

Welcome

## Australian Biosecurity Forum

Tuesday 16 September 2008

Organised by the Australian Biosecurity Cooperative Research Centre for  
Emerging Infectious Disease



## Session I

### Current biosecurity issues for Australia

Chair: Mal Nairn, Chairman, Australian Biosecurity CRC

**Nigel Perkins, AusVet /Australian Biosecurity CRC**

Ron Glanville, Biosecurity Queensland

Karrie Rose, Taronga Conservation Society Australia

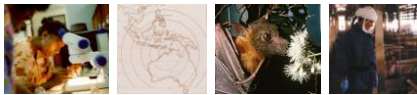
Peter Collignon, Australian National University and Canberra Hospital



### Current threats to Australia's livestock industries.

#### What are the lessons from the equine influenza outbreak?

Nigel Perkins



Program Co-ordinator  
Advanced Surveillance Systems



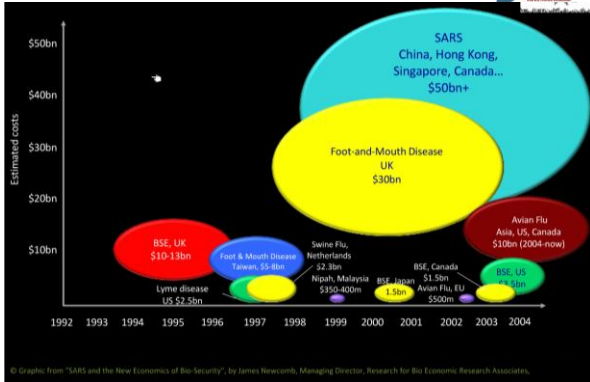
### Current threats to livestock

- **Recent animal disease outbreaks have severely disrupted international meat trade**
  - AI, FMD, BSE
  - economic impacts of livestock disease outbreaks in past 10-15 yrs exceed \$80 billion
- **Global trade and interconnectedness**
  - increasing livestock & human populations
  - growth of Asian livestock industries
  - increasing pathogen exchange with wildlife
- **Human health risks of EIDs are increasing (nipah, SARS, AI, ...)**
- **Bioterrorism**

AUSTRALIAN  
BIOSECURITY  
CRC

FOR EMERGING  
INFECTIOUS DISEASE

## Economic impact of recent outbreaks

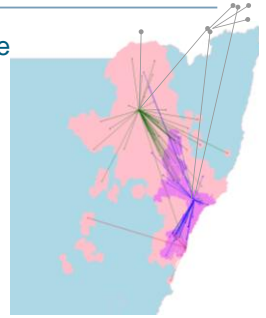


© Graphic from "SARS and the New Economics of Bio-Security", by James Neerincx, Managing Director, Research for Bio-Economic Research Associates.

## Equine influenza 2007



- Highly contagious disease
  - most geographic spread due to horse movements prior to standstill
  - then local spread & occasional outlier spread
- 25 Aug to ~25 Dec 2007
  - 9,000+ IPs
  - ~75,000 horses on IPs



## EI 2007: features of response

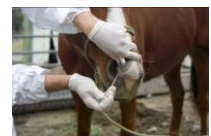
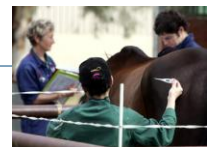


- Movement controls & biosecurity
- Rapid & effective tests
- Vaccination
- Industry cooperation
- Business resumption
  - zoning & controlled movements



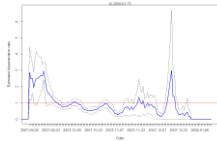
## EI 2007: Challenges

- Horse demographics(?)
- Speed & scale of outbreak
- Predictions of failure
- Capacity & logistics
  - people, samples, data
  - surge capacity
- Communication (www updates)
- GM vaccine
- Business resumption vs disease eradication
- Socio-economic impacts
- National success vs individual impact



## EI 2007: Scientific questions

- **Mechanisms of spread?**
  - airborne spread?
  - fomites
  - birds, dogs, insects, people ...
- **Duration of infectiveness following exposure of susceptible horses**
- **Efficacy of vaccination**
  - individual horses
  - population control



## EI 2007: Reasons for success

- **Response structure & function**
  - AUSVETPLAN
  - Co-ordinated leadership
  - Multi-agency effort: Emergency Management, Police, DPI&F/DPI, AAHL, DAFF, ...
  - Technical input through CCEAD, CVOs and other sources
- **Flexibility of framework: adaptation of response based on science, experience, & socio-economic issues**
- **Commitment from community/industry**



## EI 2007: Conclusion

- **Large scale outbreak eradicated in <5 months**
- **Invaluable training & experience in disease-combat for**
  - community, horse industry
  - state jurisdictions & others (DAFF, AAHL, ...)
  - veterinarians
- **Important flow-on effects on preparedness and response capacity for other threats (FMD, nipah, AI, SARS, hendra, ...)**



Horse stand-still lifted in the Northern Territory

Human vigilance kept the Territory disease-free.



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Queensland the Smart State

## Biosecurity Queensland

Emerging diseases: lessons from Hendra virus and other emerging disease threats

Ron Glanville  
Chief Veterinary Officer

Queensland Government  
Department of Primary Industries and Fisheries

Biosecurity Queensland

## Timeline - HeV Incident - Redlands Vet Clinic, June/July 2008

	June	July
POSSIBLE CASES	1	0
CONFIRMED CASES	5	2

Changed clinical expression

Biosecurity Queensland

## History of Hendra Virus Incidents..

Location	Incident Details	Date
Mackay	2 horses & one human	August 1994
Hendra	20 horses & two humans	September 1994
Cairns (Trinity Beach)	1 horse	January 1999
Cairns (Gordonvale)	1 horse & one human	October 2004
Townsville	1 horse	December 2004
Peachester	1 horse	June 2006
Murwillimbah	1 horse	October 2006
Peachester	1 horse	June 2007
Cairns (Clifton Beach)	1 horse	July 2007
Redlands	5 horses & two humans	June 2008
Proserpine	three confirmed, one other possible case	July 2008

Queensland Government  
Department of Primary Industries and Fisheries

Biosecurity Queensland

## Hendra virus – Risk Assessment

= Likelihood x Consequence  
**x Outrage**

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### Devoted vet Ben Cunneen falls victim to Hendra

Natasha Biza and Sarah Ellis | August 22, 2008

Font Size Print Page

**YET Ben Cunneen, the latest victim of the deadly Hendra virus, lived and died to care for horses.**

He met his wife, champion equestrian rider Gill Rogers, through his work as an equine specialist. The couple had only just celebrated their first wedding anniversary when Ben, feeling tired and fluey, went to the doctor in mid-July.



Research focus..

- drivers for emergence.
- dynamics of infection in the reservoir.
- mode of transmission to horses.
- factors associated with spillover events (location, breed, age, housing).
- possible changing genetic profile of the virus
- risk management.



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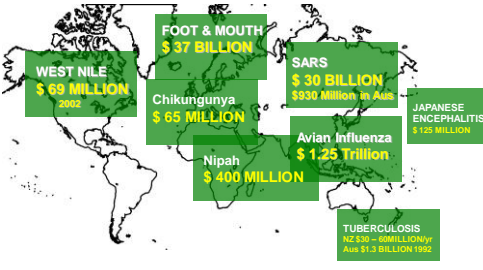
## Wildlife Health & Biosecurity in Australia

Karrie Rose DVM, DVMSc  
 Hamish McCallum BSc(Hons), PhD, DIC  
 Adrian Wayne BSc(Hons), PhD  
 Richard Speare BVSc, MB BS, PhD




## Socio-Economic Impacts

Diseases with Wildlife in their Ecology

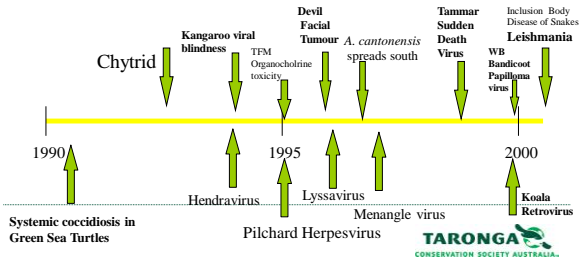


Disease	Impact
WEST NILE	\$ 69 MILLION (2002)
FOOT & MOUTH	\$ 37 BILLION
Chikungunya	\$ 65 MILLION
Nipah	\$ 400 MILLION
SARS	\$ 30 BILLION (\$30 Million in Aus)
Avian Influenza	\$ 1.25 Trillion
JAPANESE ENCEPHALITIS	\$ 125 MILLION
TUBERCULOSIS	NZ \$30 - 60 MILLION/y Aus \$1.2 BILLION 1992

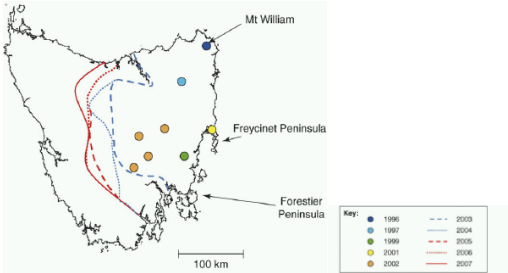


# Wildlife Disease Emergence in Australia

## A Decade in Review



## Distribution of Facial Tumour Disease



**TARONGA**  
CONSERVATION SOCIETY AUSTRALIA



Woylie Population Declines

## Situation

Woylie declines:

Western Australia 93 - 97% (2000-2007)  
South Australia >90% (2005-2007)

Rapid loss 25% - 95% per annum

Substantial 90% - 100% loss per site

Species level > 80% loss (2001-2008)

**TARONGA**  
CONSERVATION SOCIETY AUSTRALIA



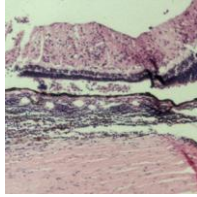
Ecosystem Health

Wildlife die offs first indicators of high levels of environmental lead in Esperance WA





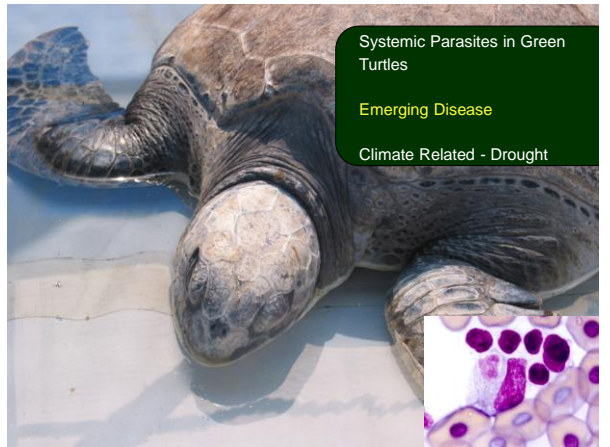
Kangaroo Blindness  
Wallal Virus – insect borne virus  
Threatened meat export industry



Tamar Sudden Death Syndrome  
Emerging Insect Borne Virus  
Climate Related  
10 year diagnostic delay



Brain worm in Tawny Frogmouths  
Exotic Disease  
Zoonotic  
Expanding Range - Climate Related

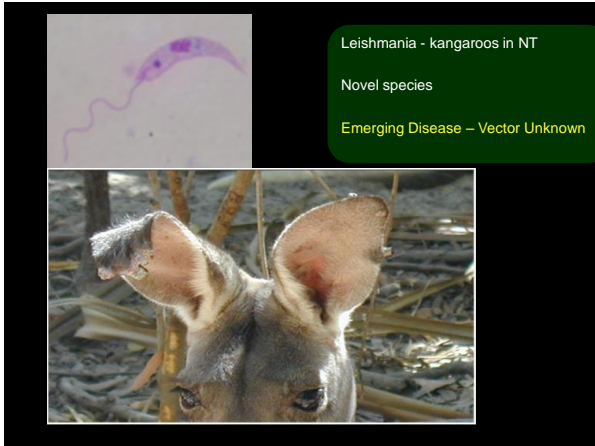


Systemic Parasites in Green Turtles  
Emerging Disease  
Climate Related - Drought





**Ecosystem Health**  
 Wildlife linked to outbreaks of salmonellosis in humans and livestock



**Leishmania - kangaroos in NT**  
 Novel species  
 Emerging Disease – Vector Unknown

**Web Links**

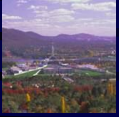
- Australian Registry of Wildlife Health  
[www.arwh.org](http://www.arwh.org)
- Chytrid fungus  
[www.icu.edu.au/school/phtm/PHTM/frogs/ampdis.htm](http://www.icu.edu.au/school/phtm/PHTM/frogs/ampdis.htm)  
[www.amphibianark.org/](http://www.amphibianark.org/)
- DFTD  
[www.utas.edu.au/foundation/devil.htm](http://www.utas.edu.au/foundation/devil.htm)  
[www.dpiw.tas.gov.au/inter.nsf/webPages/BHAN-5358KH?open](http://www.dpiw.tas.gov.au/inter.nsf/webPages/BHAN-5358KH?open)  
[www.tassiedevil.com.au/](http://www.tassiedevil.com.au/)
- Woylie  
[www.dec.wa.gov.au/programs/saving-our-species/woylie-conservation-research-project/about-the-woylie.html](http://www.dec.wa.gov.au/programs/saving-our-species/woylie-conservation-research-project/about-the-woylie.html)



**Session I**  
**Current biosecurity issues for Australia**

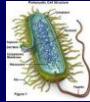
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## The bugs within:

the continuing and increasing threat of antimicrobial resistance



Peter Collignon

Infectious Diseases and Microbiology, The Canberra Hospital  
Professor, Canberra Clinical School, Australian National University

## Antibiotics are

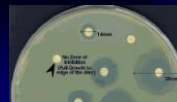
### “Magic bullets”

- Kill the bacteria causing infections but little or no harm to individuals with the infection

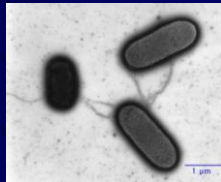
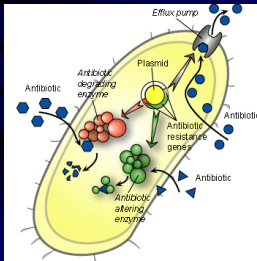


## Resistance; the bugs are smart

- breakdown or inactivate the antibiotic
- barriers; stop it getting into the bacteria
- **bacteria change the goal posts**
  - altered targets, receptors

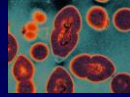


## Resistance encoded by DNA that moves around eg by plasmids



## Resistance is a growing problem

- Most bacteria
  - Staphylococcus (MRSA)
  - E.coli
  - Pneumococcus
  - Vancomycin resistant Enterococcus (VRE)
- Some no therapy, for most therapy difficult and expensive
  - MRSA
  - Pseudomonas, Acinetobacter
  - Salmonella



## MRSA (methicillin resistant Staph. aureus)

- Common
  - many hospitals >30% of S.aureus isolates
  - often multi resistant
- now also many community strains
- as virulent as most other strains of S.aureus
- High death rates
- vancomycin is a 2nd rate antibiotic!
  - But all we have got in many situations

## MRSA -What is the situation in Australian Hospitals? (AGAR)

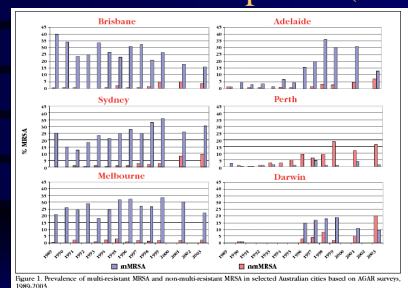
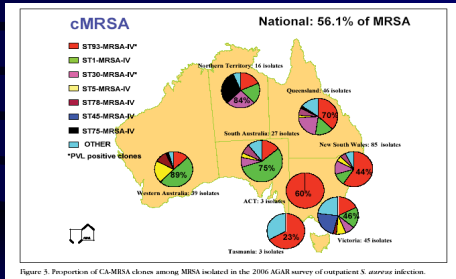


Figure 1. Prevalence of multi-resistant MRSA and non-multi-resistant MRSA in selected Australian cities based on MGAR surveys, 1989-2005.

## Community (AGAR)



MICROBIOLOGY AUSTRALIA • SEPTEMBER 2008

## Antibiotic resistance is worse in developing countries; China

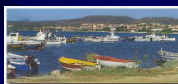
- MRSA
  - 82% if hospital acquired *S. aureus*
  - 22% if community acquired
- *E. coli* (community)
  - 60% resistant to fluoroquinolones
  - 56% gentamicin resistant
  - 29% ceftriaxone resistant



Li, Weinstein et al. Beijing 1998-1999  
Zhanghua Yi, Xian Za Zhi; 2001;  
Li, Yu et al. Infection, 2001

## Antibiotic resistant bacteria are everywhere! Not only in people and hospitals

but animals, meat, fish, vegetables, water



## Antibiotic resistant bacteria do NOT stay quarantined to one area – clones spread!

More importantly - the genes that encode this resistance spread – the genes are the real clones.



## Antibiotics – are the epitome of a wonder drug

but we are wasting them!

- People
  - Viral infection
  - Prolonged prophylaxis
  - Overly Broad spectrum
- Animals and environment
  - Extensive use
  - Often inappropriate (growth promotion, mass prophylaxis)

## What drives resistance?

- Volumes of antibiotics used
  - the more that are used then the more resistance
- way they are used
  - long term
  - low concentrations, sub-therapeutic
- spread of resistant bacteria
  - person to person, faecal contamination
  - water and food
- poor hygiene/infection control



## What do we need to do?

- prudent use
  - Reserve “critically important” antibiotics for people
- education
- prevent infections
- research and development
- surveillance

## Session 2

### Future threats to Australia



Chair: Warwick Anderson, CEO, NHMRC

**Martyn Jeggo, CSIRO Australian Animal Health Laboratory**  
Moira McKinnon, Australian Biosecurity CRC  
Mark Burgman, Australian Centre of Excellence for Risk Analysis  
Lyn Gilbert, Institute of Clinical Pathology and Medical Research, Westmead



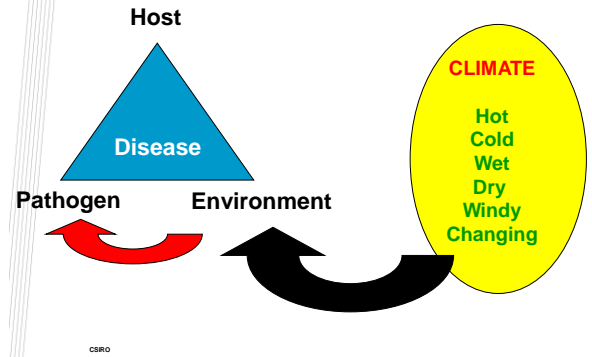
www.csiro.au

Climate Change and Risks to Livestock Health and Trade, particularly from bluetongue virus

Dr. Martyn Jeggo  
Director Australian Animal Health Laboratory (AAHL)



## Climate – does it have an impact and how?



CSIRO

## Which diseases and why?

### viruses

Obligate intracellular organisms  
Major cause of new and emerging disease  
Rely on close proximity of susceptible hosts  
But can rapidly evolve  
And use intermediate hosts and vectors to survive  
Meet the "arboviruses"

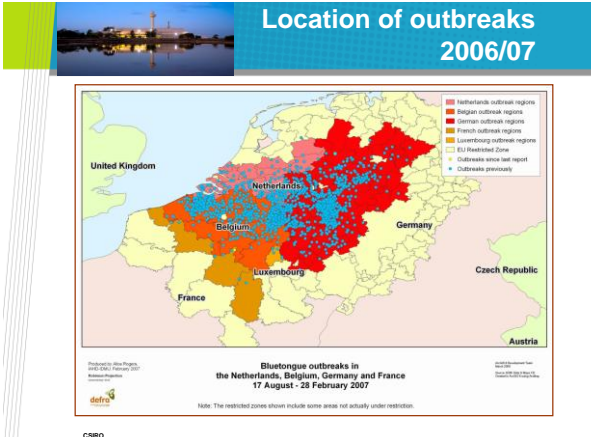
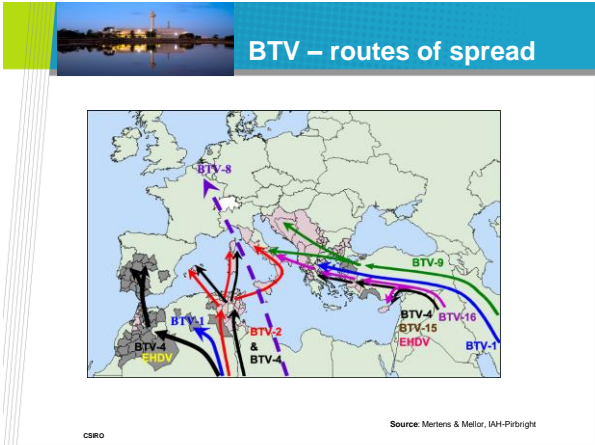
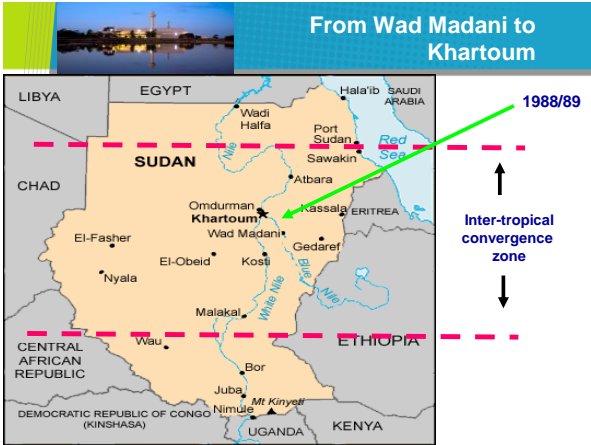
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## Bluetongue

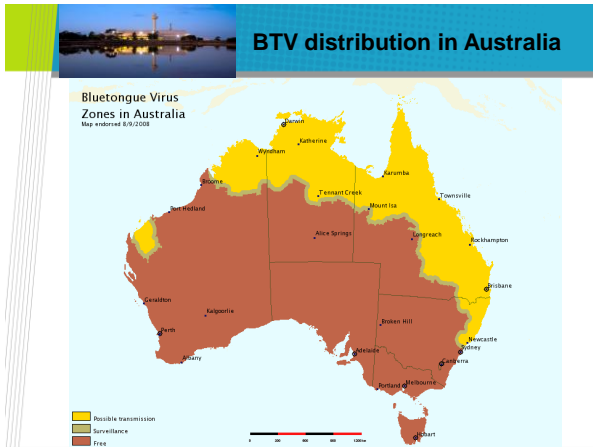


CSIRO





- ### And the effects of bluetongue
- Australia was free of bluetongue until...
  - Severe embargo on trade
  - Building of AAHL
  - But NO disease
  - Perceptions is all that is needed!



## Conclusion

- **Climate (and therefore climate change)** clearly has an effect on disease occurrence
- **But not all diseases are equal**
- **We need to better understand the effect of climate on these “high risk” diseases**
- **And then plan appropriate interventions**
- **Role of complex system science and predictive bio-modelling**

CSIRO

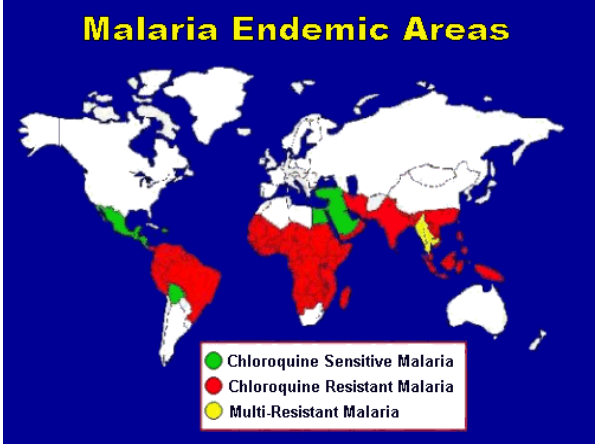
## Session 2

### Future threats to Australia

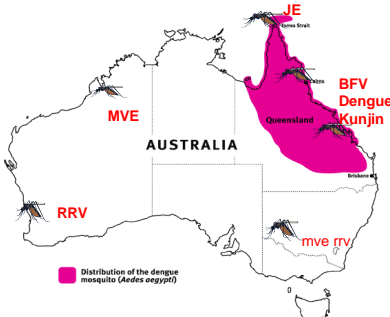
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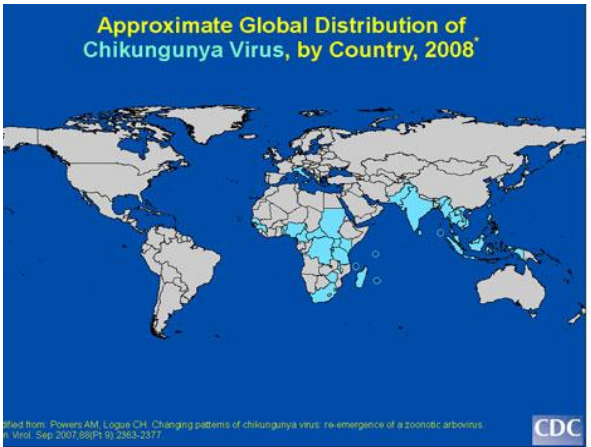
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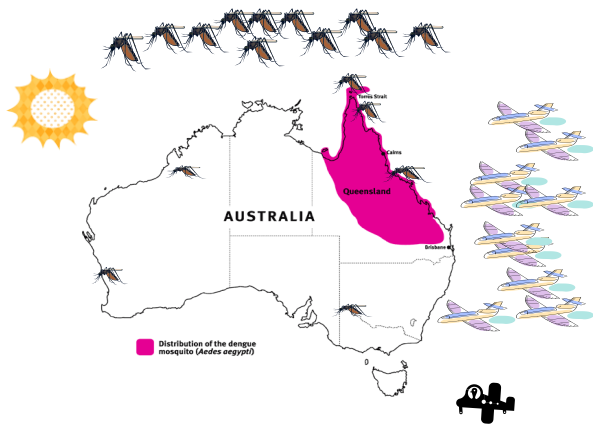


*Aedes aegypti* the Americas 1960, 2005





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## Balancing trade and threat

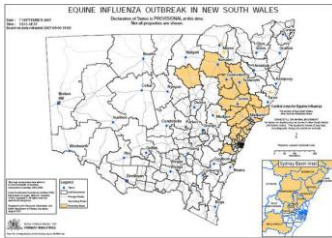
Mark Burgman



## Who we are



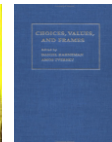
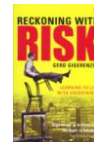
1. Dealing with the perception and social construction of risk,
2. Analysing trade-related risks
  - opportunities



## Why people worry about the 'wrong' things

Judgements in uncertain situations are coloured by...

- framing
- level of personal control
- understanding of the issues
- degree of personal experience
- dreadfulness of the outcome (kill size, outrage)
- equitability
- visibility



## Language

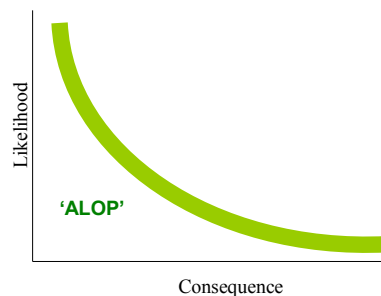
Language-based description of likelihood	Probability Interval
High	0.7 - 1.0
Moderate	0.3 - 0.7
Low	0.05 - 0.3
Very Low	0.001 - 0.05
Extremely low	10 <sup>-6</sup> - 0.001
Negligible	0 - 10 <sup>-6</sup>

Biosecurity Australia

Unknown/Unclassified	>1 per 10 <sup>-2</sup> or unknown
High	<1 per 10 <sup>-2</sup>
Moderate	<1 per 10 <sup>-3</sup>
Low	<1 per 10 <sup>-4</sup>
Slight	<1 per 10 <sup>-5</sup>
Negligible	<1 per 10 <sup>-6</sup>

USDA likelihood that a disease exists in a region

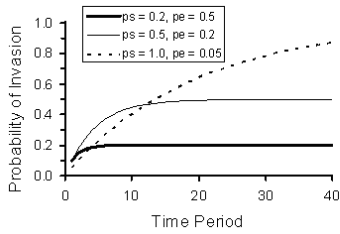
## Iso-risk curve



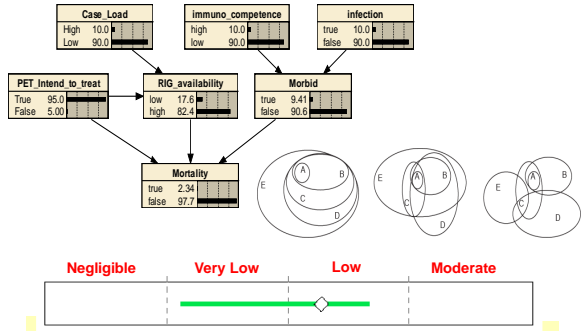


## Understanding risk, volume of trade and time

McCarthy et al 2007



## Qualitative methods, language and expert judgement



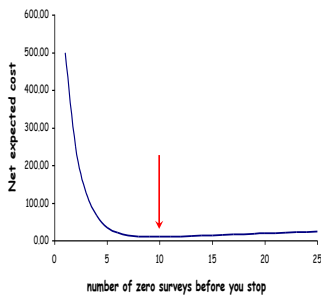
## Evaluating trade-offs

$$n^* = \frac{\ln(-C_s / (C_e \ln(1/r)))}{\ln(r)}$$

$n^*$  is the optimal stopping time where net expected cost is minimized

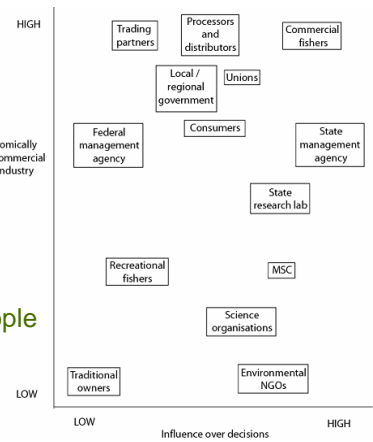
and  $r = q(1-p)$  is the probability the species is present but was not detected

$C_s/C_e$  is the relative cost of surveying



## Better ways of dealing with people

Stake in an economically viable commercial fishing industry





## Things to be done

### Elicitation (subjective / expert estimation)

- Quantities, probabilities, models, utilities

### Testing new methods

- Qualitative methods, monitoring, surveillance

### Working with people

- Aggregating opinions: numerical, behavioural
- Resolving language-based misunderstanding
- Who to involve, how, when?
- How to build trust



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## Bioterrorism

Lyn Gilbert,  
Centre for Infectious Diseases  
& Microbiology, ICPMR  
September 2008



## Bioterrorism

- **Malicious use** of natural or engineered **pathogens or toxins** against individuals, troops or populations

*“.....calculated to **evoke extreme fear**..... (to achieve).. a political objective....”*

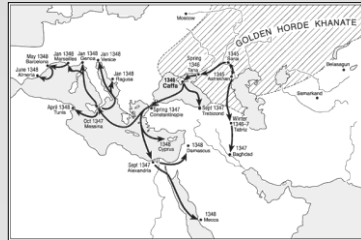
*National Antiterrorism Plan 1995*

## Bioterrorism

- Long, diverse history
- Warring armies or cults using naturally occurring pathogens
  - .....limited, localised effects

## Caffa, Crimea 1346

- Retreating Mongol army catapulted plague-infected corpses into city.



- Escaping Italian traders spread plague throughout Europe

Wheleis, 2002

<http://www.cdc.gov/ncidod/EID/vol8no9/01-0536.htm>

## World Wars



- Attacks against horses and cattle - by both sides
  - anthrax, glanders

- Japanese Unit 731: experimental infection of prisoners with anthrax, plague, cholera;
- 1000s of deaths

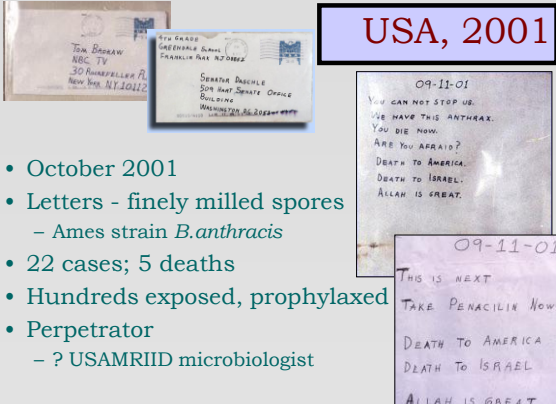
Biological weapons convention, 1975

## Sverdlovsk, USSR, 1979

- Anthrax epidemic
  - 77 cases, 68 deaths - over 6 wks;
  - "tainted meat"
- Post glasnost - investigation\* 1993
- Conclusion:
  - release of anthrax spores (?~1 g) from military research facility
  - probably unintentional

\*Meselson, et al., Science, 1994;266:1202-8

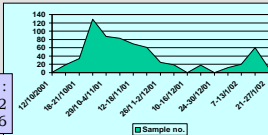
## USA, 2001



- October 2001
- Letters - finely milled spores
  - Ames strain *B.anthraxis*
- 22 cases; 5 deaths
- Hundreds exposed, prophylaxed
- Perpetrator
  - ? USAMRIID microbiologist

## Collateral damage

- 10,000s “white powder” incidents
  - >1200 in Australia
  - Hoaxes & mistakes
- Seriously challenged resources
  - Hazmat, police, public health, laboratories
  - Poorly prepared



“suspicious” white powders :  
NSW Nov 01-Feb 02  
Total 856

## Outcomes

- Better co-ordination between agencies
- Better procedures, protocols, facilities
  - Also applicable to emerging infections
- Improved laboratory security
- Remaining problems
  - Surge capacity; expertise
  - Laboratory security and safety

## “Dual-use dilemma”

- Potential misuse of research results (unexpected; defensive) e.g.
  - hypervirulent mousepox virus (2001)
    - Later applied to cowpox
  - synthesis of infectious poliovirus (2002)
    - Full genome of smallpox virus available
  - reconstruction of 1918 H<sub>1</sub>N<sub>1</sub> flu A (2005)

## Dual use: issues and ethics\*

- Are some types of research impermissible?
- Defensive vs offensive research?
  - Potential to save, vs destroy, life
- Principle of scientific freedom vs security
  - Publication of results
- Should scientific research be regulated?
  - If so - by whom or what

Remaining potential for “insider” misuse

*\*S Miller & M. Selgelid, 2008*



Surveillance, intelligence, security

## 1600s American Indians; smallpox



Smallpox-contaminated blankets from Europeans; “goodwill” gesture.

*Eitzen & Takafuji 1997*  
[http://www.vnh.org/MedAspChemBioWar/chapters/chapter\\_2.htm](http://www.vnh.org/MedAspChemBioWar/chapters/chapter_2.htm)

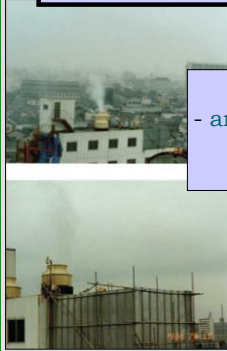
## Dalles, Oregon, USA, 1984

- >750 salmonellosis cases
- Contaminated restaurant salad bars
- Rajneeshee cult




Dalles restaurants targeted by Rajneeshee

**Tokyo, Japan, 1993**



**Tokyo, Japan 1993**  
- anthrax spores released  
by Aum Shinrikyo  
- Sterne strain





**Biosecurity Risk Intelligence  
Scanning Committee**



**Session 3**  
**Pushing back the barriers**


**Chair:** Peter Core, Australian Centre for International Agricultural Research

**Tom Aldred, Dept. Agriculture, Fisheries and Forestry**  
John Edwards, Murdoch University /Biosecurity CRC  
Peter Daszak, Consortium for Conservation Medicine  
Julie Hall, World Health Organisation



Australian Government  
Department of Agriculture, Fisheries and Forestry

**Pushing Back the Biosecurity Barriers**  
**- managing risk in the right places**



**TOM ALDRED**  
**16 September 2008**

**DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY**

## Biosecurity Continuum - a fundamental concept

**Protect Australia's favourable pest and disease status**  
enhance access to international markets

**Pre-border, border, post-border**  
porous-border  
risk analyses and pathways, target effort

**Pre-border, managing risk off-shore**  
multiple nations working together expands our options  
increases Australia's biosecurity defences  
core part of biosecurity, not simply 'aid'



DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY

## Role of the AQIS Northern Australia Quarantine Strategy (NAQS)

**Manage the quarantine aspects of border movements through the Torres Strait**

**Identify and evaluate the unique quarantine risks facing northern Australia**

**Develop and implement measures for the early detection of targeted pests and diseases**

**Strengthen Australia's quarantine through collaborative capacity building activities in Papua New Guinea, Indonesia and Timor Leste**



DEPARTMENT OF AGRICULTURE, FISHERIES AND FORESTRY

## NAQS - The Torres Strait and our proximity to PNG



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## Pathogenic Varroa mite in PNG

**Detected in PNG Highlands on 30 May 2008.**

**A pilot control and surveillance program was developed by AQIS and the PNG quarantine authorities and funded by AusAID.**

**The pilot program was implemented in July 2008 in the Eastern Highlands of PNG.**

AQIS entomologists provided training to PNG authorities and bee keepers in pest surveillance and control methods. PNG is continuing implementation of the control program across the country.

Further bee pest surveillance and training will take place in PNG in late 2008.



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## Off-shore Surveillance

Adult Varroa collected in PNG



Surveillance training – Goroka



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## Session 3

### Pushing back the barriers

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## Australia's Role in Protecting the Livestock Industries in Southeast Asia

John Edwards



Biosecurity Forum  
16 September 2008

DISCOVERERS WELCOME



## The Need to Address Biosecurity Threats offshore

The increasing biosecurity threats to Australia

Many arising in Asia

Need to strengthen on shore procedures eg quarantine, biosecurity at all levels, hone emergency response procedures

However, that approach can never eliminate risk entirely

Can't rely on Fortress Australia approach alone.

Need to identify and reduce the risk of biosecurity threats at source.



DISCOVERERS WELCOME

## The Main Animal Biosecurity Threats

### Asian perspective

Highly Pathogenic Avian Influenza  
 FMD  
 CSF  
 PPR (South Asia and increasing in SE Asia)  
 PRRS  
 Rinderpest (Free, but finish the job of zone progression)

### Australian perspective

Asia list plus  
 African Swine Fever (AFS)  
 Nipah virus  
 BT (vectors and viruses)  
 Newcastle disease  
 Surra  
 Screw worm fly  
 Varroa mite in bees  
 The next big one?



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## The Main Animal Biosecurity Threats

### Aquatic Animal health threats

90% of world's production in Asia  
 Major disease events eg White Spot Virus  
 Environmental issues and chemical residues  
 The next big one?



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## What is being done in Southeast Asia?

Australian agencies: Ausaid, ACIAR, AB CRC, DAFF and State governments, Universities, Private providers eg AusVet  
 Programs for animal health, public health and trade support  
 International donors and agencies  
 Focus on CLMV countries

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## Development Issues and Beneficiaries

Transboundary animal diseases (TADS) require a regional or multilateral approach. Will fail without all involved

Different Production systems including small holder, medium scale low biosecurity, large scale high biosecurity

Environmental differences

- diversity eg islands, uplands, lowlands  
 - differences and similarities to some parts of Australia eg FMD

Animal movements – traditional/traders/difficulties with regulation/multiple agencies and corruption

Social, cultural, language, religious and political differences

Attitudes to disease control/animal welfare



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## Development Issues and Beneficiaries

Impact on health/food security/poverty alleviation. Can have adverse effects without knowing. eg AI and initial suggestions of kill all the chooks/ducks/fighting cocks

Capacity and resources available to countries in Southeast Asia

Malaysia, Thailand, Singapore, Brunei

Vietnam, Philippines, Indonesia

CLMV – Cambodia, Lao PDR, Myanmar, (Vietnam ?) + Timor Leste

Market failure - Veterinary services as an international public good. - WB/OIE

Benefits for Australia and the developed world (The major beneficiaries)



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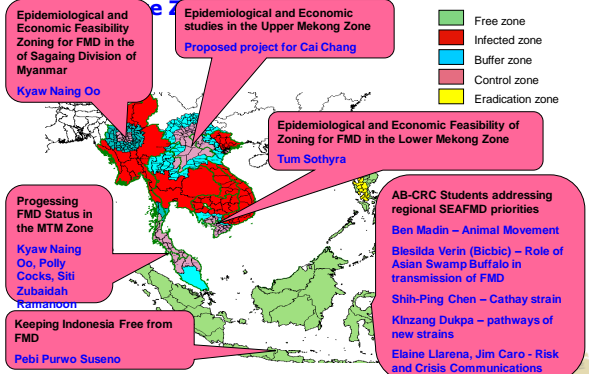
## The Southeast Asia Foot and Mouth Disease Program as an Example of a Successful Regional Program



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## Research to Support SEAFMD 2020



## Session 3 Pushing back the barriers

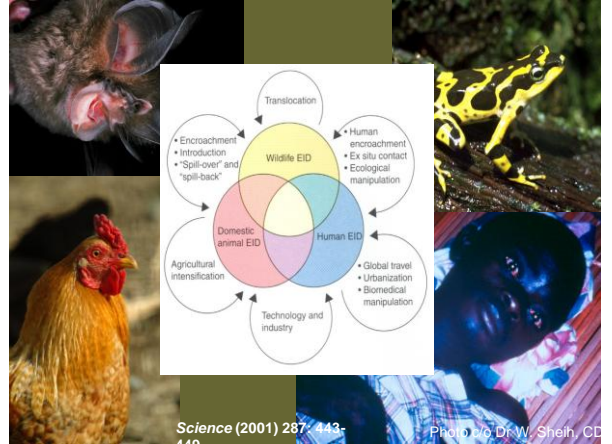
Chair: Peter Core, Australian Centre for International Agricultural Research

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## The coming plague: Predicting the next emerging disease

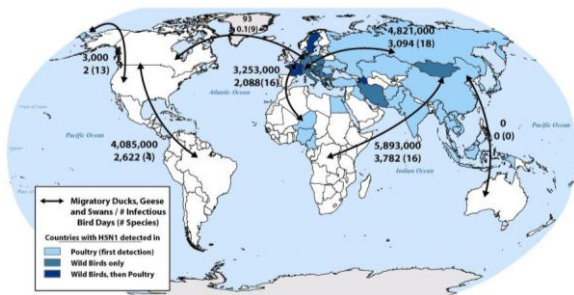
Peter Daszak  
[www.conservationmedicine.org](http://www.conservationmedicine.org)



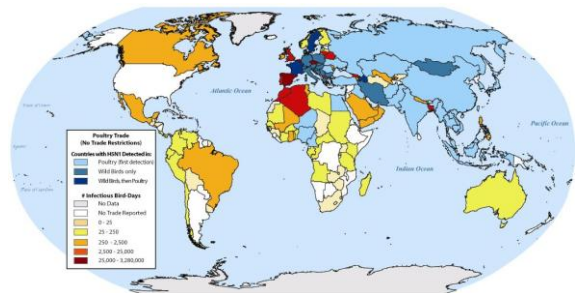
Science (2001) 287: 443-449

Photo: J. P. Dr. W. Sheikh, CD

## Predicting future spread: Migratory birds



## Predicting the spread of H5N1 avian influenza : Poultry trade

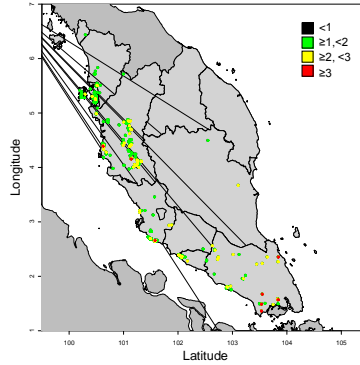


Nipah virus in Malaysia  
Species chain for Nipah virus transmission



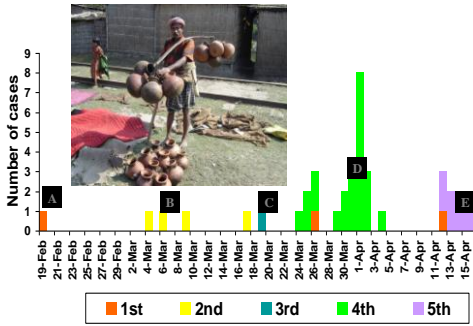
Consortium for Conservation Medicine

Nipah virus emergence in Malaysia  
Risk of re-emergence



Work funded by the NIH Fogarty International Center

Nipah virus: 5 chains of person-to-person transmission

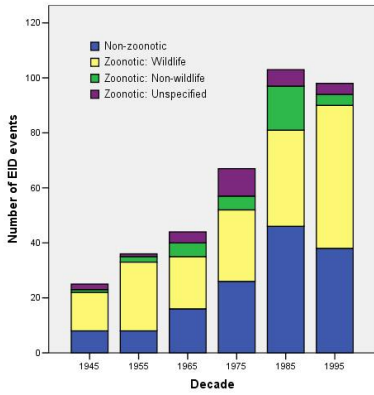


Faridpur outbreak

- Person-to-person transmission has now been reported for Nipah virus in Bangladesh, with up to 5 chains of transmission in the Faridpur outbreak

Consortium for Conservation Medicine

### Emerging diseases are on the rise



Analysis of all 450+ known emerging disease 'events' since 1940

New diseases from wildlife are the dominant group in the 1990s

Jones et al (2008) *Nature*

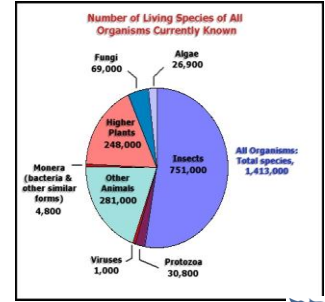


### Can we predict the next SARS or HIV?

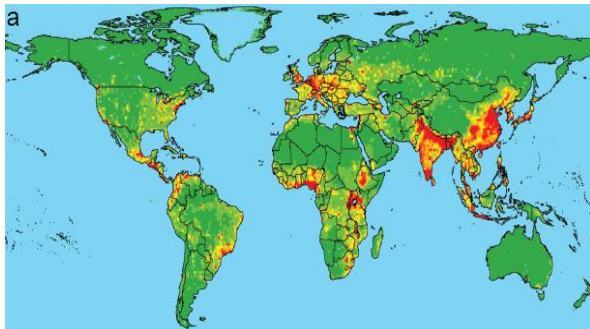
There are 50,000 known vertebrate species. If each has 20 endemic viruses, there are over 1 Million vertebrate viruses (20,000 in bats alone)

Only 2,000 or so viruses have been described, so 99.8% of vertebrate viruses remain to be discovered

Large potential for future zoonotic emergence!



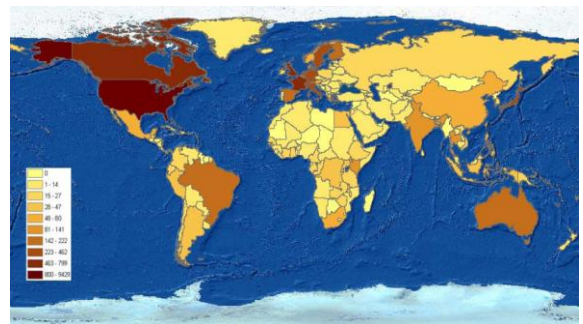
### Risk of a new emerging disease from wildlife



Global distribution of relative risk of any EID event  
0 – green to 1 – red

Jones et al. *Nature* (2008)

### Global effort to combat EIDs is poorly allocated



Jones et al. *Nature* (2008)



10 Hufnagel, L. et al. (2004) Proc. Natl. Acad. Sci. USA 101, 15134-15139 25000  
Copyright ©2004 by the National Academy of Sciences



### Session 3 Pushing back the barriers

**Chair:** Peter Core, Australian Centre for International Agricultural Research

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**Julie Hall, World Health Organisation**

## Emerging Infectious Disease Threats



Dr Julie Hall MBE  
 Deputy Regional Advisor  
 Communicable Diseases  
 Western Pacific Regional Office, WHO

## Overview of Presentation

1. Highlight infectious diseases that could pose a threat to Australia over the next decade
2. Highlight current issues with regional capacity to detect and respond to infectious disease threats of potential concern to Australia



# 1. Highlight Infectious Diseases that Could Pose a Threat to Australia Over the Next Decade

# Infectious Diseases of Concern

Threat to Australia:

- **Direct threat** to human health as a result of importation/emergence and onward transmission
- **Indirect threat** to Australia as a result of socio-economic impact in regional neighbour

Three kinds of threats:

- **Surge:** current disease threats that could increase as a result of changes our environment
- **Shift:** Current diseases that could become a threat of greater concern if the pathogen were to alter
- **Surprise:** New/unrecognized pathogens that could emerge and threaten human health

# Infectious Diseases of Concern

## 1. Surging Threats:

Current disease threats that could increase as a result of changes our environment

### **Dengue and other vector borne diseases such as JE, West Nile, Chikungunya**

- Climatic changes, urbanization, changes in water usage

### **TB, HIV, rabies, leptospirosis**

- Urbanization, societal disruption, migration

### **MDR-TB, MRSA, other drug resistant infections**

- Inappropriate drug use, health care incentive systems

### **Man-made bio-risks**

- Dramatic increase in number of high containment laboratories in the region since SARS and advancements in technology

# Infectious Diseases of Concern

## 2. Shifting Threats:

Current diseases that could become a threat of greater concern if the pathogen were to alter

### **Influenza**

- Multiple strains, mutation rate in some (e.g. H5) very high
- Many sites in Asia endemic for range of avian influenza strains

### **Hendra and nipah**

- Evidence of continual changes in these viruses
- Australia vulnerable due to overlapping bat colonies

### **SARS-like viruses**

- Still in existence and continually mutating

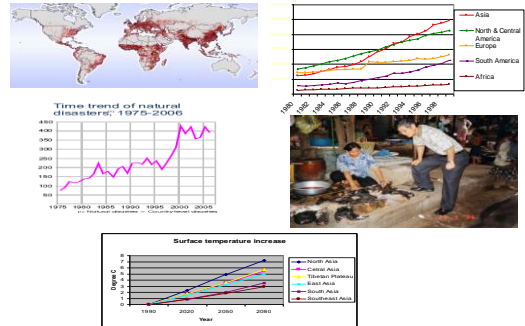
# Infectious Diseases of Concern

## 3. Surprise threats:

New/undiscovered pathogens that could emerge and threaten human health

- One a year globally on average for past three decades
- Incidence new events is rising
- Asia Pacific region has all the drivers – and they are increasing

## Drivers



## 2. Highlight Current Issues with Regional Capacity

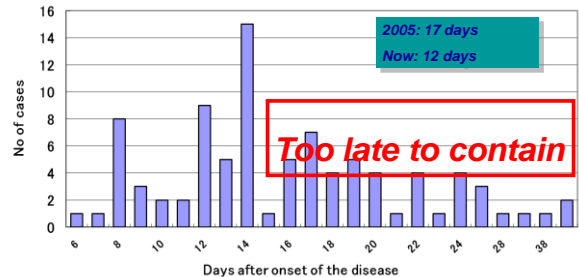
- Emerging Infectious Disease threats were the driving force behind revision of IHR
- Capacity to detect and respond to events of potential international health concern by 2012
- Capacity building supported by Asia Pacific Strategy on Emerging Diseases (APSED)
- AusAid major contributor to APSED implementation



## Capacities

- Current situation in middle and low resource countries in the Asia Pacific Region
- Many of these countries are considered potential 'hot spots' for surge, shift and/or surprise infectious disease threats
- Using avian influenza as example

### 1. Detect – early enough



World Health Organization, Western Pacific Regional Office  
Communicable Disease Surveillance and Response



World Health Organization, Western Pacific Regional Office  
Communicable Disease Surveillance and Response



### 2. Diagnose – accurately enough

- Recent external evaluation of national influenza laboratories in the region showed that 90% could accurately diagnosis influenza A/H5
  - Significant improvement in recent years
- However accuracy and availability of testing facilities is much lower for many other priority diseases

### 3. Respond – effectively enough

- Around 60% of all countries have in place rapid response teams
  - Up from <10% three years ago
- Only a quarter of countries report that they have adequate infection control in hospitals and the surge capacity to cope with major outbreak
  - All countries report that there has though been a marked increase in knowledge and stockpiling of resources at national level in recent years

World Health Organization, Western Pacific Regional Office  
Communicable Disease Surveillance and Response



World Health Organization, Western Pacific Regional Office  
Communicable Disease Surveillance and Response





## Conclusion

- Multiple potential threats to Australia
- Increasing the capacity of regional neighbours to detect and respond to events of potential significance should be a critical component of Australia's threat management strategy
- Significant improvements in past 5 years as a result of SARS, pandemic and IHR driven investment
- Need for continued support and strengthening – even when perceived risk level may have fallen

World Health Organization, Western Pacific Regional Office  
Communicable Disease Surveillance and Response



**Closing  
comments**