

Australia's Biosecurity Future

Preparing for future biological challenges



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Executive Summary

As an island nation Australia has, for the most part, been able to maintain an enviable biosecurity status.

A commitment to biosecurity (mitigating the risks and impacts associated with pests and diseases) has allowed us to protect our unique natural habitats and the health of our citizens while at the same time maintain an advantage in primary industries. However, the current status should not be taken for granted.

A number of global megatrends highlight significant change and growing complexity relating to biosecurity challenges, pointing towards a future where existing biosecurity processes and practices may not be sufficient. This report provides an in-depth discussion of five biosecurity megatrends and outlines a number of megashocks that could result if we remain complacent in the face of this growing complexity.

The aim of this report is to stimulate thinking about Australia's biosecurity future by distilling the key opportunities and challenges for our biosecurity system into a format that is easily

accessible for a wide audience – including those who are directly or indirectly involved in the biosecurity field, as well as those who are not. The key issues and implications identified in this report are therefore relevant to industry and research leaders, all levels of government, and even the general community.

The findings from this report are based on extensive consultation across the biosecurity community, including representatives from government, industry and science/research. Many of the key themes will therefore be familiar to those already working in the biosecurity field. However, through the foresight tools of megatrends and megashocks (see A Guide to Futures Thinking below for more information on these tools), the reader is encouraged to think beyond the short-term horizon to consider how things may change over the coming 20 to 30 years across all areas of biosecurity.

Instead of focusing on where we are today, this report aims to provoke consideration of where we are heading and what we need to do to protect Australia's enviable biosecurity status. Rather than just looking at one area of the biosecurity system, this report looks at how a number of important trends cut across plant and animal industries (including marine), the environment and human health.

We cannot afford to be complacent; the management of biosecurity will require a step change towards smarter and more efficient strategies that are ahead of, or in line with, the pace of change around the world. This report is not intended to provide all the answers to the challenges we face but to highlight how the biosecurity landscape may change over the coming decades, in order to open up discussion about what needs to be done to secure the biosecurity future that we want for Australia.

A GUIDE TO FUTURES THINKING

There are a number of tools that can be used when conducting foresight studies. This report draws primarily on megatrends and megashocks as they are effective tools for developing an evidence-based narrative about the future that can feed into a strategic planning or decision making process.

Megatrends and megashocks allow for the identification of plausible future directions for the coming two to three decades as they are based on current and historic evidence and can therefore help leaders to make wiser choices and achieve better outcomes.

Megatrends provide a view of a future trajectory based on a number of identified trends. In this report the megatrends point towards a shift in the types of biosecurity risks Australia will face in the future and the way these risks will need to be managed.

The megatrends are all forward-looking, with a 20-30 year time horizon. Although some aspects of the megatrends are already occurring, they will continue to play out and have an impact over the coming decades.

It is not the megatrends in isolation, but the relationships between them, that are most important when using the megatrends to inform decision making. The interaction of a number of different megatrends has the potential to create megashocks.

Megashocks involve significant, relatively sudden and potentially high impact events, the timing of which is very hard to predict, but do not emerge without some warning.

The megashocks in this report are set in the year 2040 – based on a future that has been shaped by the identified megatrends. They include hypothetical examples across plant and animal industries, marine, environment and human health.

Megashocks can vary in scale and occur at an industry, regional, national, or even change to global level.

Biosecurity Megatrends

A megatrend is a significant shift in social, environmental, economic, technological or geopolitical conditions that has the potential to reshape the way an organisation, industry or society operates. This report has identified five biosecurity megatrends (*An Appetite for Change; The Urban Mindset; On the Move; A Diversity Dilemma?*; and *The Efficiency Era*) that all point towards a shift in the types of biosecurity risks we are likely to face in the future and the way that these risks will need to be managed.

The number of factors placing pressure on our biosecurity system continues to grow and we need to be prepared to respond. Trends relating to agricultural expansion and intensification, urbanisation and changing consumer expectations, global trade and travel, biodiversity pressures, and declining resources could lead to a future where existing processes and practices relating to biosecurity are not sufficient. Importantly, the megatrends should not be considered in isolation as they are all interrelated and the interactions of the different megatrends have the potential to lead to biosecurity megashocks.

A high-level summary of the megatrends and their biosecurity implications is outlined to the right.

SUMMARY OF THE BIOSECURITY MEGATRENDS AND THEIR KEY IMPLICATIONS

AN APPETITE FOR CHANGE

Megatrend Overview

- Growing global food demands are creating opportunities for growth in Australian agriculture
- Rising agricultural pressures (e.g. water scarcity, pesticide resistance) are challenging the productivity of the sector
- In order to remain competitive in a growing global market, we are seeing greater agricultural intensification, vertical integration and expansion into new areas
- At the same time, we are continuing to see growth in niche markets (e.g. organic and bioproducts)

Biosecurity Implications

- Our 'pest and disease free' status will increase in importance in a growing and highly competitive global market for primary produce
- Future focus will be on productivity improvements – the way we approach such improvements could either increase or decrease the strength of our biosecurity system
- Agricultural intensification and vertical integration can create single point sensitivities in the biosecurity system
- Vertical integration requires an end-to-end consideration of biosecurity along the entire value chain
- Land-use change associated with agricultural expansion can impact on the resilience of our ecosystems
- The new biosecurity risks created by agricultural expansion will need to be proactively addressed to ensure the future viability of our primary industries
- Foreign investment associated with agricultural expansion has the potential to either increase or decrease the level of biosecurity risk for Australia
- As niche markets grow, we may need to consider entirely new approaches to managing pests and diseases

THE URBAN MINDSET

Megatrend Overview

- We are continuing to see growth in urban populations, particularly in developing countries
- Australian 'urban dwellers' are increasingly disconnected from primary industries
- We are seeing growing consumer expectations relating to food production (e.g. organic, free-range, locally-sourced)
- Our cities continue to encroach upon new areas of land
- Peri-urban producers are a diverse group and are generally disconnected from traditional agricultural networks

Biosecurity Implications

- Densely populated urban areas, particularly in developing countries, can act as disease incubators and increase disease outbreak risks
- A general disconnection from primary production in Australia is leading to a lack of understanding of biosecurity issues and their impacts
- Changing consumer expectations require new and adaptive biosecurity capabilities
- The ongoing expansion of our cities is changing interactions between people, wildlife, agriculture and disease vectors, increasing risks such as zoonotic disease
- It is important to engage with peri-urban/amateur producers as part of the biosecurity community to improve their understanding of biosecurity risks and their adoption of biosecurity practices

ON THE MOVE

Megatrend Overview

- The number of international tourist arrivals for Australia continues to increase
- We continue to see an increase in the movement of goods and vessels around the world, in line with growing global trade
- In a globalised world, bioterrorism (including agroterrorism) is a potential threat
- We are also seeing greater movement of goods across our interstate borders

Biosecurity Implications

- Increased travel creates opportunities for infectious diseases, including those resistant to antibiotics and antiviral medications, to enter Australia
- Increased movement of people and goods can help to bring pests or diseases into the country that could impact on our environment or primary industries
- There will remain a need for offshore biosecurity investment
- We need to protect our biosecurity status and maintain our competitive advantage in export markets, while at the same time avoid being perceived as protectionist
- We may see the development of more and/or stronger regional and global biosecurity standards
- Online retailing is creating greater opportunities for the introduction of pests and diseases through illegal fauna and flora trade
- The potential threat of bioterrorism requires ongoing vigilance
- Greater domestic freight movements can help pests and diseases to spread across the country

A DIVERSITY DILEMMA?

Megatrend Overview

- We have experienced biodiversity loss in recent centuries, globally and in Australia, with many species on the brink of extinction
- Many of the drivers of biodiversity loss are related to human activity (e.g. land clearing, invasive species)
- Efforts are being made by a number of countries to preserve biodiversity and limit further losses
- A changing climate is causing shifts in ecosystem diversity
- We are continuing to see a loss of species and genetic diversity within agriculture

Biosecurity Implications

- Significant biodiversity loss can decrease the resilience of our natural environment to pests and diseases
- The management of invasive species can be a valuable and cost-effective tool in curbing biodiversity losses
- Biodiversity can provide a number of benefits, such as ecosystem services (e.g. pollination). Understanding the interconnections between biodiversity and biosecurity may therefore prove to be a vital component of biosecurity management
- Climate change can facilitate the movement of pests and disease vectors into new areas
- The loss of agricultural diversity can create food security risks in the case of a pest or disease outbreak
- Preserving genetic diversity can help in the development of pest and disease resistant crops and animals

THE EFFICIENCY ERA

Megatrend Overview

- An ageing population is leading to a decline in biosecurity specialists and experienced farmers, with a lack of younger talent to fill the gaps created
- Biosecurity investment does not appear to be keeping pace with the growing challenges we face
- Technology and innovation across surveillance and monitoring; data and analytics; communication and engagement; genetics; and smaller, smarter devices will play an important role in addressing future biosecurity challenges
- It is important to identify and address the barriers that could prevent technological innovation from delivering the efficiencies required

Biosecurity Implications

- A lack of biosecurity specialists and investment could limit our ability to prevent and respond to shocks
- Low cost sensors and automated systems create opportunities to better identify pests and diseases
- Improvements in data modelling and visualisation, combined with increased data availability, can improve long-term decision making
- New communication tools, as well as behavioural and social science, can help to improve the flow of information and engage the wider community including citizen scientists, in biosecurity management
- Progress in surveillance and diagnostics in the area of genetics allows for better detection and understanding of pests and diseases, as well as opportunities to breed resistant species
- The development of diagnostic devices that are smaller, smarter and capable of detecting a range of pests and diseases could create a step change in quarantine and surveillance activities
- Issues such as poor design, a lack of funding and poor data integration could limit the potential for technological solutions to address current and future biosecurity challenges

Biosecurity Megashocks

The way that the biosecurity megatrends play out and, importantly, how they interact with one another over the coming decades will be significant in shaping Australia's biosecurity future.

The intersection of the megatrends, and the sub-trends within them, has the ability to expose Australia to a greater level of biosecurity risk with the potential for future 'megashocks' to Australian industry, the environment or even our way of life. For example, agricultural intensification combined with greater levels of trade and declining biosecurity investment could create the conditions for a megashock for Australia's plant or animal industries. None of these trends in isolation have the ability to create such an event, but the way they interact can increase both risk and impact levels for biosecurity threats, with the potential to facilitate megashocks.

Megashocks involve significant, relatively sudden and potentially high impact events, the timing of which is very hard to predict. Numerous hypothetical biosecurity megashocks

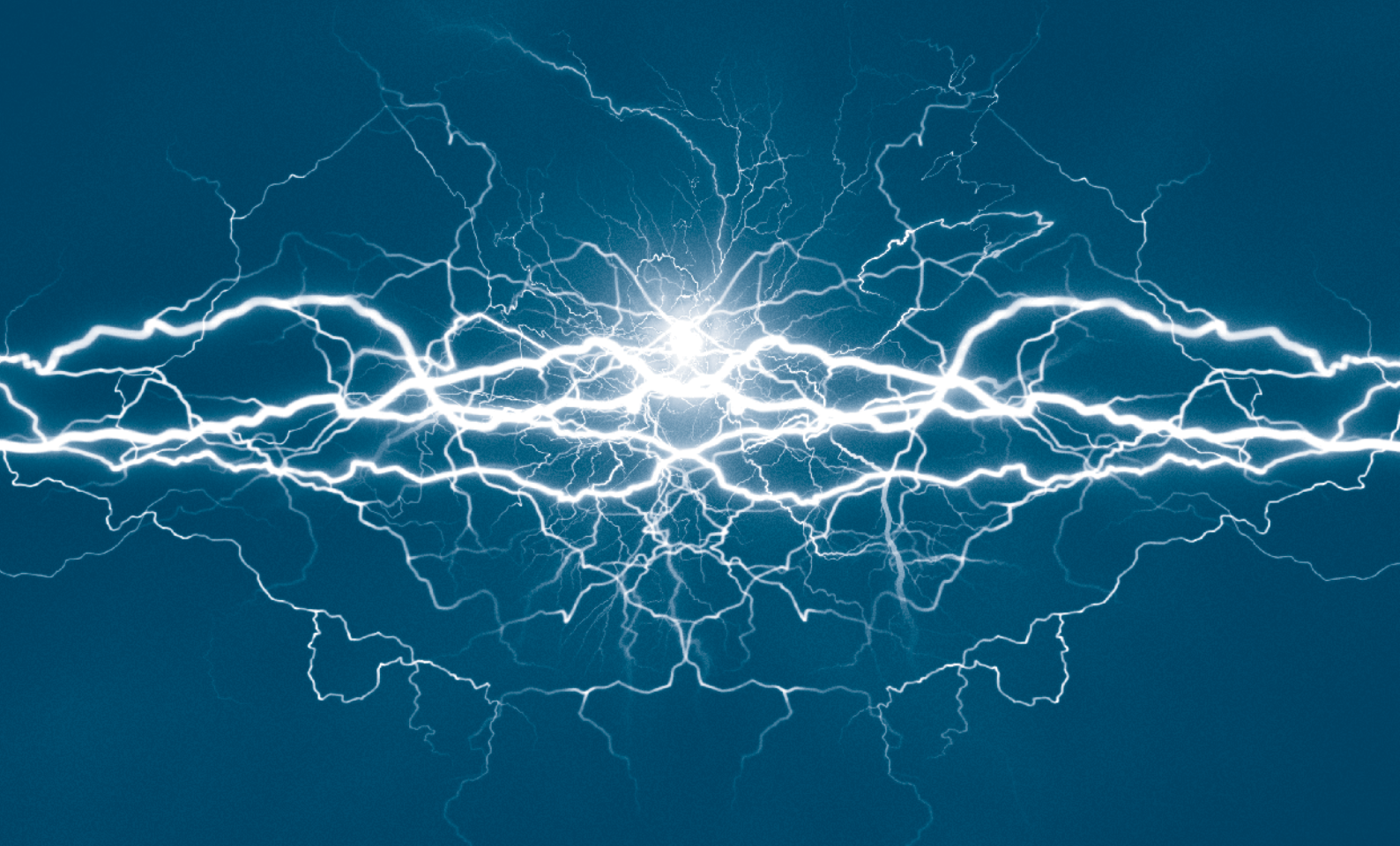
can be identified across plant and animal industries, marine, environment and human health. This analysis has focused on a selection of two to three potential megashocks within each of these five categories, based on what the biosecurity community identified as some of the most important threats we might face over the coming 20-30 years.

Many of the megashocks discussed are based on known threats that are well understood and that we may be somewhat prepared for. However, the interaction of the megatrends over the coming decades could create the conditions for these potential threats to turn into megashocks. On the other hand, some of the chosen megashocks are based on threats that we may not yet fully understand but that have the potential to become a more serious concern for Australia in the next 20-30

years as the megatrends continue to reshape the biosecurity landscape.

Megashocks can have significant impacts across economic, environmental and/or social dimensions. They can also vary in scale, from more localised or industry-specific megashocks through to those with impacts of national or even global significance. The examples discussed in this report represent a cross-section of megashocks with varying degrees of impact.

While it can be argued that Australia has so far been spared from significant biosecurity megashocks, they are not an uncommon occurrence at a global level. The twelve megashocks outlined on the following pages illustrate that Australia cannot use its relatively fortunate history as an excuse for complacency in the face of growing biosecurity challenges.



SUMMARY OF TWELVE POTENTIAL BIOSECURITY MEGASHOCKS

PLANT INDUSTRIES

MEGASHOCK OVERVIEW

- A nationwide incursion of a new race of an exotic wheat stem rust – one more virulent than existing races of UG99
- The nationwide loss of pollination services from feral European honey bees due to a multi-state varroa mite incursion
- A nationwide incursion of a new exotic fruit fly

PRIMARY IMPACTS

- Substantial yield reductions for wheat, with potential yield reductions in other crops (e.g. barley)
- Major economic losses for several of Australia's fruit, vegetable and nut industries
- Significant economic losses for several of Australia's fruit and vegetable industries

CONTRIBUTING MEGATRENDS

- **An Appetite for Change** – Agricultural intensification and homogenisation are creating single point sensitivities in our biosecurity system
- **The Urban Mindset** – Changing consumer demands (e.g. for organic produce) could create new challenges for pest and disease management
- **On the Move** – Greater global movement of people and goods (particularly imports of plant products) is creating new opportunities for pests and diseases to enter the country
- **A Diversity Dilemma?** – The loss of certain species (e.g. pollinators) could threaten the viability of a number of crops
- **The Efficiency Era** – Declining resources could limit our ability to prevent and respond to an incursion

ANIMAL INDUSTRIES

MEGASHOCK OVERVIEW

- A nationwide outbreak of a variant strain of foot and mouth disease
- A bluetongue outbreak across Australia's major sheep producing regions

PRIMARY IMPACTS

- The devastation of a number of Australia's livestock export markets – e.g. beef, pork, sheep
- Significant economic losses for Australia's sheep and wool industries

CONTRIBUTING MEGATRENDS

- **An Appetite for Change** – Agricultural expansion and intensification could heighten the spread and effects of a pest or disease outbreak
- **The Urban Mindset** – Growth in peri-urban production could heighten the threat and impacts of a pest or disease outbreak if small-scale/hobby producers fail to engage with biosecurity issues
- **On the Move** – Greater global trade is creating new opportunities for pests and diseases to enter the country
- **A Diversity Dilemma?** – A warming climate is allowing the spread of pests, diseases and disease vectors into new areas
- **The Efficiency Era** – Declining resources could limit our ability to prevent and respond to a pest or disease outbreak

ENVIRONMENT

MEGASHOCK OVERVIEW

- A highly virulent rust spreads across multiple ecosystems
- The government 'walks away' from environmental biosecurity

PRIMARY IMPACTS

- Widespread environmental damage that threatens several plant species, including food sources for a number of animal species
- Too difficult to predict

CONTRIBUTING MEGATRENDS

- **On the Move** – Greater global movement of people and goods is creating more opportunities for pests and diseases to enter the country
- **A Diversity Dilemma?** – Agricultural expansion, climate change and other biodiversity pressures are reducing the resilience of our environment to pests and diseases
- **The Efficiency Era** – Rising cost pressures and a push for efficiencies could lead to future disinvestment in environmental biosecurity management

MARINE

MEGASHOCK OVERVIEW

- The successful establishment of black-striped mussel
- An outbreak of infectious salmon anaemia

PRIMARY IMPACTS

- Substantial economic losses for a number of industries (including shellfish, fishing and tourism) and significant costs for wharves, marinas and pumping stations
- The decimation of Australia's salmon industry

CONTRIBUTING MEGATRENDS

- **An Appetite for Change** – Expansion and intensification of aquaculture production could increase the potential impacts of a pest or disease outbreak
- **On the Move** – Greater international vessel movement will increase the opportunities for pests and diseases to enter our waters
- **A Diversity Dilemma?** – Warming ocean temperatures may see pests and diseases move into new areas
- **The Efficiency Era** – Declining resources could limit our ability to prevent and respond to a pest or disease outbreak

HUMAN HEALTH

MEGASHOCK OVERVIEW

- A nationwide zoonotic disease epidemic
- A bioterrorist attack
- A rapid spike in antimicrobial resistance

PRIMARY IMPACTS

- Widespread human infection with the potential for high fatalities
- Significant human infection within a particular region, with likely fatalities, depending on the type of attack
- A significant rise in fatalities associated with bacterial and viral infections

CONTRIBUTING MEGATRENDS

- **An Appetite for Change** – If poorly managed, intensified agricultural production systems and agricultural expansion can increase the risk of a zoonotic disease outbreak
- **The Urban Mindset** – A growing population and urbanisation, particularly in developing countries, are increasing the potential risk for an emerging infectious disease outbreak. Urban encroachment and peri-urbanisation are also changing interactions between people, wildlife, agriculture and disease vectors, increasing the risk of diseases passing from animals to humans
- **On the Move** – Greater global travel increases the risk of any future disease outbreak quickly becoming a global pandemic. It can also help to facilitate the spread of antibiotic and antiviral resistant diseases
- **A Diversity Dilemma?** – Biodiversity loss can increase the risk and incidence of zoonotic diseases
- **The Efficiency Era** – Declining biosecurity resources may limit our ability to develop the vaccines, therapeutics and surveillance technologies required to limit the effects of emerging infectious diseases on the Australian population

The Way Forward

The biosecurity megatrends illustrate the unparalleled change that is increasing the complexity of the biosecurity landscape. This will require us to significantly increase the effectiveness of our biosecurity effort through strategic investments in capability and technology, just to maintain Australia's current level of preparedness. The biosecurity megashocks illustrate the potential consequences of remaining complacent amidst this growing complexity.

Biosecurity can be regarded as insurance against risk; whereby the access to good information and the implementation of good decision making processes makes it possible to act pre-emptively, trading off the risks avoided against the costs of measures imposed. In order to be successful, this approach requires rigour in risk management and decision making to ensure that the costs of biosecurity activities don't outweigh the benefits.

At the same time, biosecurity should not just be viewed as insurance against risk but also as an enabler. A world-leading biosecurity regime can improve market access opportunities. It can also play an important role in enabling the sustainable agricultural expansion and intensification required to realise the growth opportunities that exist for our agriculture sector. Finally, as food safety and security becomes a growing concern around the world, we may see future opportunities to export our biosecurity-related services and knowledge.

Minimising and managing risks while capitalising on the opportunities that a successful biosecurity regime presents will only be possible through a coordinated approach involving government, industry, scientists and the general community. As the biosecurity successes and failures in one area or industry are intertwined with the fate of the others, there needs to be a focus on finding common solutions in order to maximise our return on investment and resources.

Importantly, any future approach needs to optimise and integrate the use of policy, science and technology, and education and engagement. A balance is also required between the initiatives that help us to prepare for, and those that allow us to better respond to and recover from biosecurity threats.

Based on the megatrends and megashocks identified in this report, there are a number of key questions that should be explored if we are to maximise the effectiveness of Australia's

biosecurity system. These are outlined in the table on the following page, where the term 'we' is used to refer to the collective biosecurity community (incorporating industry, government, and science and research). While not intended to be exhaustive, this list of questions aims to spur discussion and highlight priorities that should be considered in the development of long-term biosecurity strategies.

With growing complexity and declining resources we seem to be on a path towards an uncertain biosecurity future. The below table outlines some of the most important considerations that provide a starting point for the process of strengthening our biosecurity regime to address growing global challenges. Decisions will need to be made regarding which of these considerations to pursue further in order to ensure Australia's economy, environment, and the health and wellbeing of our citizens are protected and enhanced, through a commitment to securing Australia's biosecurity future.



KEY CONSIDERATIONS FOR AUSTRALIA'S BIOSECURITY FUTURE

1 Policy

PREVENTION ACTIVITIES

- | | | | |
|---|---|--|--|
| 1.1. How do we secure sufficient funding for long-term biosecurity prevention activities without detracting from other national priorities? Are there opportunities for new funding models such as a national levy, broader industry responsibility for funding along the value chain (e.g. supermarkets), insurance and/or philanthropy? | 1.2. How do we make sure prevention activities are proactive and well maintained given that success often breeds complacency? Put another way, how can we maintain investment without having to see a major crisis locally or overseas? | 1.3. How do we ensure policy keeps up with changing biosecurity risks driven by changes in market demand? For example, have our policies and practices in poultry kept up with demand for free-range in a way that allows us to appropriately manage the risks involved? Are we well prepared to | manage the risks created by the vertical integration of national food supplies? |
| | | | 1.4. What incentives could be created to increase farmer and industry participation in surveillance (onshore and offshore)? Is there an opportunity to incorporate biosecurity responsibilities in land tenure agreements or property registrations? |

2 Science & Technology

PREVENTION ACTIVITIES

- | | | | |
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| 2.1. How can we best leverage smaller and smarter sensor technologies for monitoring – for example, to monitor for the presence of wild animals (e.g. ducks on free-range farms or feral animals) or to understand environmental conditions (e.g. climate) in order to better predict risk levels? | detect multiple pests and diseases, rather than developing unique surveillance systems for each potential threat? Are we making the most of the current surveillance and monitoring systems that we have in place? | into long-term preventative strategies such as preventative breeding programs? | citizen science data and analysis is scientifically valid and useful? |
| 2.2. Are we fully exploring the potential opportunities that exist for a single monitoring system to | 2.3. How can advancements in diagnostics be leveraged for early identification and understanding of future disease strains and pathogens? How can this be incorporated | 2.4. How can we develop and leverage a better understanding of the relationship between biodiversity and biosecurity? | 2.6. How can we develop a more integrated system for managing data that allows decision makers to more easily take a holistic view of biosecurity issues across the country? |
| | | 2.5. How can trends related to citizen science be further embedded in national and industry biosecurity efforts? How can we ensure that | 2.7. How can we leverage scientific models and predictive analytics to improve decision making and certainty in response situations? |

3 Communication/Engagement

PREVENTION ACTIVITIES

- | | | | |
|---|--|---|--|
| 3.1. How can social and behavioural sciences be leveraged to improve general public perceptions and behaviours related to biosecurity? Importantly, what level of attitudinal | and behavioural change is really appropriate - i.e. how do we ensure we aren't investing in campaigns that don't deliver the necessary benefits? | 3.2. How can the Australian biosecurity community better engage and educate hobby farmers and amateur producers across the country? | be maximised to cost-effectively communicate biosecurity values and drivers and create a long-term, two-way dialogue with a wide set of stakeholders, including the community? |
| | | 3.3. How can social media and new online communication channels | |

RESPONSE ACTIVITIES

- | | | | |
|---|--|---|--|
| <p>1.5. How do we ensure that our response considers all areas of potential impact, such as the potential environmental impact of an industry megashock?</p> <p>1.6. How do we ensure measured responses to threats? In particular, how do we ensure that improvements in surveillance don't lead</p> | <p>to an unnecessary level of response? On the other hand, how do we avoid underestimating seemingly small threats that have long-term implications?</p> <p>1.7. What policies are required to ensure that Australia has the skills and capabilities to respond to national threats in the</p> | <p>context of our ageing workforce and declining resources in biosecurity?</p> <p>1.8. How do we ensure that resource and funding agreements are in place such that bureaucracy and governance challenges do not stifle our responsiveness? How can we ensure we have the 'fighting funds' required</p> | <p>to respond immediately, in the case that the lines of responsibility aren't initially clear?</p> <p>1.9. How do we ensure that jurisdictions are working together as effectively as possible to allow for a nationally coordinated approach when responding to biosecurity threats?</p> |
|---|--|---|--|

RESPONSE ACTIVITIES

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|--|---|---|--|
| <p>2.8. How can traceability and surveillance be maximised to increase the speed at which we can regain a disease free status?</p> | <p>2.9. How can technology be used to improve collaboration and knowledge sharing between industry, government and the research community during response situations?</p> | <p>2.10. How might autonomous systems and advances in robotics be applied to improve the effectiveness of our biosecurity response?</p> | <p>2.11. How can we use technology to improve on-farm or on-site real-time diagnostic testing in order to reduce the need for sample collection followed by high cost laboratory-based diagnostics and dramatically improve our speed of response?</p> |
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RESPONSE ACTIVITIES

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| <p>3.4. How can we ensure that online communication channels are not hijacked by misinformation or one-sided information during a biosecurity crisis?</p> | <p>3.5. Given the complexity of the national biosecurity landscape, how can education and communication ensure that public overreaction/panic is avoided during megashock events?</p> | <p>3.6. How can we use communication to bring together the disparate biosecurity community in order to facilitate a faster and more effective response? How can we</p> | <p>ensure that we quickly mobilise all relevant industries, hobby farmers and even the general public, if and when it is required?</p> |
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