day. We need to watch out for that.

Biosecurity is all of us!

References

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