

# **“Biosecurity, Mitigating the Risk of Disease Emergence and Impact”**

## **The Role of Digital Pathology in Maintaining Australia’s Biosecurity**

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**There has been an increase in the number of new diseases of human, veterinary and wildlife health significance.**

A few examples

# Human & Veterinary Health

(Australia)



## General cost (HeV):

1. Human health min. of 2 deaths.
2. Veterinary health approx 18 race horses dead (over time).
3. Social impact (racing public).
4. Racing Industry
  - local industry
  - export industry

## Financial cost:

- Unknown (losses to racing industry, human & vet health, exports)

(Malaysia)

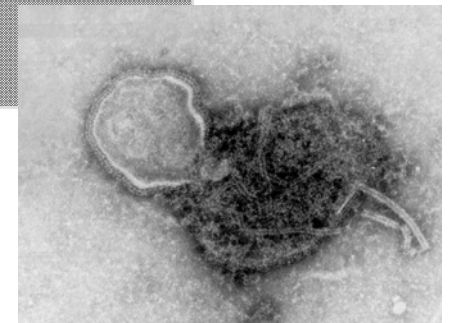


## General cost (NiV):

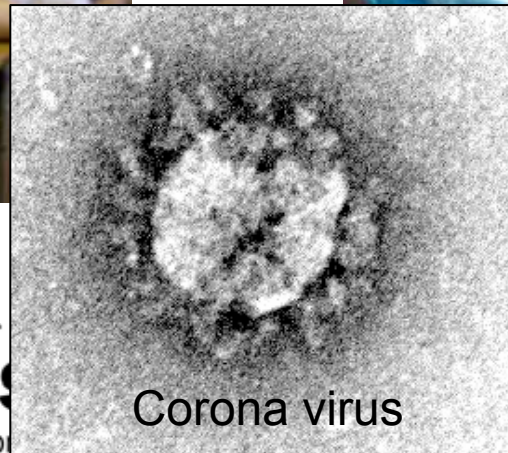
1. Human health min. of 105 deaths.
2. Local/export industry. (> 1,000,000 pigs slaughtered)
3. Social impact (income/lifestyle)

## Financial cost:

- estimated \$200,000,000



# Human Health: SARS



Corona virus

Headline, Monday, June 9, 2003

## This man started S



First patient: Huang Kingfu.

THIS is the first picture of the man identified as having started the spread of the deadly SARS virus.

Chef Huang Kingfu, 36, says he is related with both men learning the epidemic.

Mr Huang fell ill last December while working at a restaurant that specialized in unusual animal dishes, in Shekou, China, on the border with Hong Kong.

It was only a February that Chinese authorities discovered his fever and breathing difficulties as acute viral respiratory syndrome.

SARS has since swept the globe, killing 711 people in 32 countries. Researchers

Chef's work link to outbreak

are conducting intensive medicine tests on Mr Huang, a father of two, in the hope of identifying the cause of the disease and finding the key to treatment.

Mr Huang is thought to have prepared and cooked wild animals, most importantly the steel rat, which scientists believe is the source of the virus.

China's government has used wild animals as a source of SARS, pneumonia, swine and birds. Mr Huang recovered from the disease in January.

Last week Chinese author-

ities identified him as the "index patient" — the man believed to be the first human SARS victim.

In his home village, near Shenzhen, he only catches and under military escort to a nearby army hospital for more medical tests.

Mr Huang said he felt profoundly guilty.

"The prospect of being in jail was enough without a jail, but now I have to live with the mental torture of knowing that I am responsible for this," he said.

"I feel so sorry, very guilty.

Of course, I did not know what I had done. I did not know that I would be the first human SARS victim.

My life has been totally destroyed by SARS.

The virus infection causes severe fever, respiratory distress and breathing difficulties which can lead to pneumonia and death.

Mr Huang suffered the first symptoms of the illness on December 5.

Within a week Mr Huang was so ill he was taken to the People's Hospital in Shenzhen city, and then on to the Guangdong Military Hospital 220km away.

Mr Huang woke up a week later with a fever on his chest, unable to speak, cough or eat.

On his recovery, Dr Huang Kingfu, the military hospital's chief doctor, said him or was OK, but that many people were now getting the disease.

"That's when I realized I had had SARS," Mr Huang said.

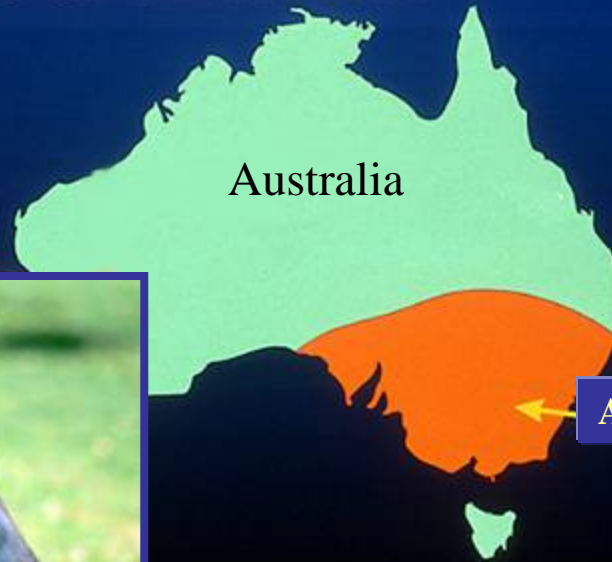
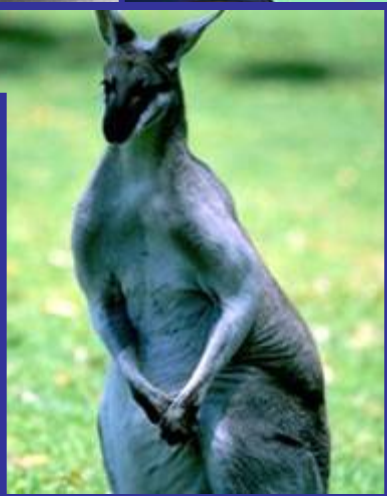
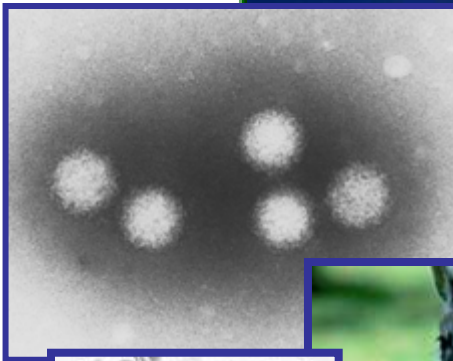
Dr Huang said he was convinced Mr Huang was the first SARS victim.

All the medical records indicate that he was the first SARS patient," he said.

SARS Nov 2002 – July 2003):  
 774 (9.6 case fatality ratio %).  
 (China, Hong Kong, Taiwan, Canada).  
 2. Total cost \$11 billion.  
 (in the Asian region alone)

# Kangaroo blindness syndrome

## EXTENT OF OUTBREAK (1994-1995)



Area of epidemic

Infected Western & Eastern grey kangaroos, red kangaroos and euros.

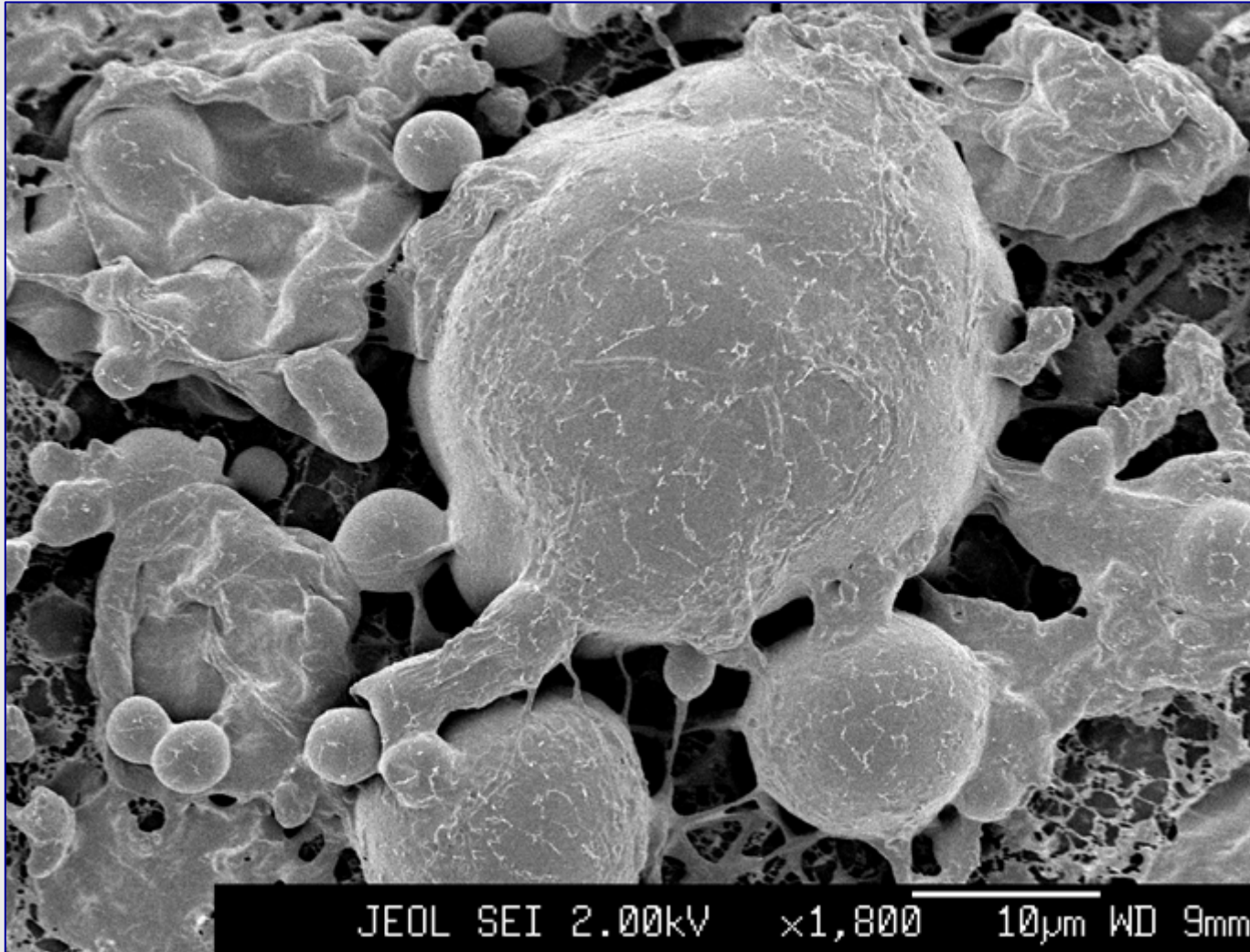
General cost:

1. Local/export industry?
3. Biodiversity/National heritage

Financial cost:

- Potential ????

# Biodiversity: Chytridiomycosis



Background: where are we coming from?

**There has been an increase in the number of new diseases of human, veterinary and wildlife health significance.**

Is there an explanation for this and should we take notice?

# Diseases & stable ecosystems.

- Infectious agents & disease, their introductions and emergence have contributed to ecosystem stability and resilience for millions of years via the processes of natural selection.
- Based on this argument new and emerging diseases are not new, they are part of our evolutionary history. They are an integral part of our environment which provide us with ‘quality-of-life services’

## Services provided by ecosystems

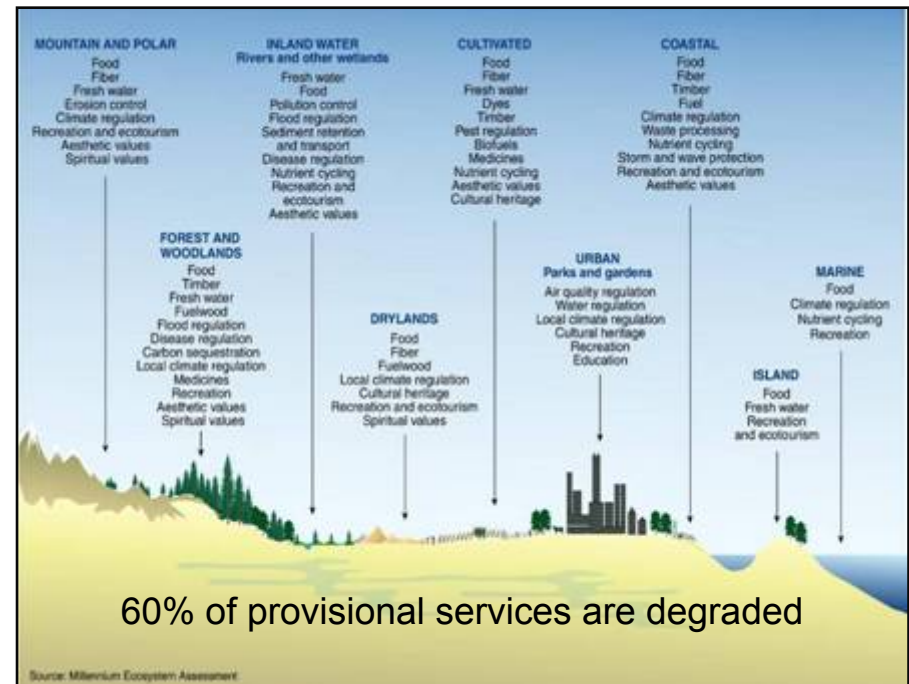
**Millennium Ecosystem Assessment**

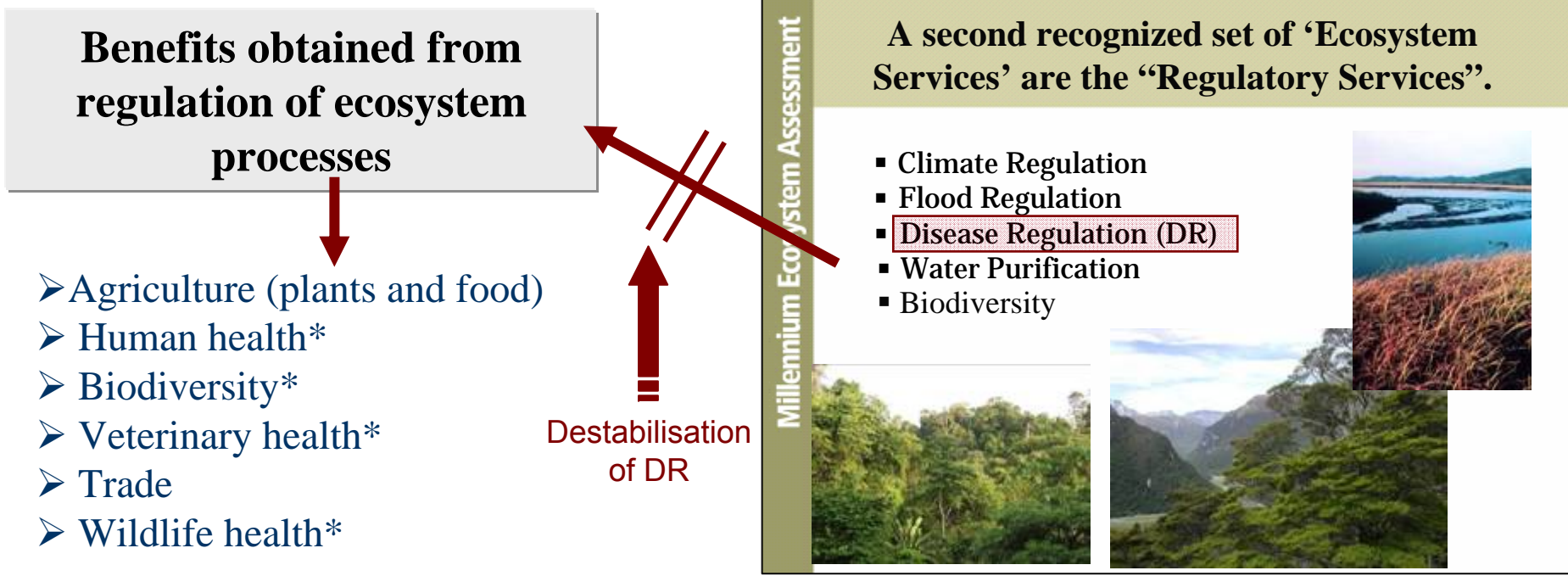
### Provisional services (from ecosystems)

- Food
- Freshwater
- Wood fuel
- Timber
- Fiber
- Genetic Resources



## However these services are being degraded

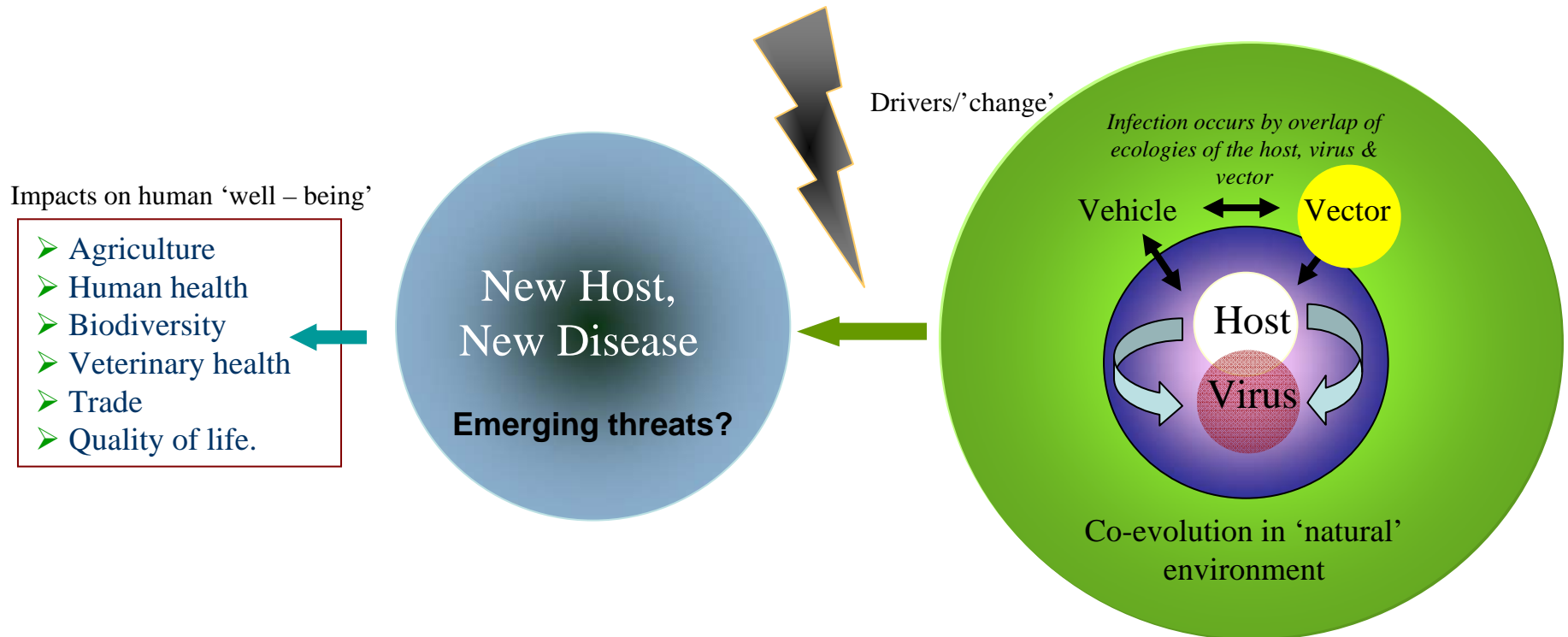




**Continued changes of the environment can lead to dismantling of regulatory services, which can affect the distribution and impact of pathogens.**

# How can this happen?

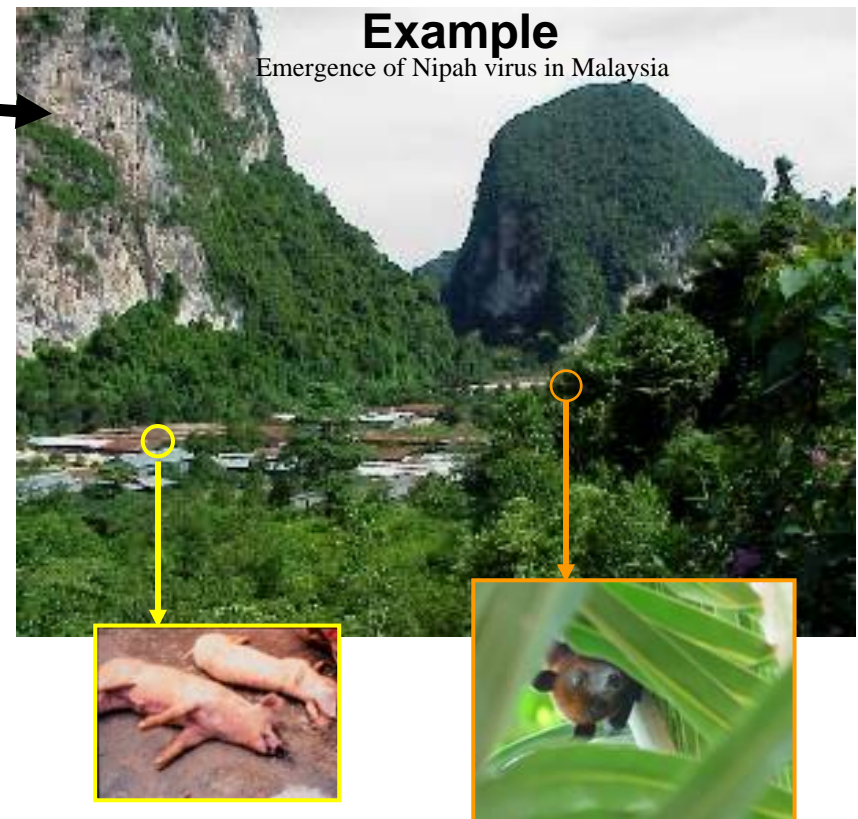
‘Change’ can facilitate the accelerated interaction of pathogens with new hosts in new environments. If ‘conditions’ are such that pathogens can effectively spread to new hosts, infect, replicate and be released and ‘transmitted’ to further hosts then new infections and diseases may emerge.



# What are the drivers?

- *Changes in the distribution and availability of surface waters, e.g., through dam construction, irrigation and stream diversion; agricultural land use changes, including proliferation of both livestock and crops;*
- *Changes in agricultural practices*
- *Deposition of chemical pollutants, including nutrients, fertilizers and pesticides;*
- *Uncontrolled urbanization or urban sprawl; climate variability and change;*
- *Migration and international travel/trade;*
- *Accidental or intentional human introduction of pathogens.*
- *Conflict (war)*
- *Poverty*
- *Abnormal events (bio-terrorism)*

Changes can lead to an increase probability of ‘pathogen spill-over’ and the emergence of new diseases



# Ecosystem Health = One Health



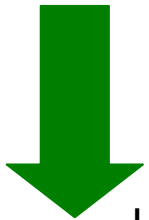
Global



National



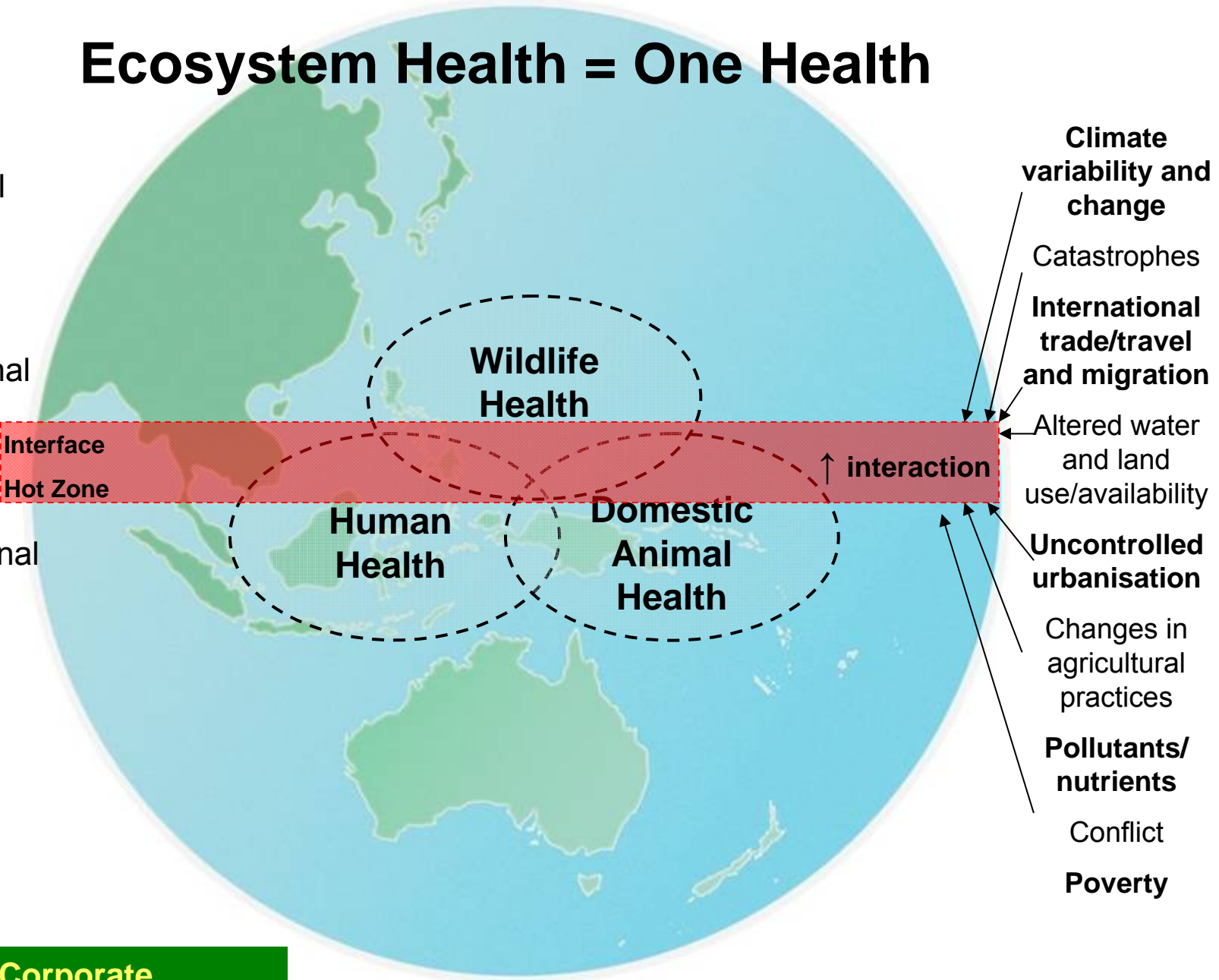
Regional



Local



**Personal & Corporate Responsibility**



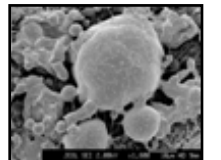
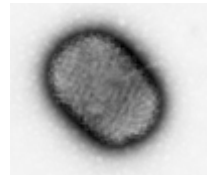
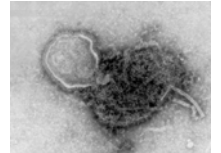
**Through the emergence of disease over the past decade, we have learned to expect the unexpected**

**– new pathogens, new hosts, new mechanisms of disease transmission.**

# The challenges:

To reduce both the chances of emergence and impact of new and exotic diseases into the Australian 'One-Health' environment there is a need to rapidly diagnose diseases (i.e. identification and differentiate one disease from another) and identify their aetiological agents.

This is done by a suite of diagnostic 'tools' of which pathology is one. Like other 'diagnostic tools' pathology must become a rapid national resource which utilises Australia's specialised resources.



Trade



Trade



Biodiversity



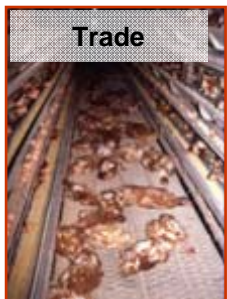
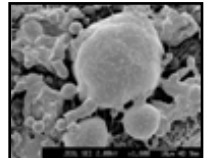
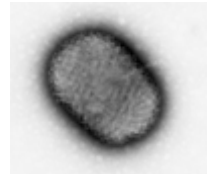
Human health



Zoonotics

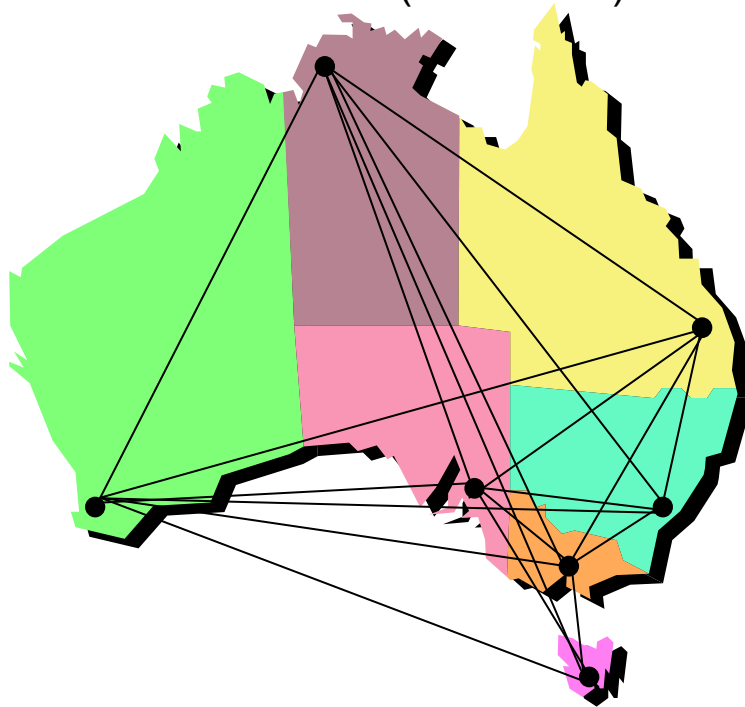
# The challenges in pathology are:

- a) have rapid processing of samples (conventional and specialised histochemistry);
- b) have access to pathologists to read slides;
- c) have access to pathologists expert in different diseases and infectious agents;
- d) have opportunity for 'group' discussions;
- e) have access to data and images from common and/or disparate databases.

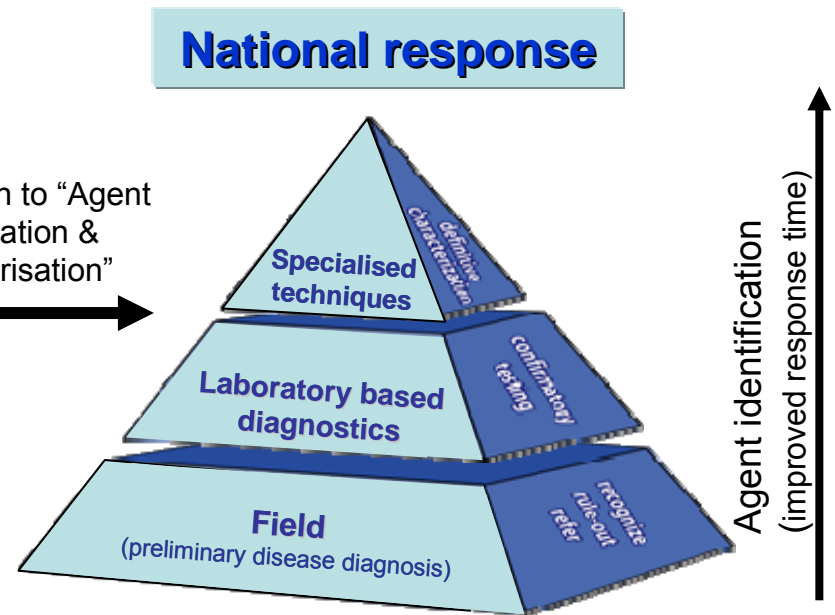


# These challenges can be met by developing a unified, rapid, national response to disease diagnosis and agent identification

Inter-connection of major diagnostic laboratories (one health)



Contribution to "Agent identification & characterisation"



# **The future of pathology in diagnostic laboratories should include the use of whole slide imaging and associated web-based software for:**

- (a) the rapid disparate:
  - (i) processing of samples (i.e. use of all diagnostic labs),
  - (ii) scanning of slides
  - (iii) storage of images and metadata;
- (b) utilisation of all Australia's pathologists (making use of expertise and sharing work load);
- (c) sharing images and databases (databases);
- (d) education purposes &
- (e) maintaining resource (human, equipment, cost) efficiency.

# Our Aims:

## Australian Registry of Wildlife Health

Universal Access – to resources and information

- Integrated data, image and metadata mgmt
- Incorporating:
  - Electronic documents
  - Powerpoint presentations
  - Videos
  - Macroscopic and microscopic image libraries
  - Annotated images

Microsoft Access - [Digital Image Enquiry Results]

Help Type a question for help

Close

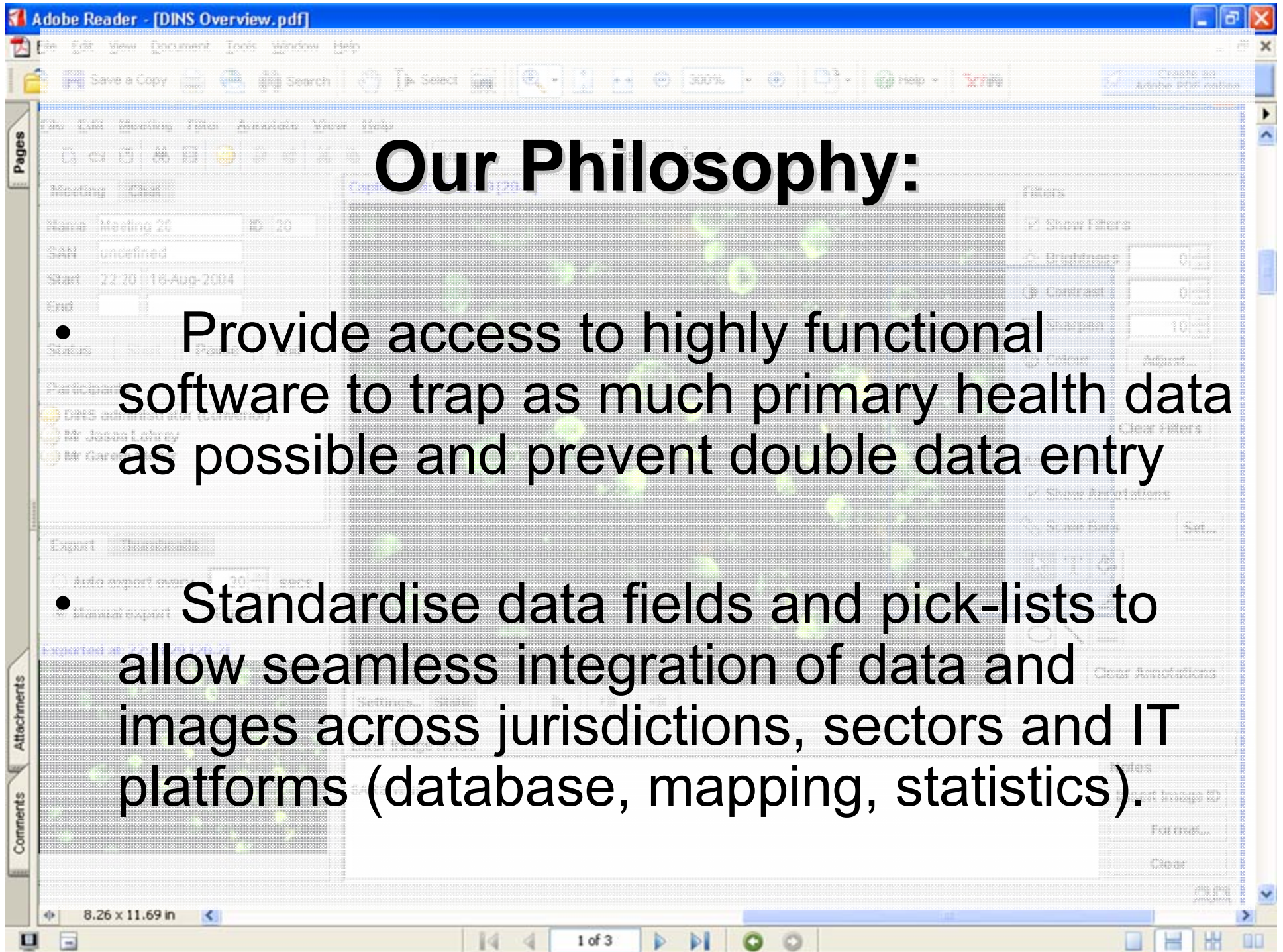
# Our Aims:

One integrated, national information management and communication system facilitating:

- Disease investigation and case management
- Emerging and exotic disease surveillance
- Education – primary training and continuing education
- Research / Project Management

Record: 7 of 35 (Filtered)

Form View FLTR NUM



# Our Philosophy:

- Provide access to highly functional software to trap as much primary health data as possible and prevent double data entry
- Standardise data fields and pick-lists to allow seamless integration of data and images across jurisdictions, sectors and IT platforms (database, mapping, statistics).

# **Whole Slide Imaging Applications -**

**Australian Registry of Wildlife Health**

- Daily Case Management and Resource Sharing
- Research – Project Sharing and Mgmt Online
- Research & Ed. – Archived Data and Images
- Education – Digital Comparative Slide Boxes
- CE – National Wildlife Pathology Rounds
- CE - What's Your Diagnosis?
- Disease Investigation – workshop emerging diseases online for rapid characterisation

# Biosecurity Intelligence Outcomes

- Mapping, tracking, predictive analysis
- Risk assessment, prioritisation and communication
- Leading to informed policy and decision making, expenditure, risk management, and support for our disease free status
- WSI Technology is an essential element



**Thank you for participating**

