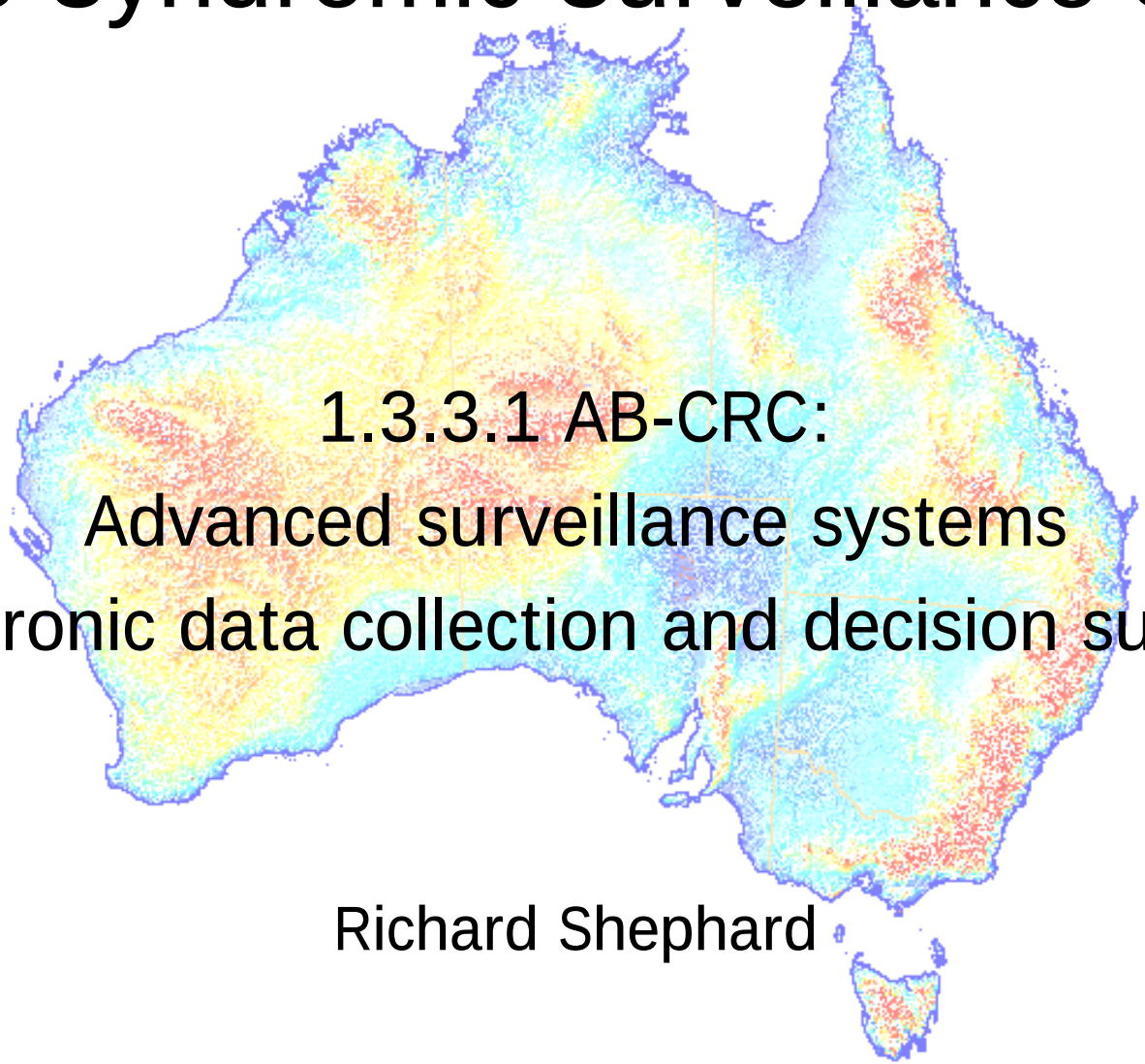
Bovine Syndromic Surveillance System



1.3.3.1 AB-CRC:
Advanced surveillance systems
-Electronic data collection and decision support

Richard Shephard

OIE Developments

- Changing approach to demonstrating freedom status
- Greater emphasis on the link between required veterinary services and surveillance
- 3 components required:
  - Surveillance & monitoring
  - Host population monitoring
  - Assessment of environmental factors

2005 OIE General Session

- Will vote on new surveillance guidelines for terrestrial code
  - An extension of aquatic animal guidelines
- Consequence:
  - Will accept a variety of data to demonstrate freedom
- Will accept novel surveillance techniques IF they have been published and reviewed
- Technique must describe:
  - Populations in detail
  - Method of data collection
  - Analytical approach
  - Biases within the system

What does this mean?

- Required outputs from surveillance system:
  - Detect disease
  - Assess progress of disease control
  - Demonstrate freedom
  - Describe distribution

- ***New (proven) technologies to do these tasks are now acceptable***

Why syndromic surveillance?

- Good surveillance ⇔market access
- Traditional surveillance is difficult in extensive beef systems
- But, we export – can we have it both ways?

Increasing the National Surveillance Capability

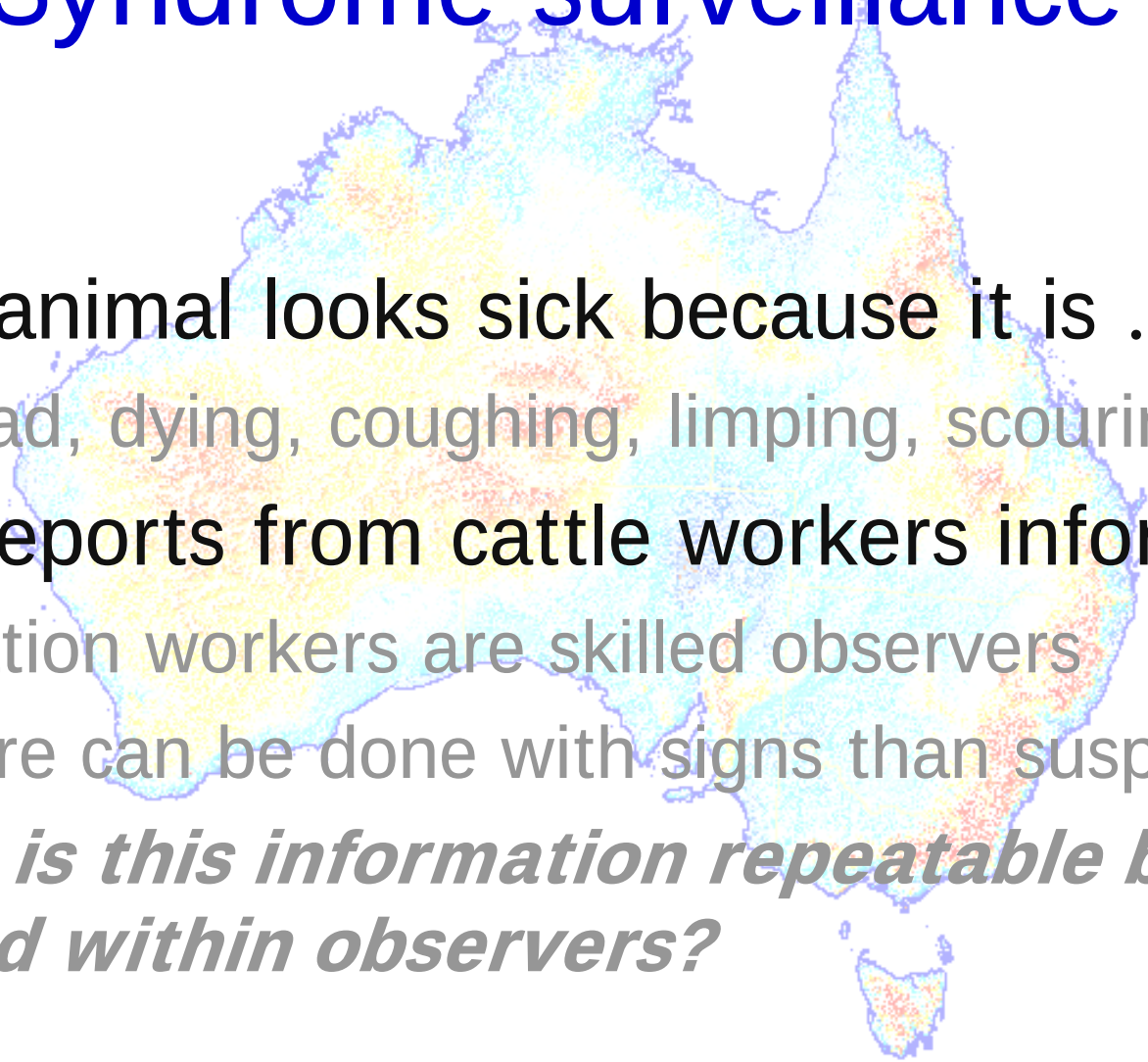
Observation → Investigation → Information

Observation Phase

Declining observation

Producers
Livestock agents
Meat inspectors
Private veterinarians
Agricultural consultants
Veterinary chemical representatives
Government animal health workers
Government veterinarians

Syndrome surveillance



- This animal looks sick because it is ….
  - Dead, dying, coughing, limping, scouring, etc.
- Are reports from cattle workers informative?
  - Station workers are skilled observers
  - More can be done with signs than suspected Dx

But, is this information repeatable between and within observers?

It’s a long way to the crush!

Why not just use vets?

- The alert clinician is good at picking unusual individuals
  - ‘This cow has neurological signs and scouring’
  - Because the combination is unusual in itself
- But, they are not so good at detecting trends within reasonably common signs
  - ‘There has been an increase in the prevalence of adult scouring sheep over the past 10 years’
  - There is nothing too unusual about the individual

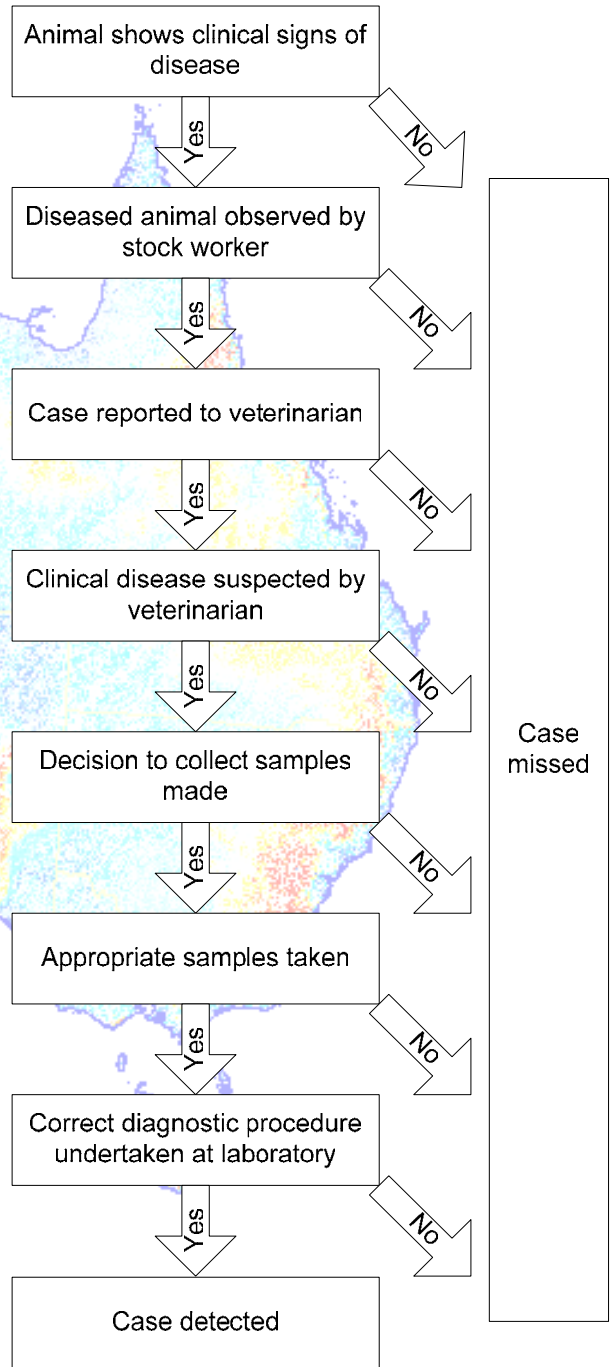
A collection of signs…

- Clinical sign / signalment combination is strong evidence for individual disease presence
  - Coughing + scouring in a few – any no. of diseases, BUT unlikely to be FMD?
- What trends in sign combinations are present?
  - Describe disease presentation in the population
  - Useful for detecting new/emerging diseases like OJD!

A system that can potentially detect the undescribed, the insidious and the non-descript

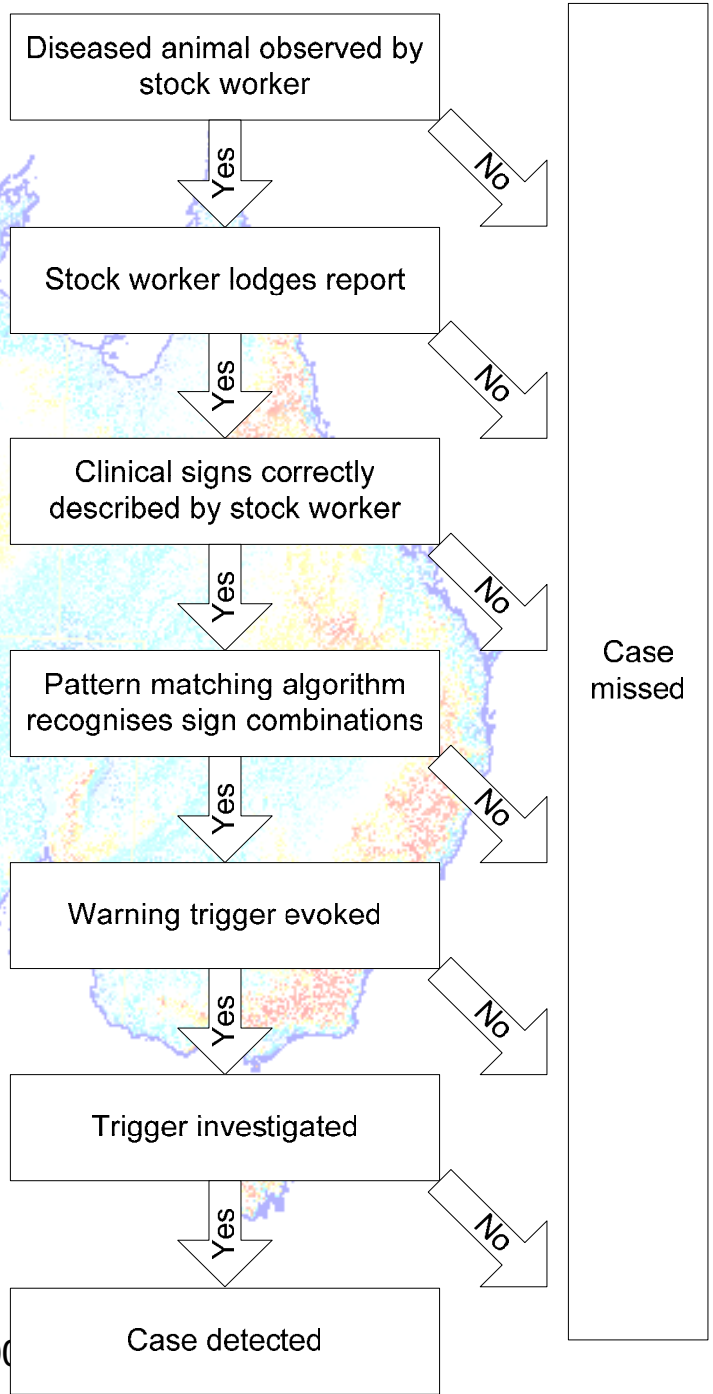
General surveillance

The current pathway for data capture



Syndrome surveillance

providing an additional pathway for detection



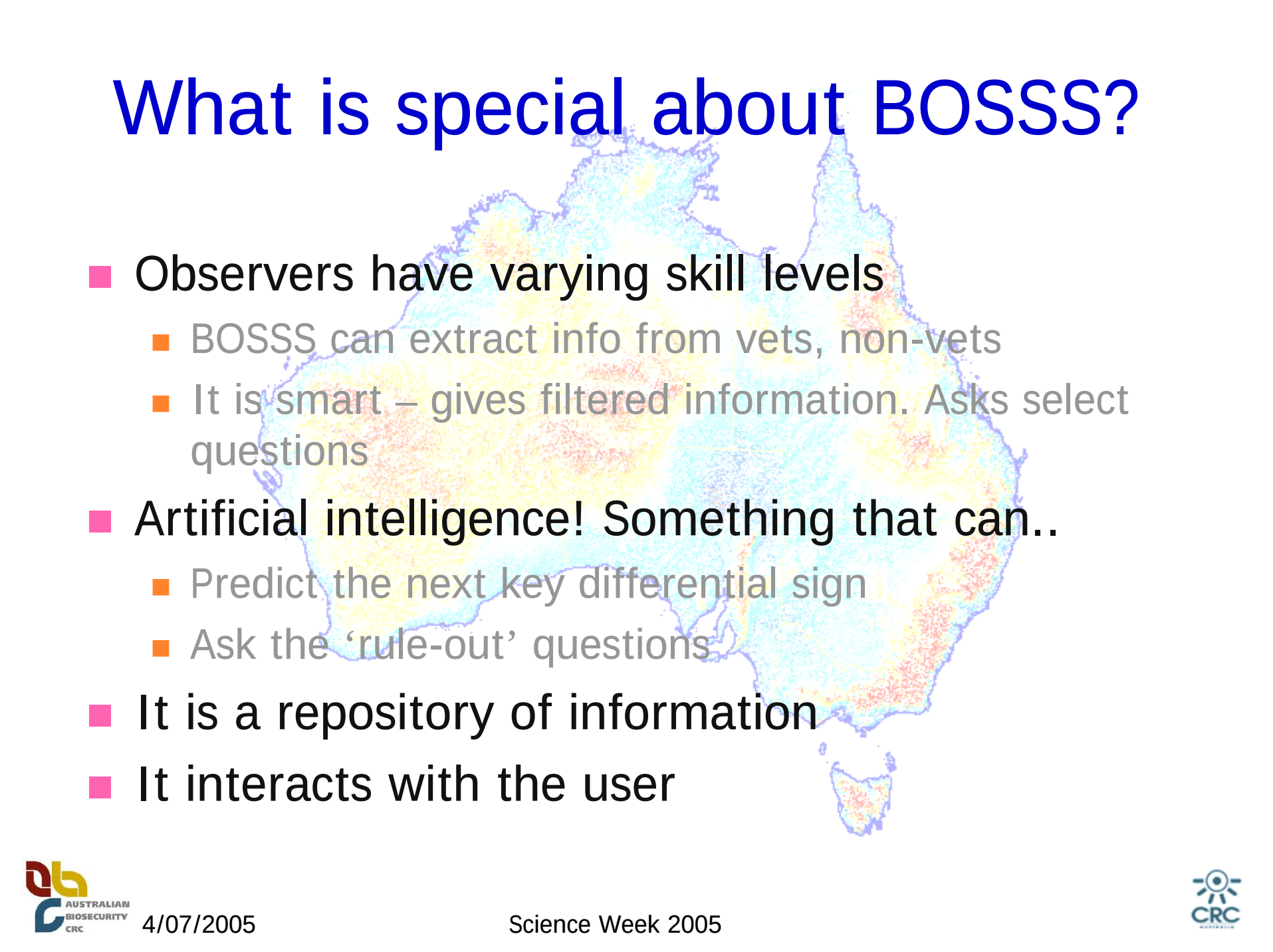
Syndrome surveillance – any advantages?

- High sensitivity but modest specificity
- It is like a screening test
  - High Negative Predictive Value
  - Modest Positive Predictive Value
- Good at ‘ruling-out’ disease
- Not good at ‘ruling-in’ disease
- Therefore producers can report with confidence!
  - They will not get locked out of any markets

Animal welfare

- We do not have a blood test for good animal welfare
- Historical records of the signs and condition of stock is some evidence
  - Syndrome observations
- This system may have advantages in this area

What is special about BOSSS?



- Observers have varying skill levels
  - BOSSS can extract info from vets, non-vets
  - It is smart – gives filtered information. Asks select questions
- Artificial intelligence! Something that can..
  - Predict the next key differential sign
  - Ask the ‘rule-out’ questions
- It is a repository of information
- It interacts with the user

Individual Observation Report

Page number ____

Station name: [redacted] -03.

Location on sta

Mob details

	Number in mob	No. affected	No. dead
Calves			
Yearlings			
Steers			
Spayed cows			
Cows	1400	1	
Bulls			
Horses			
Other			

When were cattle last observed? (pick the most suitable interval): 1 Wk ☑ 1 Mo ☐ 3 Mo ☐ >3 Mo ☐

Were similar signs observed at this time?: Yes ☐ No ☐ Unsure ☐ N/A ☐

Has a veterinarian investigated this problem? Yes ☐ No ☐

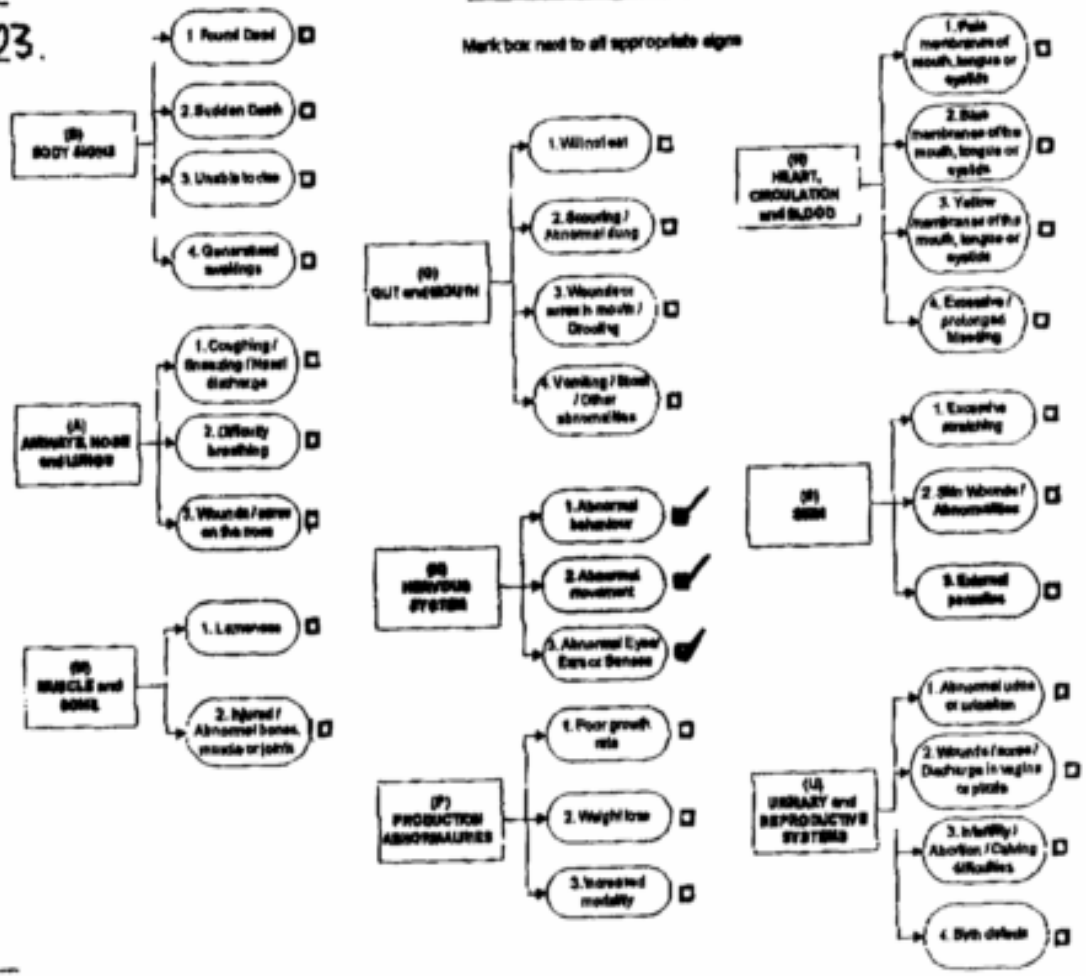
Diagnosis obtained: No ☑ Yes ☐ _____

Breed (predominant breed if mob): Brahman CBX

Comments: found alone in holding pdk, just stood there when ridden up to and looked as tho' it was staring into the sun/space. When made to walk off she staggered sideways then walked off. Looked like she had just calved in the last 24 hrs (no calf around) & very milked up. (milk fever?) Shot 3 days later.

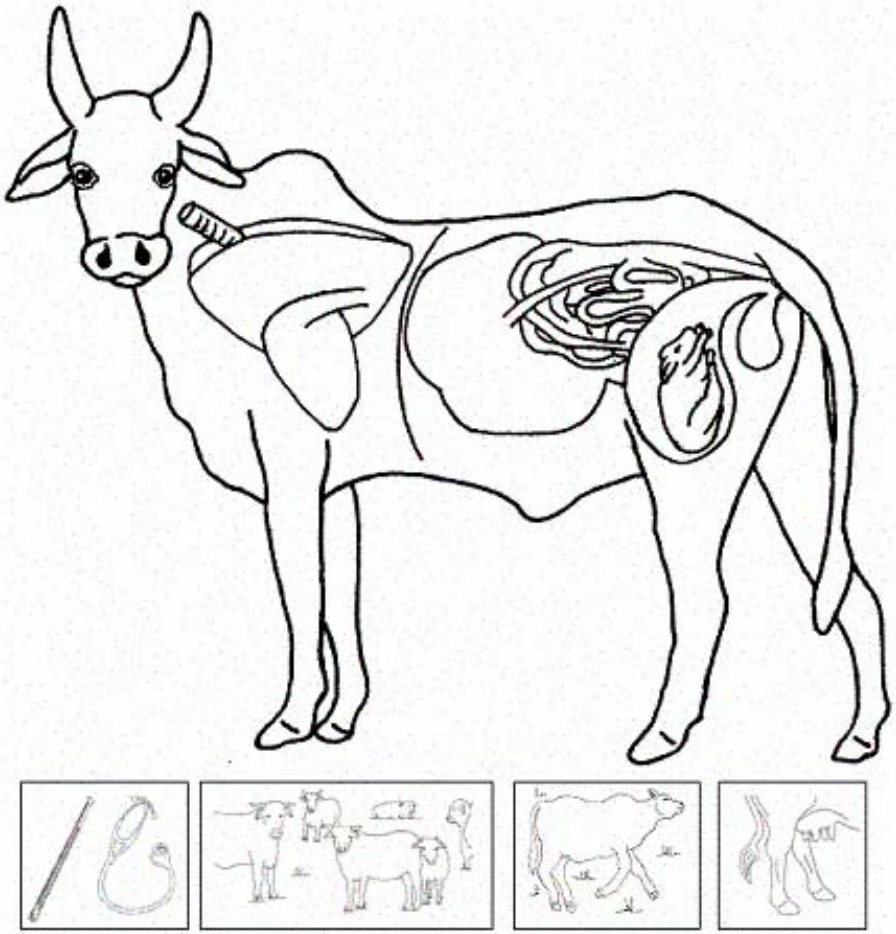
Clinical sign list

Mark box next to all appropriate signs



Enter basic data

1) Click on the affected part of the animal



2) Select details from the lists below

Head and Brain

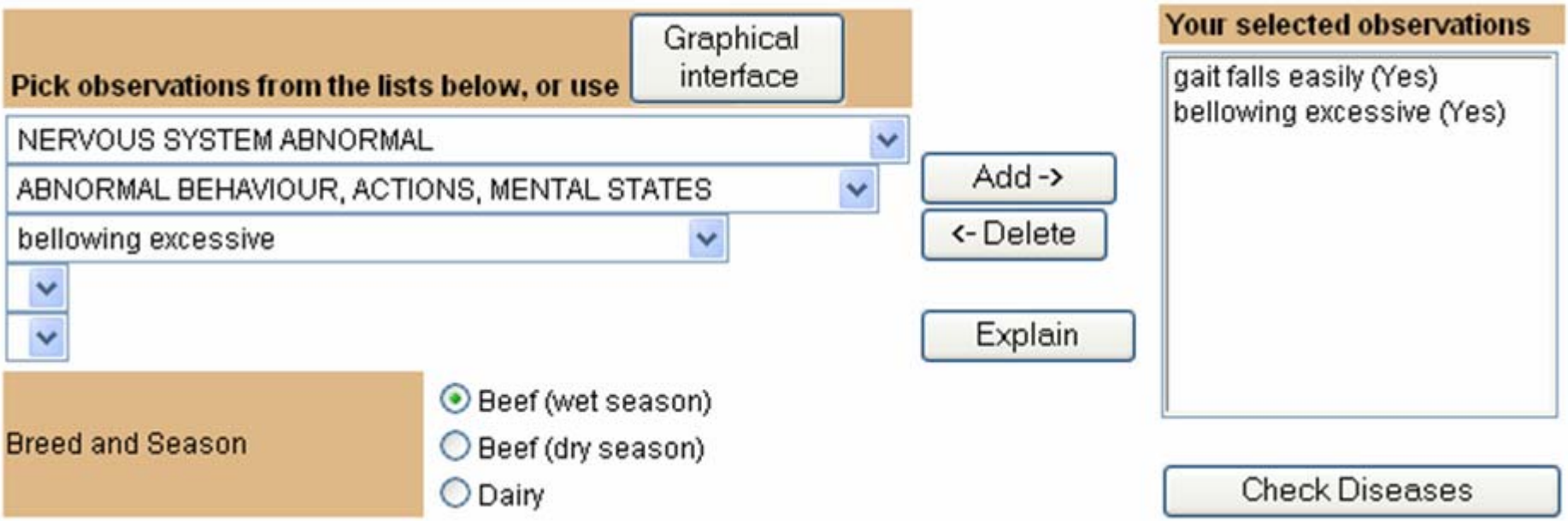
ABNORMAL BEHAVIOUR, ACTIONS, MENTAL STATES

-- Click here to select from list --
ABNORMAL BEHAVIOUR, ACTIONS, MENTAL STATES
ABNORMAL MOVEMENTS (INCL. PROGRESSION, PARALYSIS, CONVULSIONS)
HEAD POSITION, POSTURE ABNORMAL
SPINE / HEAD (AXIAL) SKELETON ABNORMAL
SKIN / HORN ABNORMALITIES
HAIR COAT ABNORMAL
LOCAL BODY PART ABNORMAL

Add Sign ↓ | Delete Sign ↑

4) When all signs are added, click the button to Continue

Enter basic data



Immediate feedback

Possible Diseases

The following list contains diseases that may be causing the problem you have described. Always check with a vet if you want to know what get a real diagnosis in case of sick animals. To find out more about a particular disease, click on the name of the disease below.

Disease	Rank
Lactation tetany acute (grass tetany)	
Rabies	
Spinal cord injury	
Spinal cord compression	
Mucosal disease cerebellar hypoplasia	
Incoordination not further specified	
Poisoning lead convulsive form	
Uterus rupture	
Muscle necrosis ischaemic	
Tetanus	
Toxaemia undifferentiated	
Brain trauma	
Paralysis/paresis not further specified	
Snakebite	
Otitis media/interna	
Ephemeral fever	
Abortion undifferentiated	
Enterotoxaemia C.perfringens type D	
Transit recumbency (transit tetany)	
Hypocalcemia nonparturient	

Risk Levels

Risk of being a **very contagious** disease

Risk of being a **zoonotic** disease

Risk of being an **exotic** disease

Risk of a Contagious Disease

There is a risk that this disease may be easily spread to other animals or properties. This case may represent a risk to other animals or properties if poor PM technique, carcase disposal or site or equipment disinfection is employed.

Risk of a Zoonotic Disease

There is a risk that this disease could be passed to humans. Contact with affected animals, or conducting a post mortem represent a risk to operators if poor PM technique, disinfection or protection are employed.

Risk of a Exotic Disease

There is a risk that this disease may be an important exotic disease (new to Australia). It is very important that you contact your local government animal health officer (vet or stock inspector) to discuss the case as soon as possible.

What next?

1) Add or Remove Signs

Return to the previous page to edit the list of signs.

Guided investigation

What next?

1) Add or Remove Signs

Return to the previous page to edit the list of signs.

Add or Remove Signs

2) Guided Examination

The system can attempt to narrow down the list of possible diseases by asking specific questions about the case.

Guided Examination

3) Recommended Actions

Should I call a vet? Should I collect samples for analysis? If so, which ones? The system can provide advice on what to do now.

Recommended Actions

Did you see these signs?

Guided Examination

Please indicate if the following signs were present or absent, or if you are unsure.

- Observations from a distance (may be done in the field)
- Hands-on examination (usually requires restraint)

1) Observations from a distance

Did you observe any of the following signs?

Clinical Sign	Yes	No	Not Sure
Animal details -sex, age, status, etc (signalment)			
lactating cow	○	○	◉
calving, during first month afterwards	○	○	◉
age adult	○	○	◉
female	○	○	◉
dry cow	○	○	◉
Behaviour, actions, mental state			
excessive response to external stimuli (hyperespon	○	○	◉
restlessness	○	○	◉
convulsions unspecified	○	○	◉
convulsions tetanic (rigid)	○	○	◉

Disease option

Possible Diseases

The following list contains diseases that may be causing the problem you have described. Always check with a vet if you want to know what get a real diagnosis in case of sick animals. To find out more about a particular disease, click on the name of the disease below.

Disease	Rank
Lactation tetany acute (grass tetany)	
Tetanus	
Failure to conceive undifferentiated	
Spinal cord injury	
Campylobacteriosis genital	
Lactation tetany subacute	
Acetonaemia wasting form	
Mastitis gangrenous staphylococcal	
Mastitis peracute coliform	
Mucosal disease cerebellar hypoplasia	
Spinal cord compression	
Trichomoniasis	
Parturition syndrome	
Incoordination not further specified	
Poisoning lead convulsive form	
Intestine obstruction, phytobezoar	
Uterus rupture	
Muscle necrosis ischaemic	
Toxaemia undifferentiated	
Metritis postpartum septic	

Risk Levels

Risk of being a **very contagious** disease

Risk of being a **zoonotic** disease

Risk of being an **exotic** disease

This appears to be a **low risk** disease. You should however always use appropriate caution when dealing with unknown diseases.

What next?

1) Add or Remove Signs

Return to the previous page to edit the list of signs.

Add or Remove Signs

2) Guided Examination

The system can attempt to narrow down the list of possible diseases by asking specific questions about the case.

Guided Examination

3) Recommended Actions

Should I call a vet? Should I collect samples for analysis? If so, which ones? The system can provide advice on what to do now.

Disease option 2

Possible Diseases

The following list contains diseases that may be causing the problem you have described. Always check with a vet if you want to know what get a real diagnosis in case of sick animals. To find out more about a particular disease, click on the name of the disease below.

Disease	Rank
Rabies	
Listeriosis meningoecephalitic	
Botulism	
Brain trauma	
Tetanus	
Spinal cord injury	
Paralysis/paresis not further specified	
Hypocalcemia nonparturient	
Cerebellum ataxia	
Snakebite	
Spinal cord compression	
Otitis media/interna	
Cerebrospinal larval migrans	
Actinobacillosis oral	
Lactation tetany acute (grass tetany)	
Myelomalacia	
Haemophilus somnus septicaemia	
Cauda equina neuritis	
Pseudorabies (Aujesky's disease)	
Stomatitis necrotic (oral necrobacillosis)	

Risk Levels

Risk of being a **very contagious** disease

Risk of being a **zoonotic** disease

Risk of being an **exotic** disease

High Risk of a Contagious Disease

There is a high risk that this disease may be easily spread to other animals or properties. You are strongly advised to contact the local government animal health officer (vet or stock inspector) to discuss the case before proceeding to conduct a post mortem, sample collection, or carcass disposal.

High Risk of a Zoonotic Disease

There is a high risk that this disease could be passed to humans. You are strongly advised contact your local government animal health officer (vet or stock inspector) to discuss the case before proceeding with a post mortem or sample collection.

High Risk of an Exotic Disease

There is a high risk that this disease may be an important exotic disease (new to Australia). It is very important that you contact your local government animal health officer (vet or stock inspector) to discuss the case as soon as possible.

What next?

1) Add or Remove Signs

Disease information

Lactation tetany acute (grass tetany)

Epidemiology

Mostly in mature cows in early lactation on deficient diets in inclement weather, or on grass dominant pastures or young cereal crops.

Diagnosis

Laboratory test: Low blood levels of magnesium. Post mortem low level of magnesium in eye fluid (vitreous humour).

Treatment

Control

Dietary supplementation with magnesium; enhancement of energy content of diet. Provision of shelter.

References

Radostits et al.Ed8p.1333; Blood PCp.516 Malmo US/VM18p.107; Bryden US/VM4p.32

Clinical signs

Disease signs

Signs for Lactation tetany acute (grass tetany)

Sign	Rank
age adult	99.90%
female	99.90%
illness lasts >1 hour <24 hours (course peracute)	99.90%
heart rate >100 per minute	95.00%
excessive response to external stimuli (hyperespon	95.00%
lactating cow	95.00%
jaw(s) clenched shut (trismus)	95.00%
blood magnesium low	95.00%
gait abnormal unspecified	95.00%
gait stiff	80.00%
down cow (posture recumbency)	70.00%
jaw(s) champing	70.00%
calving, during first month afterwards	70.00%
tissues contain haemorrhages multiple PM	70.00%
heart sounds loud	70.00%
convulsions unspecified	70.00%
convulsions tetanic (rigid)	70.00%
tremor	70.00%
blood calcium low	70.00%
voluntary feed intake < 50% of normal	50.00%
restlessness	50.00%
milk yield (individual) below normal	50.00%
no significant internal lesions HISTO	40.00%
dribbling urine / passing small amounts urine	30.00%
gait falls easily	30.00%

Sign guide

Paralysis/paresis unspecified

General Information

Inability to move parts of the body, or serious weakness of the movements, the type of paralysis not being specified

Diseases that may show this sign

[Home | Change Password | Logout]

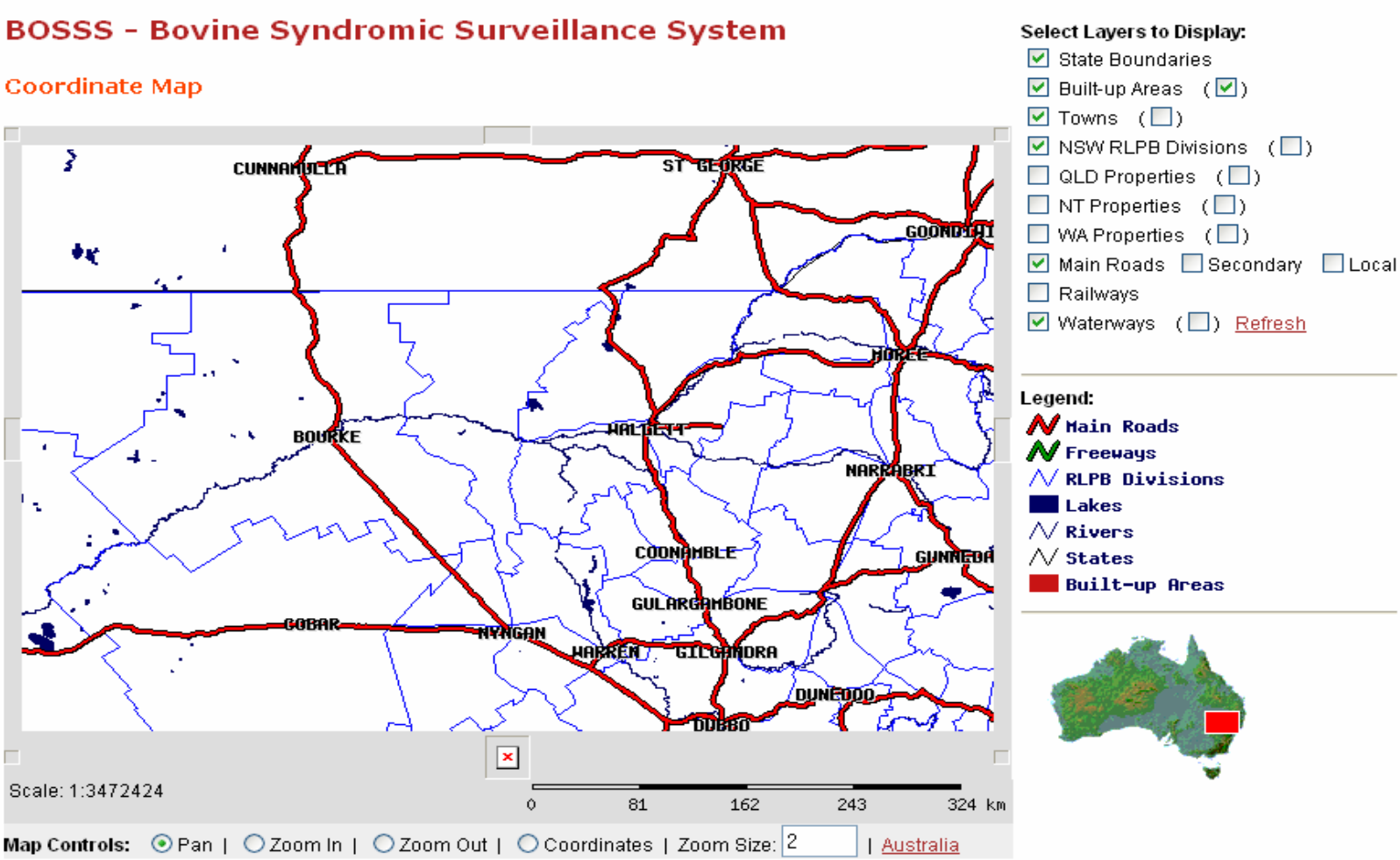
PM Guide

Contents

Step 16: Remove the stomachs and spleen

1. Pull and roll the stomach down and away from its attachments to the roof of the abdomen.
2. The spleen will come into view attached to the rumen as you roll the rumen out.
3. Cut the spleen from the rumen and place aside for later inspection.
4. You can inspect the ovaries and uterus of female cows and remove if further inspection is required at this stage.
5. Inspect the bladder and inside of the pelvis when the organs have been removed

Mapping – locating disease in place



Network of expertise

Ask the Experts

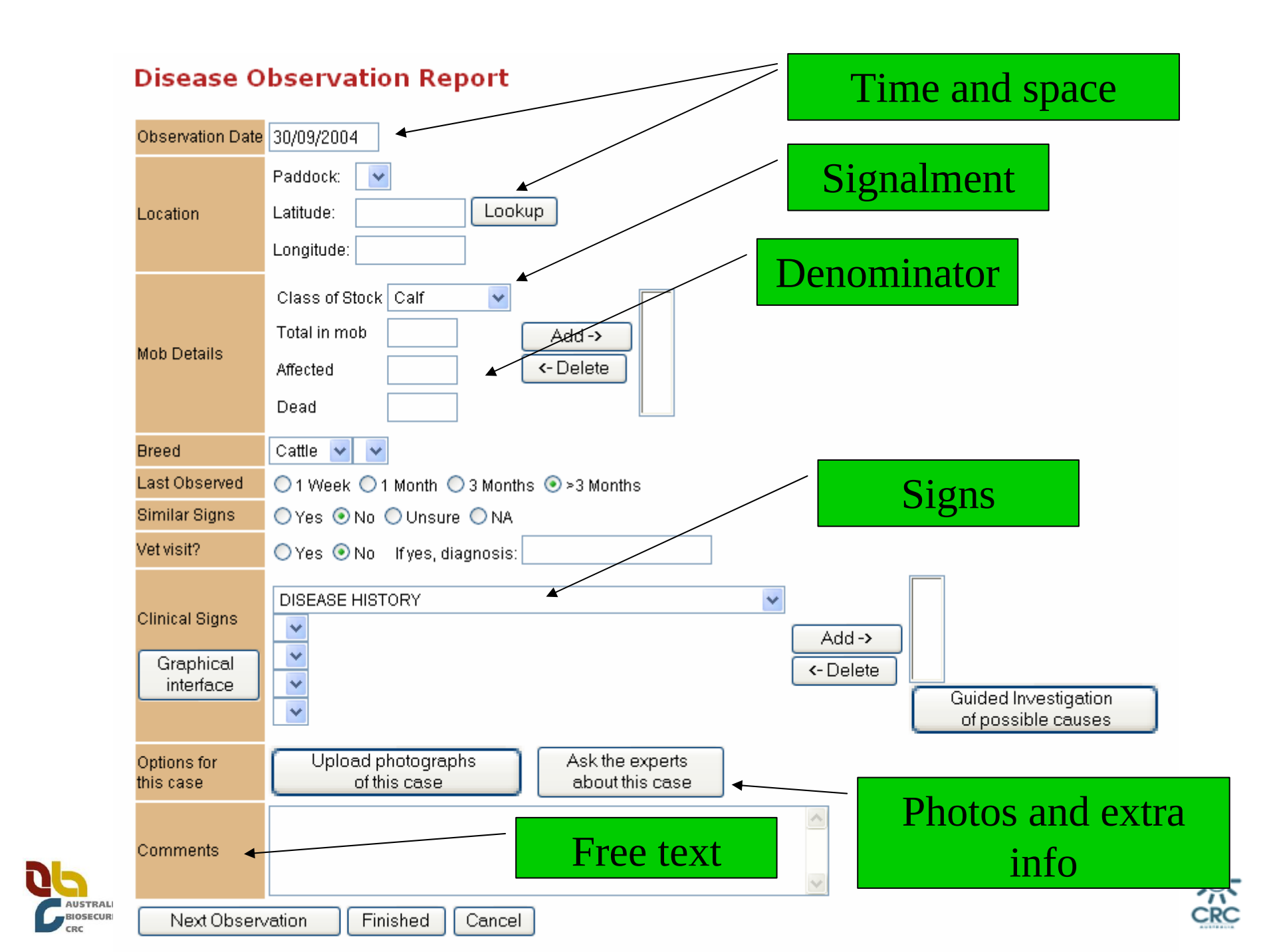
Questions related to this disease report will be automatically directed to a panel of local and national experts for their comment. The more detail provided in the diseas report, the easier it will be to answer the question. Clear photographs are also very useful.

Case report number 138

Subject

Text

Submit Question


Disease Observation Report
Observation Date
30/09/2004
Location
Paddock:
Latitude:
Lookup
Longitude:
Mob Details
Class of Stock
Calf
Total in mob
Affected
Dead
Add ->
<- Delete
Breed
Cattle
Last Observed
1 Week
1 Month
3 Months
>3 Months
Similar Signs
Yes
No
Unsure
NA
Vet visit?
Yes
No
If yes, diagnosis:
Clinical Signs
DISEASE HISTORY
Graphical interface
Add ->
<- Delete
Guided Investigation of possible causes
Options for this case
Upload photographs of this case
Ask the experts about this case
Comments
Next Observation
Finished
Cancel
Time and space
Signalment
Denominator
Signs
Photos and extra info
Free text

New Signs – CRC linkages

Pick observations from the lists below, or use Graphical interface

RAPID FIELD DIAGNOSTIC TESTS

pen-side test for foot-and-mouth disease (FMD) is positive

Add ->

<- Delete

Explain

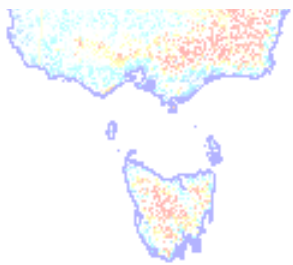
Breed and Season

- (•) Beef (wet season)
- ( ) Beef (dry season)
- ( ) Dairy

Your selected observations

pen-side test for foot-and-mouth disease (FMD) is positive (Yes)

Check Diseases

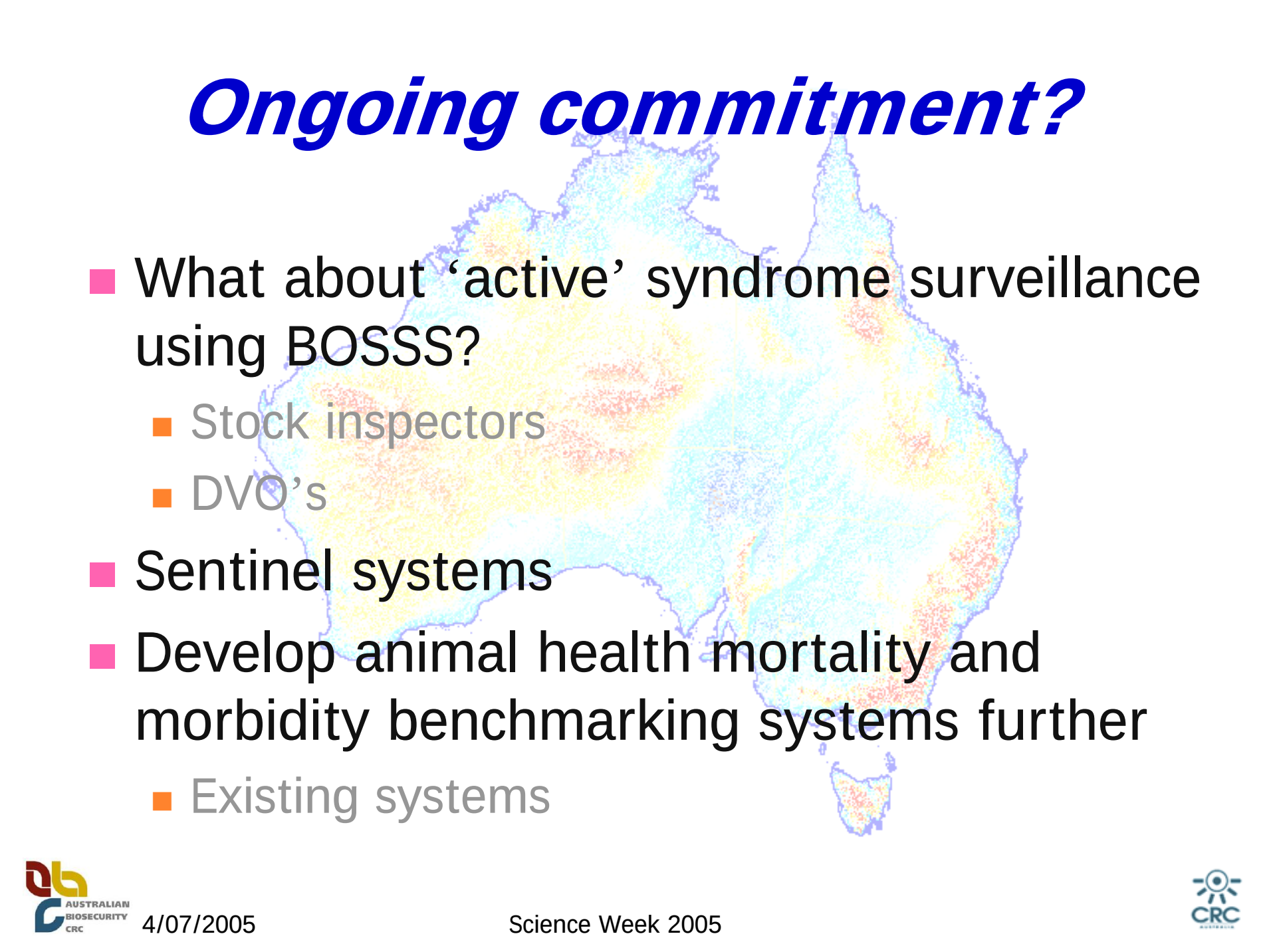


Output – producer information

- Differential list of diseases
  - Diagnostic work-up guide
- Morbidity and mortality data
  - Do I get more of this than the neighbors?
  - Did my intervention make any difference
- Disease history for the property
  - Export market access value

Objective: make them come back

Ongoing commitment?



- What about ‘active’ syndrome surveillance using BOSSS?
  - Stock inspectors
  - DVO’s
- Sentinel systems
- Develop animal health mortality and morbidity benchmarking systems further
  - Existing systems

Surveillance value: We know..

- Prevalence of disease signs in the population
  - And sign combinations
  - Where and when disease occurred
- What happened last year
  - We have historical data and denominator data

Therefore:

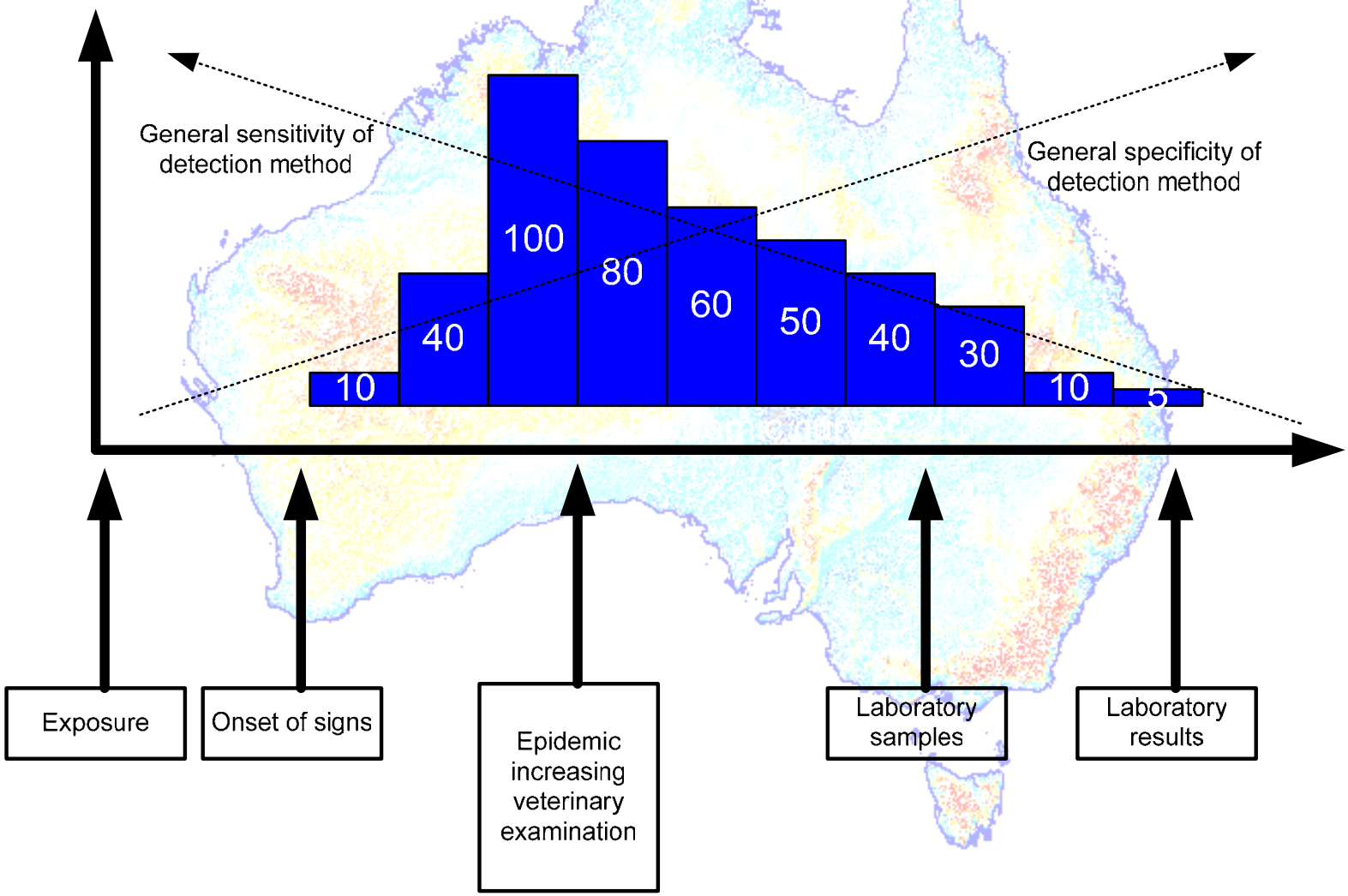
- We can see if disease presentation is changing over time

This is surveillance – note OIE changes

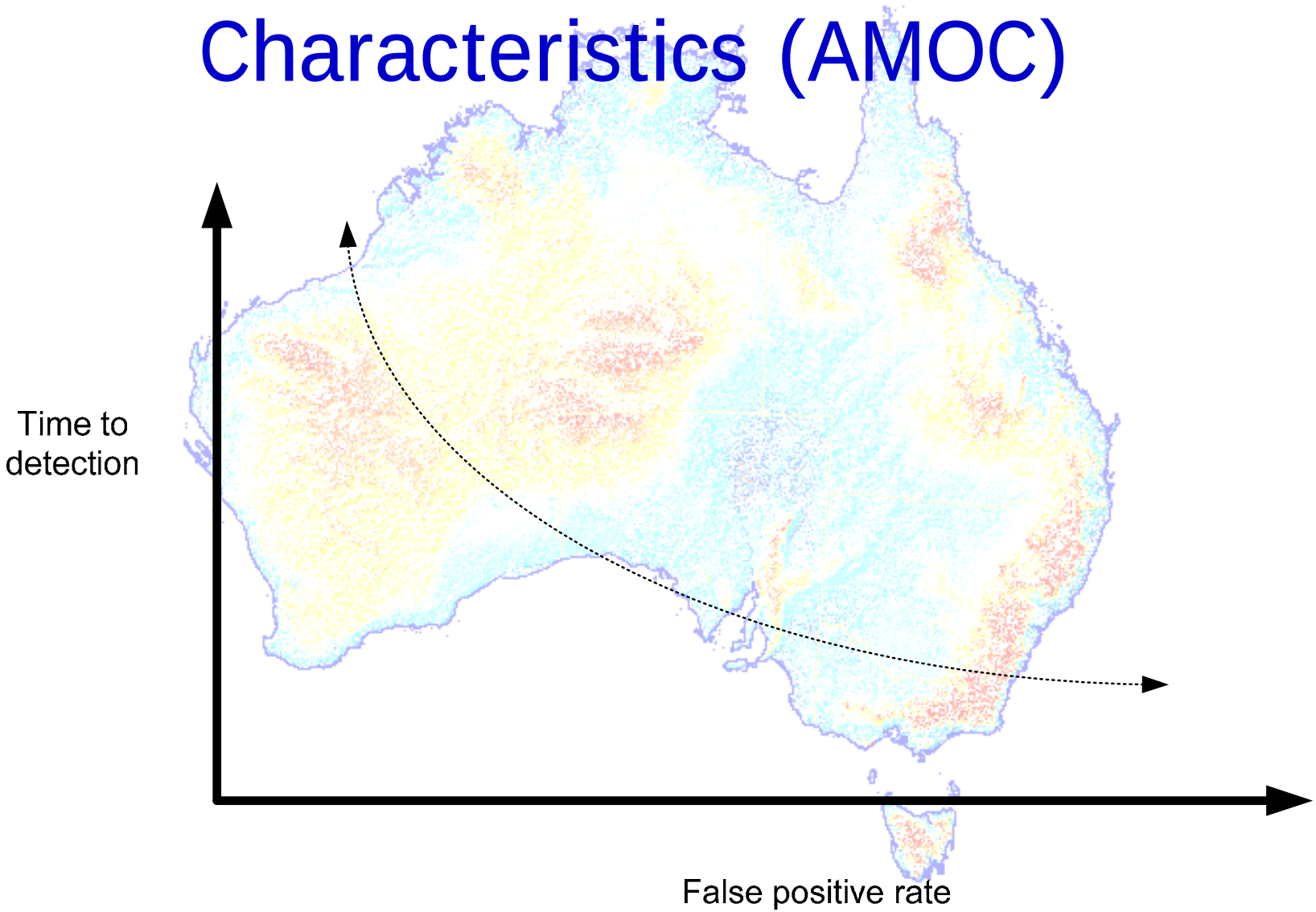
Advantage – can detect new and emerging diseases

- Pattern recognition system
  - will detect change in background disease
- Something is happening out there?
  - We can now direct traditional targeted/general surveillance towards investigating the trigger
- Syndrome surveillance is sensitive and general. Targeted surveillance is specific, and therefore not sensitive for diseases that are not targeted

Se, Sp and time to detection



Activity Monitoring Operatic Characteristics (AMOC)

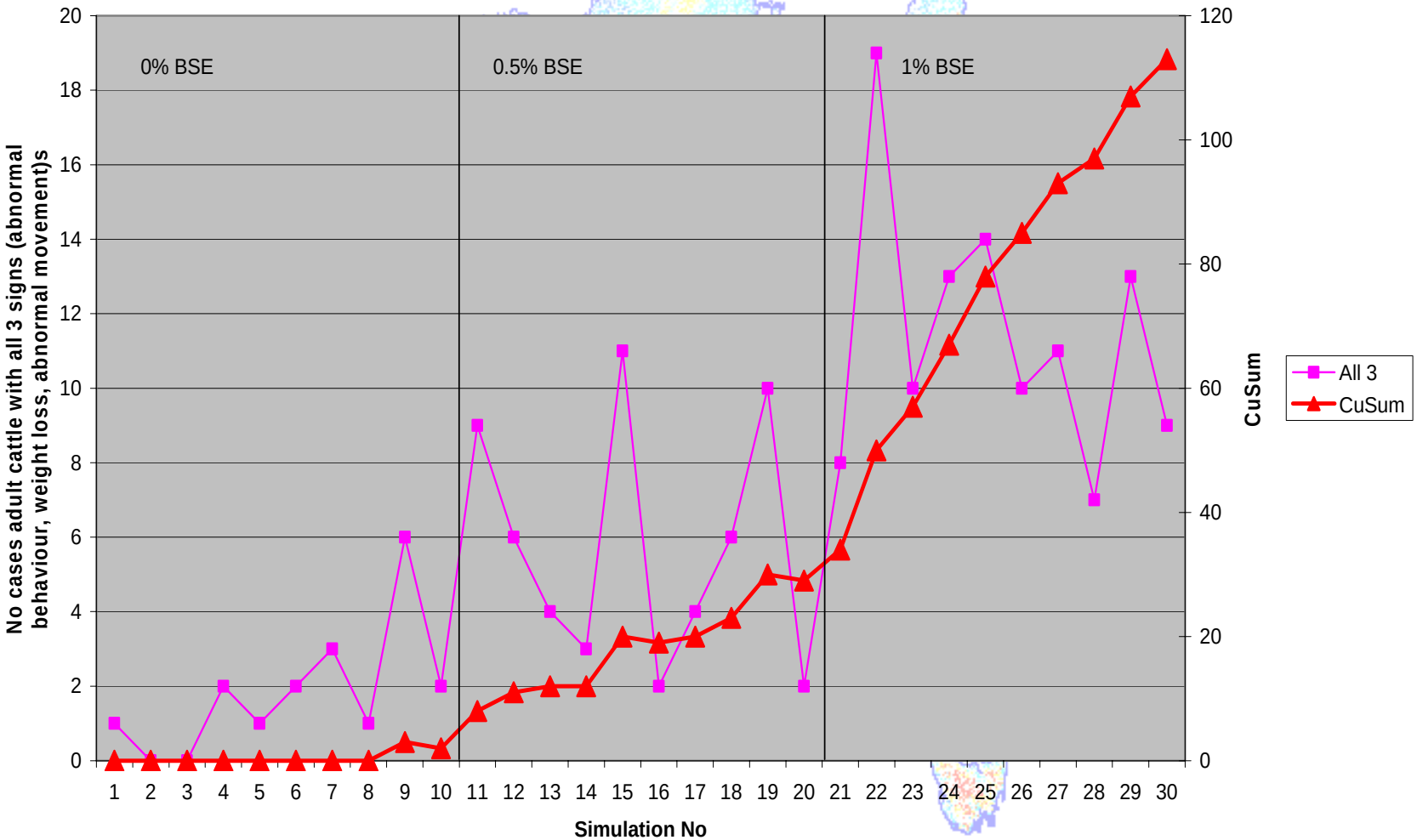


How?

- Statistical process control methods
  - CUSUM,
  - Maybe WSARE, etc
  - Detect the **trends**
- A skilled and functioning human!
  - The **alert clinician**

Combine the alert clinician with a trend detection system

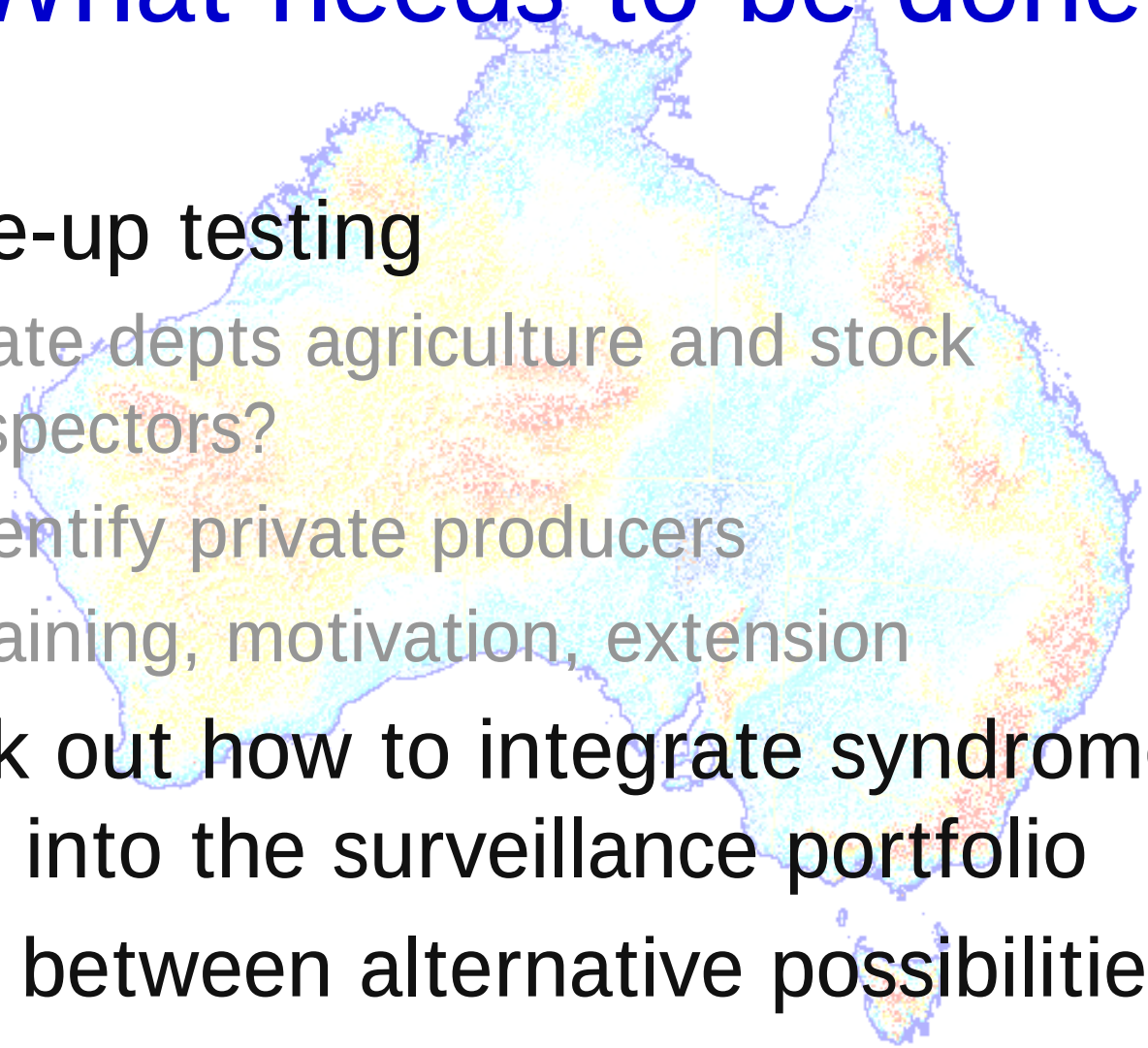
CuSum – BSE in cattle



Where are we at now?

- Proof of concept
  - They can do it – proved by the pilot
  - Reliability – to be tested
- Why would they keep doing it?
  - This is untested
  - Is there production information value?
  - What about when they don't need a diagnosis?
- How do we cover incomplete coverage
  - Use actively within Dept Ag (eg stock inspectors)
  - Statistical techniques exist
  - We need access to the image library to allow meaningful sensitivity and specificity estimates

What needs to be done



- Scale-up testing
  - State depts agriculture and stock inspectors?
  - Identify private producers
  - Training, motivation, extension
- Work out how to integrate syndrome data into the surveillance portfolio
- Test between alternative possibilities

Strengths	Weaknesses	Opportunities	Threats
Graphical data entry	Processes and responses to signals from BOSSS must be elucidated	Disease investigation assistance	Trading partner import protocols
Large disease information database	Work required to incorporate into existing systems eg NAHIS	Education	Fear of regulatory impost
Access to 'experts' by producers	How to interpret data	Access to expertise	Unwillingness to provide all data
Detection algorithms	Biased reporting	Improved general surveillance	Lack of support
Mapping capacity	Training required to use well	Early detection of emerging disease	Data privacy and security
Improved data consistency	Tried before with stock inspectors from 1993 in NT and didn't work because not user friendly and no recognised benefit	Describe syndrome distribution	Producers misuse for diagnosis and make wrong decisions
Learning tool – "Oliver"	Won't work without "multiple motivators" for users	Help identify surveillance "holes"	Could send people on 'wild goose chases'
Capture of negative data	System will need to be 'sold' to industry	Link to NLIS	Farmers get false sense of self-reliance and gives less contact with veterinary system
Addresses a real need	Reliance on technology that needs to be robust	Link to image library	Increased burden of reporting on farmers
Immediate feedback	Potential for delayed response	Fit with new technologies	Potential misuse of data
Potential to engage producers	Who pays?	Widen network of producers	Inappropriate 'experts' and quality of advice
Potential to reduce chance of misdiagnosis	Need for compatibility with SCAAHLS and other approaches to syndromes	Get technical people to where they are needed	Issues of 'quality' of database
Keeps international observers happy		Permits prioritisation of veterinary resources	Who 'owns' the data and ensures integrity
'Patches' a geographic strategic hole in beef cattle surveillance		Ability to integrate with State systems	Desire for a sensitive surveillance system vs political expediency
Complements existing systems		Farmers get better understanding of problems and have greater contact with veterinary system	

My plans for the future

- Electronic system
  - Hand held device with automatic transfer of data
- Widen the network of experts
  - Provide first port of call for information
  - Provide succinct, pertinent, easily accessed info
- Preempt pen-side test development
- Fit with new technologies
  - Especially EID and individual animal management

Improve field level investigation