

# Australia's Biosecurity: future challenges and directions

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# OVERVIEW

- The disease risks
- The policy context
- The trade environment
- The Beale Review
- The science–policy interface
- Science
- Conclusions



# THE DISEASE RISKS

- Incursions of exotic diseases
  - spread into disease-free areas (BSE, FMD, influenza ...)
  - spread into new hosts (influenza ...)
- Re-emergence of endemic diseases
  - changes in distribution, virulence, prevalence or host range (e.g. ND in Australia ...)
- Emergence of 'new' (previously unknown) diseases
  - overseas: Nipah, BSE, CCD ...
  - Australia: Hendra, Menangle, PMC ...
- Human-induced risks
  - inadvertent (laboratory 'escapes')
  - deliberate (bioterrorism)

# Some recent incidents globally

- Pigs: circovirus-associated diseases, *Streptococcus suis*, Nipah ...
- Poultry: infectious bursal disease; avian influenza ..
- Cattle: BSE, FMD, WNV, classical swine fever, bluetongue in Europe ...
- Crustaceans: crayfish plague, Taura syndrome ...
- Finfish: iridoviruses, furunculosis ...
- Amphibians: chytrid fungus
- Humans: SARS, multiple drug resistant TB, Chikungunya ...

# Incidents happen in Australia too!

- pilchard mortality (1995, 1998)
- Hendra virus
- chytrid fungus
- kangaroo blindness (orbivirus)
- Japanese encephalitis
- Australian bat lyssavirus
- black-striped mussels
- Asian green mussels
- anthrax
- avian influenza (1976, 1985, 1992, 1994, 1997)
- Newcastle disease (1998–2000)
- Tasmanian devil facial sarcoma
- porcine myocarditis
- pearl oyster mortality ('oyster oedema disease')
- abalone herpesvirus
- equine influenza

# THE POLICY CONTEXT

- Globalisation and trade
- Intensification
- Increasing concern re global food security
- The quarantine continuum
  - pre-border, border, post-border
- Emergency management
  - prevention, preparedness, response, recovery
- ‘One Medicine’
  - ~75% of ‘new’ diseases are zoonotic
- Increased societal demands
  - food safety, animal welfare, ‘food miles’ ...
  - reduced p.c. meat consumption in developed societies

# Changing questions

- When an outbreak of a ‘new’ animal disease occurred 10–15 years ago:
  - what effect will it have on productivity?
  - will it affect trade?
  - how much will it cost to control or eradicate?
  - *might* it infect people?
  - ...
- Now, the first question when one occurs is:
  - can you *guarantee* it won’t infect people?

*(a very different question than asked previously)*

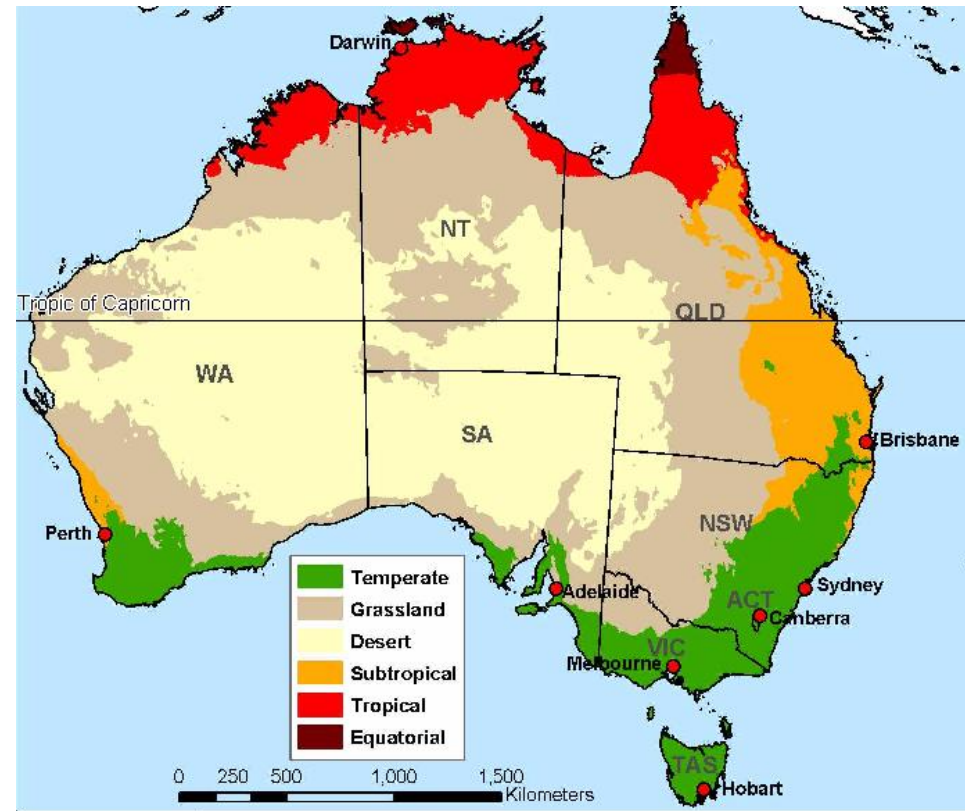
# Changing expectations

- Slaughter-out responses are no longer as acceptable to society, especially if other options (e.g. vaccination) are available
  - UK 2001 FMD slaughter response: ‘Bambi factor’ (Phoenix the photogenic white calf)
  - ‘bird flu’ in Asia (2003 – now)



# Environmental change

- Environmental change
- Climate and disease



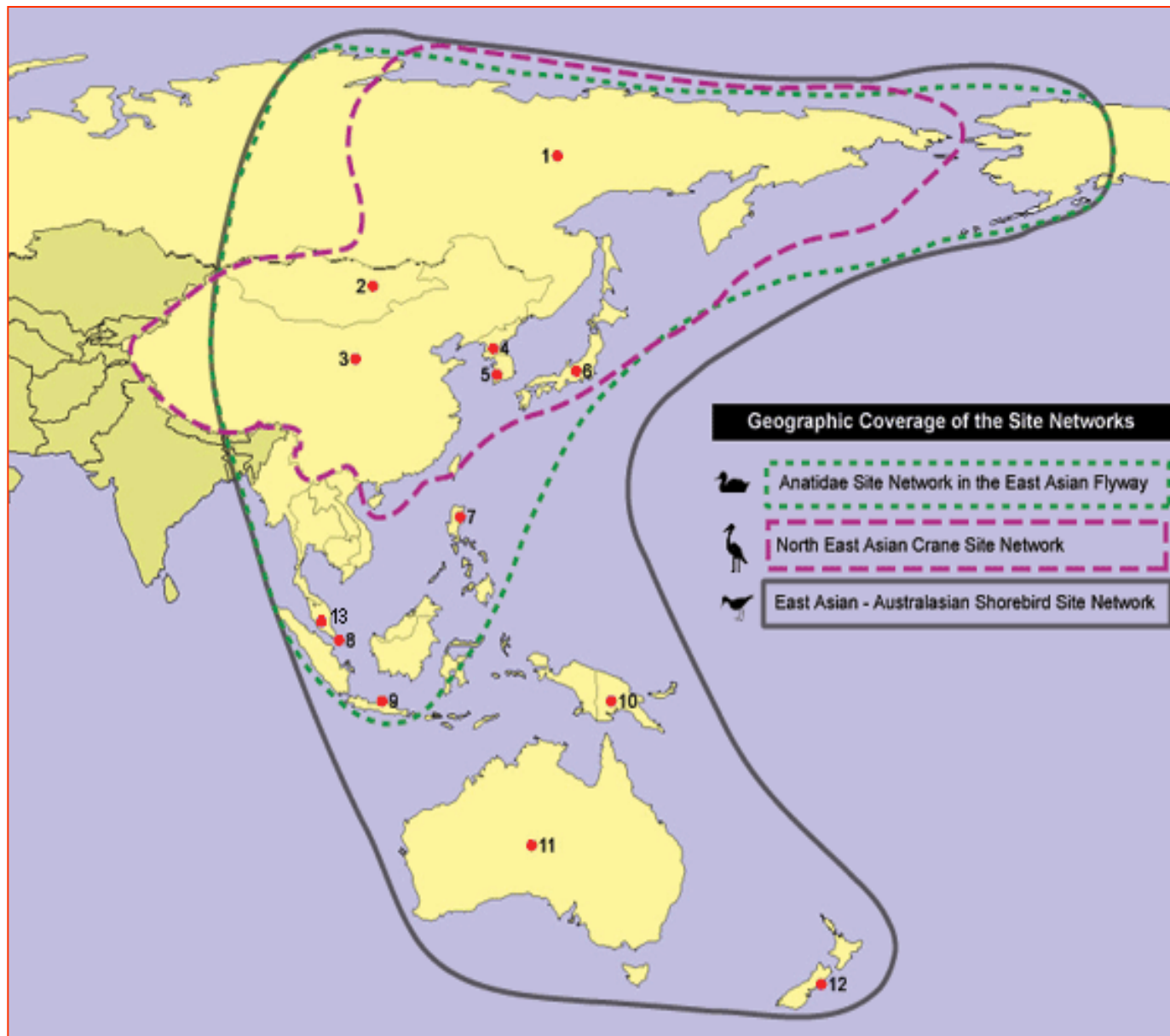
# Diseases affected by climate: direct

- Vector-borne diseases
  - arboviruses
  - tick-borne
- Endoparasites
  - nematodes (gastrointestinal roundworms)
  - trematodes (liver fluke etc.)
- Ectoparasites
  - myiasis (screw-worm fly etc.)
- Soil-borne pathogens
  - anthrax, botulism, meliodosis ...

# Diseases affected by climate: indirect

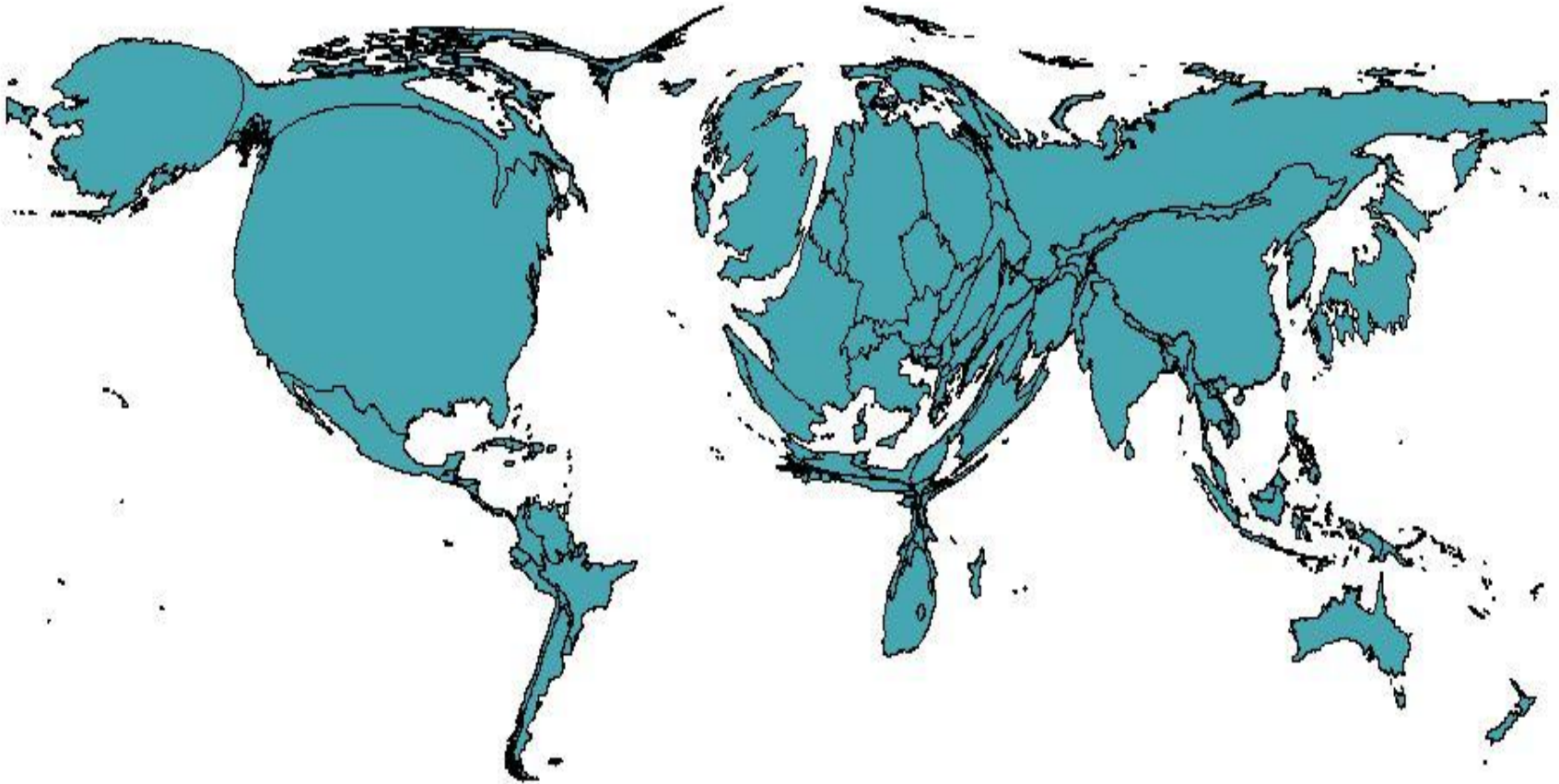
- Pasture and weed changes
  - changes to land use and production systems
  - changes in host–agent interactions
- Increased variability (extreme events)
  - vector ‘dumping’ (exposing naïve host populations)
- Heat stress
  - increased susceptibility to diseases
  - productivity decrease: reproduction, growth rates etc. (salmon, dairy ...)
- Avian diseases
  - changes to wetlands and migration patterns

# Anatid and shorebird flyways



# Emissions of greenhouse gases

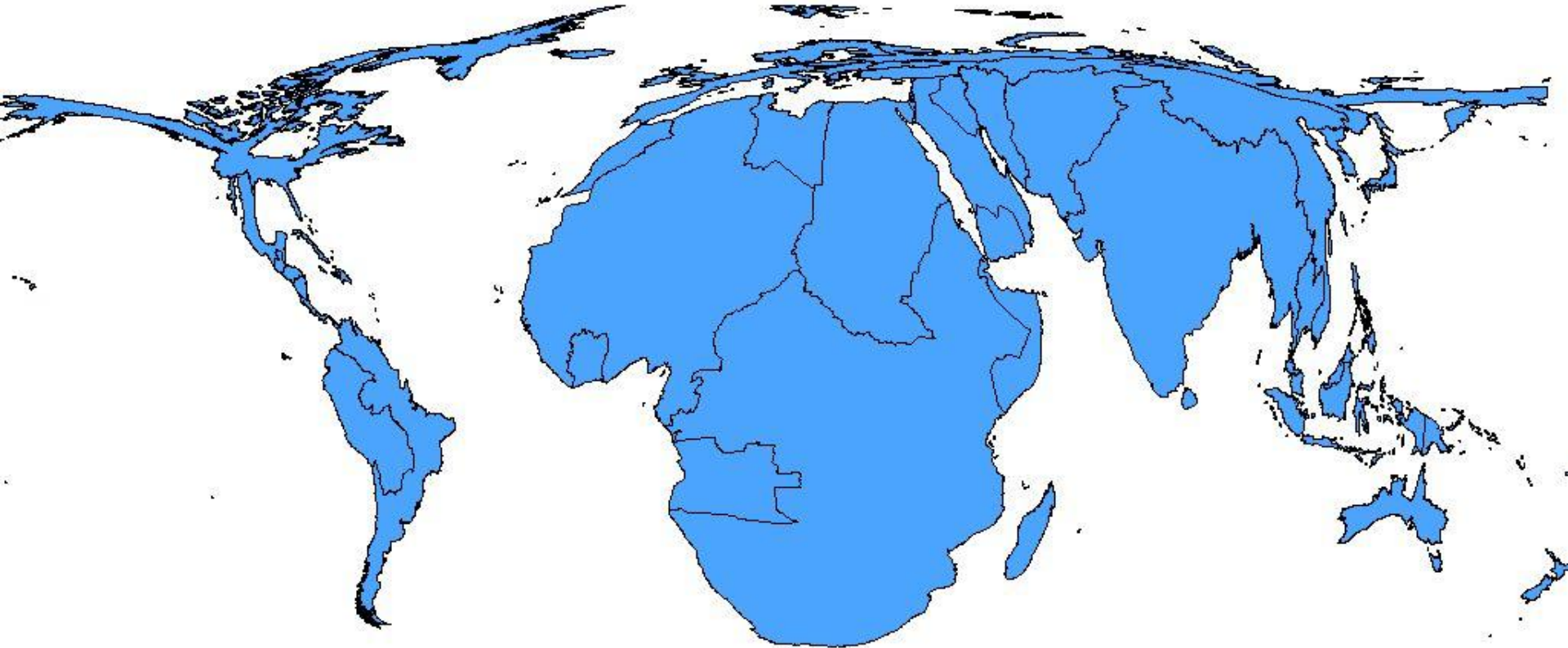
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Density equalling cartogram. Countries scaled according to cumulative emissions in billion tonnes carbon equivalent in 2002. Patz et al

# Health impacts of climate change

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Density equalling cartogram. WHO regions scaled according to estimated mortality (per million people) in the year 2000, attributable to the climate change that occurred from 1970s to 2000. Patz et al, in press

# A paradigm shift?



# THE TRADE ENVIRONMENT

- World Trade Organization (WTO)
  - Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement)
  - Agreement on Technical Barriers to Trade (the TBT Agreement)
- Standards and guidelines, for risk analysis
  - World Organization for Animal Health (OIE)
  - Codex Alimentarius Commission
  - International Plant Protection Commission

# The appropriate level of protection (‘acceptable risk’)

<b>Likelihood of entry and exposure</b>	<i>High</i>	Negligible risk	Very low risk	Low risk	Moderate risk	High risk	Extreme risk
	<i>Moderate</i>	Negligible risk	Very low risk	Low risk	Moderate risk	<b>= ALOP</b>	
	<i>Low</i>	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk	High risk
	<i>V. Low</i>	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk	Moderate risk
	<i>E. Low</i>	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk	Low risk
	<i>Negligible</i>	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Negligible risk	Very low risk
		<i>Negligible impact</i>	<i>Very low</i>	<i>Low</i>	<i>Moderate</i>	<i>High</i>	<i>Extreme impact</i>
<b>Consequences of entry and exposure</b>							

# Issues and challenges in IRAs

- What is an 'acceptable' level of risk?
  - how to define 'appropriate level of protection' (ALOP)?
  - use/abuse of '(pre)caution'
- Assessing and describing likelihoods (L)
  - qualitative, semi-quantitative, quantitative
  - validating these estimates
- Assessing potential consequences (C)
  - national, regional and local effects
  - data and information gaps
  - measuring and valuing **public health** and **environmental** consequences

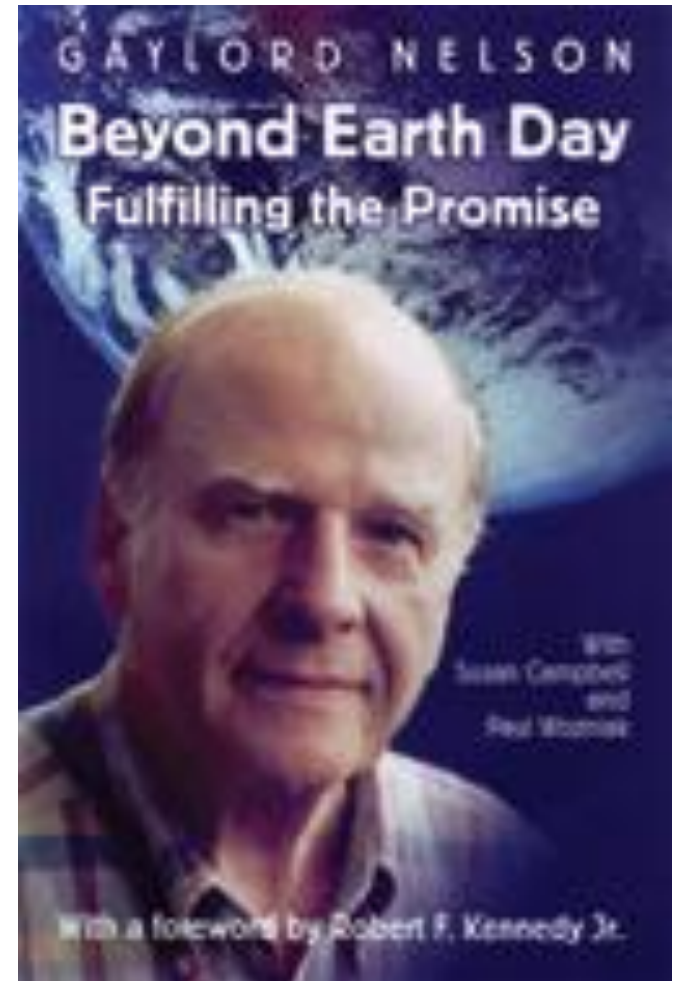
# Issues and challenges in IRAs (2)

- How to measure and describe uncertainty
  - in estimates of L and C
- Distributional aspects
  - who benefits?; who bears consequences?
  - compensation/adjustment?
- How to manage outrage
  - Sandman's equation: Risk = 'Hazard' + Outrage
  - Outrage is as real, measurable, and as much a part of risk as Hazard ('L X C')
  - we manage Hazard better than Outrage

## A paradigm shift?

**‘The economy is a wholly owned subsidiary of the environment, not the other way around.’**

— Gaylord Nelson



# The Beale Review

- In February 2008, the Australian Government announced an independent review into Australia's quarantine and biosecurity systems
  - Mr Roger Beale AO (chair), Dr Jeff Fairbrother AM, Mr Andrew Inglis AM and Mr David Trebeck
- The panel submitted its report in September 2008
  - *One Biosecurity: a working partnership*
- Government released the report and its preliminary response in December 2008
  - Government agreed, in principle, to the report's recommendations, with resourcing implications to be considered in the Budget process

# Beale conclusions

- ‘Australia operates a good biosecurity system, indeed one that is often the envy of other countries given its
  - comprehensiveness
  - transparency and
  - scientific rigour’
- Australia operates sound quarantine and biosecurity systems that can be improved further to deal with increasing risks, such as
  - climate change
  - globalisation and
  - increased passenger and cargo movement

# Beale conclusions (cont.)

- The system is ‘far from perfect’ and has been subject to strenuous criticism, at home and abroad, for
  - carelessness, opaqueness, excessive time delays, perceptions of political interference, poor communication with stakeholders,
  - for being too restrictive and for being too liberal.’
- The review noted that ‘pleasing everyone is difficult’ and that
  - ‘despite rigorous scientific analysis, some issues remain inherently matters for professional judgement.’

# Beale principles

Reiteration and strengthening of ‘the three core principles enunciated in the Nairn Review’:

- An integrated biosecurity continuum
  - pre-border, border, post-border
- Risk assessment reflecting ‘scientific evidence and rigorous analysis’
- Shared responsibility:
  - Commonwealth, States/Territories, businesses, general community

Reiteration that ‘zero risk is unattainable and undesirable’

# Beale Review's challenges

- Globalisation
- Human spread into new habitats
- Increasing tourism and cargo movements
- Potential risk of agri-terrorism
- Movement of genetic material globally
- Climate change
- Looming shortage of plant and animal health professionals
- Physical constraints (e.g. airports)
- Financial constraints

# Beale recommendations

- Establish a new national authority, with:
  - a new Biosecurity Standards Commission to oversee it
  - an Inspector General of Biosecurity to audit it
- Develop new biosecurity legislation to replace the *Quarantine Act 1908*
- Create a new national agreement on biosecurity with the states and territories
- Move away from mandatory intervention targets to a ‘risk–return’ approach
- Increase funding for biosecurity functions and upgrade IT systems.

# Recommendations (2)

- Biosecurity IRAs to increase economic, environmental and human health focus
  - more detailed and explicit consequence assessment
- In IRAs, greater obligation on proponents to provide information on risk
- Increased focus on data and intelligence along continuum to inform risk management
- Increased internal QA and audits
- Increased Commonwealth role post-border
  - monitoring and surveillance; agreed pest/disease priorities; agreed R&D priorities; improved 'quality and use' of diagnostic laboratories

# Recommendations (cont.)

- Increased resources
  - IT systems
  - training, audit, infrastructure etc.
- Funding the changes
  - increased Budget funding
  - return to 100% cost-recovery for export certification
  - review cost-recovery arrangements increased passenger movement charges
  - agreed ‘matching’ State/Territory commitment to post-border investments

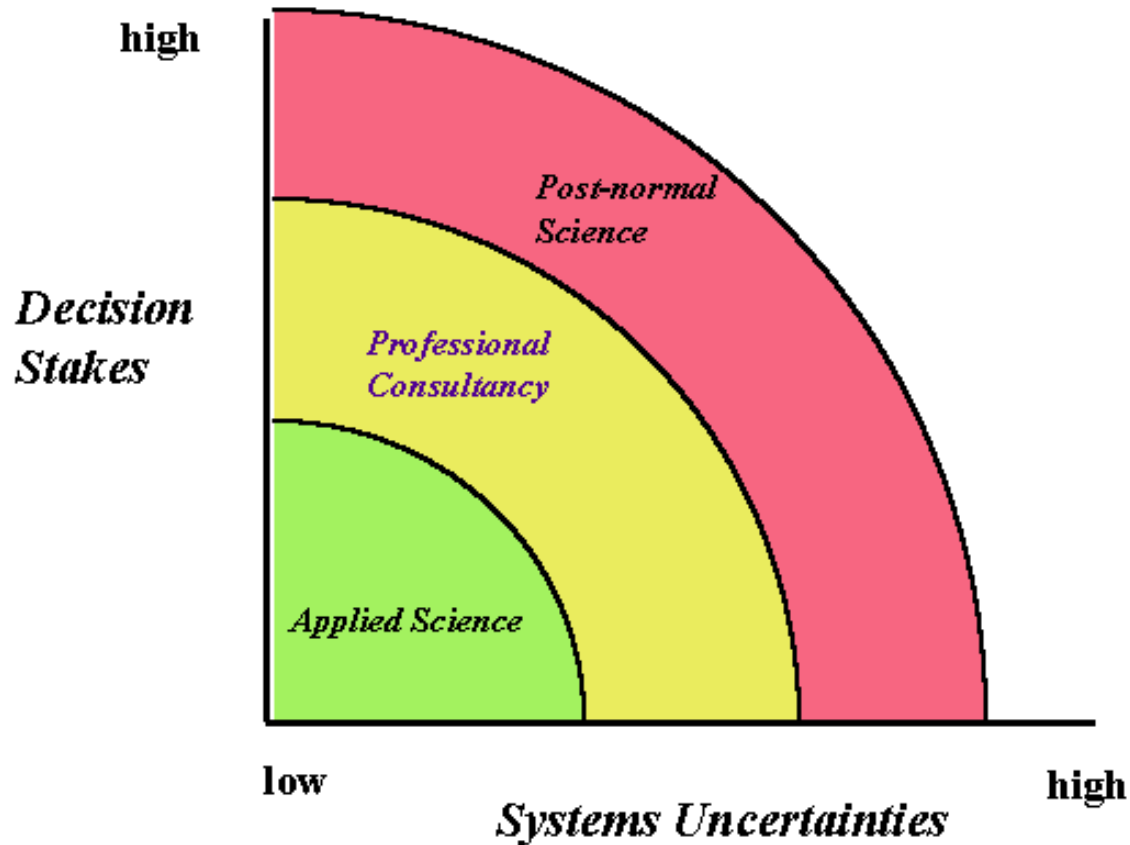
# THE CHANGING SCIENCE–POLICY INTERFACE

- Science and public policy
- Post-normal science

# Science and public policy

- Science is a broad discipline
  - integrates information of a range of ‘medical’ disciplines (including their new technologies)
  - provides a sound framework for analysis and synthesis
  - leads to outputs that can readily be provided as input to policy
  - but is still largely based on classical, reductionist approaches
- To provide better inputs to policy
  - as we grapple with issues of greater complexity and uncertainty, there is a need to add other approaches

# Post-normal science: different science for different problems



Funtowicz, S.O. and Ravetz, J.R. (1994) Uncertainty, Complexity and post-normal science. *Environmental Toxicology and Chemistry*, 13: 1881–1885.

## PNS (2)

- Recognises the need for a new style of science to address complex issues
- Often when policy involves science we find
  - the issues are complex and facts are uncertain
  - values are in dispute and stakes are high
  - decisions are needed urgently
- PNS
  - ‘certainty’ is replaced by ‘extended dialogue’
  - the ‘expert’ is replaced by an ‘extended peer community’
  - ‘hard facts’ are replaced by ‘extended facts’ (informal knowledge, experience ...)
  - traditional science is informed by different perspectives

# Black swans

- Characteristics
  - outliers (low probability)
  - high impact
  - low predictability
- The highly expected *not* happening is also a Black Swan
- Black Swan logic makes *what you don't know* far more important than what you do know ...
  - in spite of (or because of?) our progress and growth in knowledge, the future will be less predictable



# CHALLENGES TO BIOSECURITY SCIENCE

- ‘Environmental accounting’
  - science-based measure(s) of total cost of food and fibre: C, N, P, water, energy, ...
- Animal welfare
  - science-based measure(s) of welfare
- Disposal
  - cost-effective, safe and environmentally friendly disposal of animal waste (and carcasses)
- Surveillance of remote/free-living populations
  - aquatic animals, wildlife ...
- Surveillance of risk factors that forecast disease emergence
  - for more targeted surveillance and preventive action

# Challenges to biosecurity science (2)

- Ensuring utility of 'new' diagnostic technologies
  - validation of new tests (for specified purposes)
  - capturing and confirming results of critical tests
- Vaccines
  - improved vaccines: safe, stable, effective, affordable, DIVA capable ...
- Therapeutics
  - strategies to counter resistance (antimicrobial, antiviral, anthelmintic , insecticidal ...)
- Demonstrating safety of 'new' technologies
  - GM animals and animal products
  - nanotechnology
  - gene therapy ...

# Challenges to biosecurity science (3)

- Preparing against possible new threats, such as bioterrorism
  - in an appropriately ‘balanced’ way
- Ensuring essential capacity
  - specialists (laboratory diagnosticians etc.)
  - research (especially retaining ‘pure’ science’)
- Building on the success of rinderpest eradication
- Building inter/trans-disciplinary collaborations
  - especially towards ‘One Health’, environment
- Improving foresight
  - better environmental scanning, intelligence-gathering and analysis for both tactical and strategic purposes
  - greater use of futures methods to reduce vulnerability and improve resilience

# CONCLUSIONS

- We measure production efficiency, productivity and profit
  - well, and in great detail
- What *should* we be measuring?
  - what about risk factors and thresholds?: population size, density, inter-connectedness ...
- What about resilience and sustainability?
  - what *should* we be measuring?: inputs, ecological footprint (energy, water, nutrients ...)
- How much do we need to know before we act?
  - What *(pre)cautionary measures* should we be taking?
    - farm/corporate/industry biosecurity (e.g. increase separation of modules, decrease animal densities/farm sizes)
    - strategic planning (e.g. land use planning/zoning)

## Conclusions (2)

- Diseases will continue to emerge ('new' or newly recognised, known or established)
  - livestock and aquatic animals, wildlife, and zoonoses
  - at local, national and international levels
- Effects will include
  - 'pathogen pollution' and effects on global biodiversity (small ecosystems such as islands especially vulnerable)
  - concerns re effects and responses (options, costs, welfare ...)
  - concerns with consumer confidence (e.g. safety of animal products)
  - concerns re underlying risk factors

# Conclusions (3)

- We live in an increasingly interconnected world
  - with unprecedented new opportunities for emerging diseases
  - we know enough now to take more preventive ('cautionary') measures
- We should use classical science and technology
  - but acknowledge that these don't have all the answers
- We need to improve our ability to provide sound input into policy
  - by improving capacity to deal with uncertainty and complexity
  - by being prepared to make science-based judgements and determinations based on what we know when asked

# STEEEP

- Social
- Technical/scientific
- Economic
- Environmental
- Ethical
- Policy/political

*The solutions to biosecurity issues need more than just 'T'*





# Further information

Biosecurity Australia: <http://www.daff.gov.au/ba>

Biosecurity Services Group: <http://www.daff.gov.au/bsg>

Biosecurity Australia *Import Risk Analysis Handbook*:

[http://www.daff.gov.au/\\_data/assets/pdf\\_file/0003/1177833/IRA\\_handbook\\_2009\\_FINAL\\_FOR\\_WEB.pdf](http://www.daff.gov.au/_data/assets/pdf_file/0003/1177833/IRA_handbook_2009_FINAL_FOR_WEB.pdf)

Nairn Review (1996):

[http://www.daffa.gov.au/\\_data/assets/pdf\\_file/0009/111969/nairn\\_report.pdf](http://www.daffa.gov.au/_data/assets/pdf_file/0009/111969/nairn_report.pdf) Government's response: <http://www.daffa.gov.au/aqis/about/reports-pubs/nairn/govt-response>

Beale Review (2008):

[http://www.daff.gov.au/\\_data/assets/pdf\\_file/0010/931609/report-single.pdf](http://www.daff.gov.au/_data/assets/pdf_file/0010/931609/report-single.pdf) Government's response:

[http://www.daff.gov.au/about/publications/quarantine-biosecurity-report-and-preliminary-response/beale\\_response](http://www.daff.gov.au/about/publications/quarantine-biosecurity-report-and-preliminary-response/beale_response)