Economic Evaluation of Preparedness, Response, and Recovery strategies

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NATIONAL CENTER FOR FOREIGN ANIMAL AND ZOONOTIC DISEASE DEFENSE

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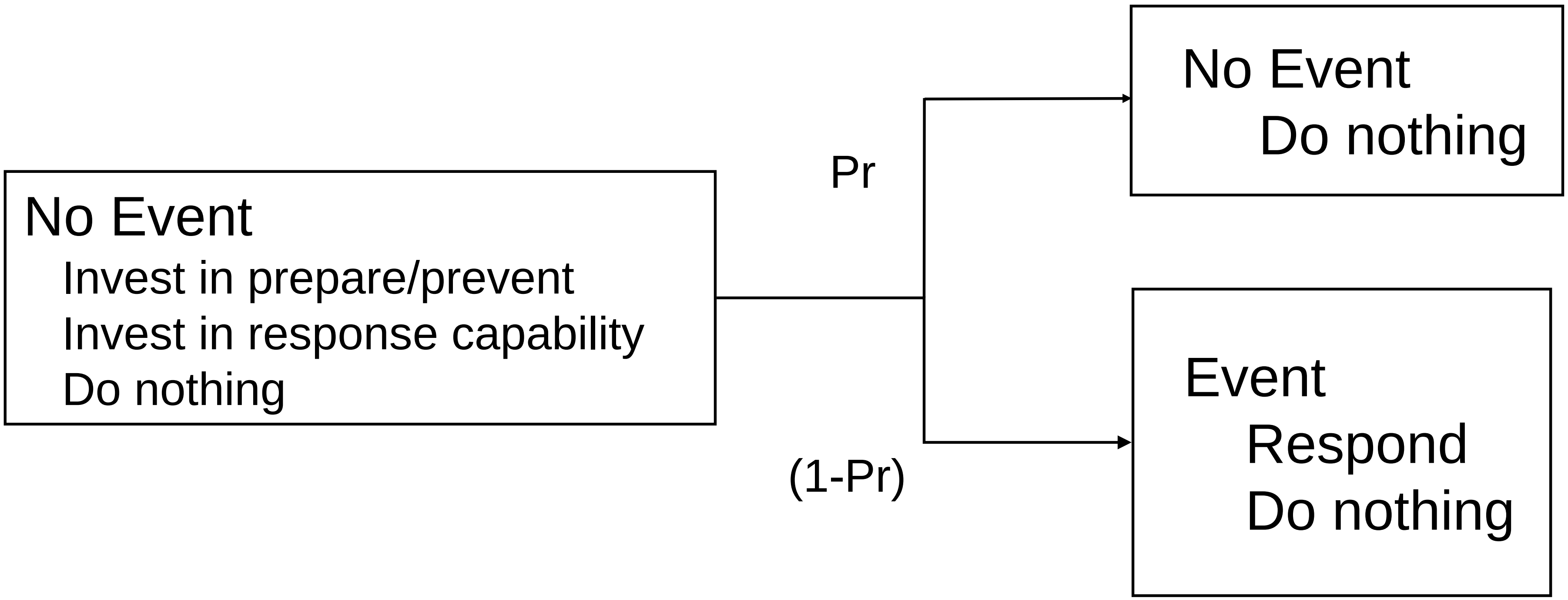
Outline

- Modeling approach addressing balance of pre event and post event efforts in a risk situation
- Many applications including FAZD focus – namely Animal disease control options and issues
  - Analytical approach
  - Case studies
    - Infectious Animal Disease
      - Animal ID
      - Periodic Surveillance
    - Hurricanes
- Items being pursued

Analytic Conceptualization
Simple Model -Two Stages

STAGE 1 *STAGE 2*



Ex ante Ex post

Analytic Conceptualization
Major elements

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Irreversibility – cannot instantly install investments given event

Conditional response depending on investments

Fixed investment costs versus variable cost of managing infrequent events

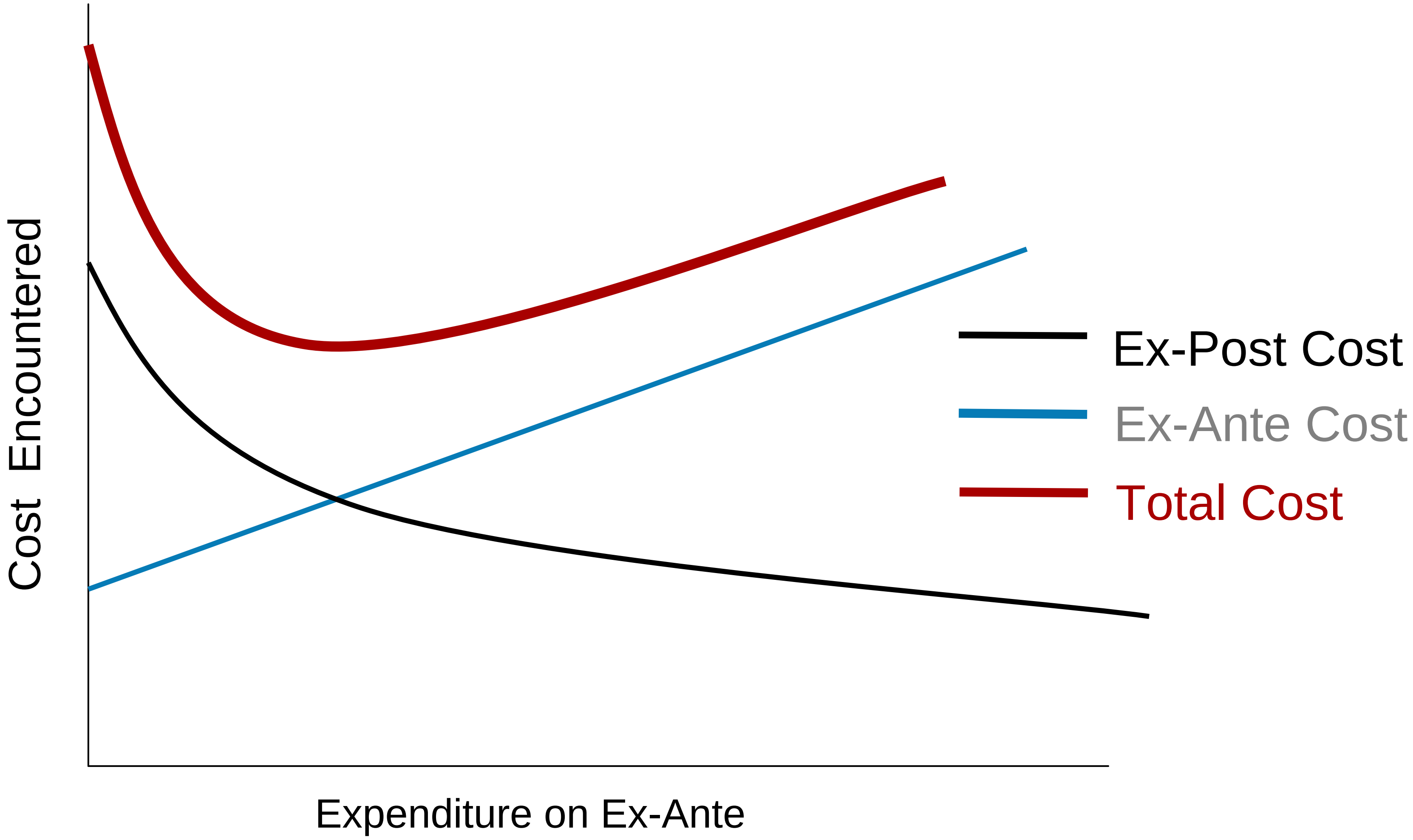
Large span of events differing in nature and severity

Probabilities

Tradeoff between investment-pre event cost and post event damages and response/recovery costs

Best strategy establishes a balance between pre event investment cost, and probabilistically post event weighted event management and damage costs

Analytic Conceptualization



Components of Event Management System

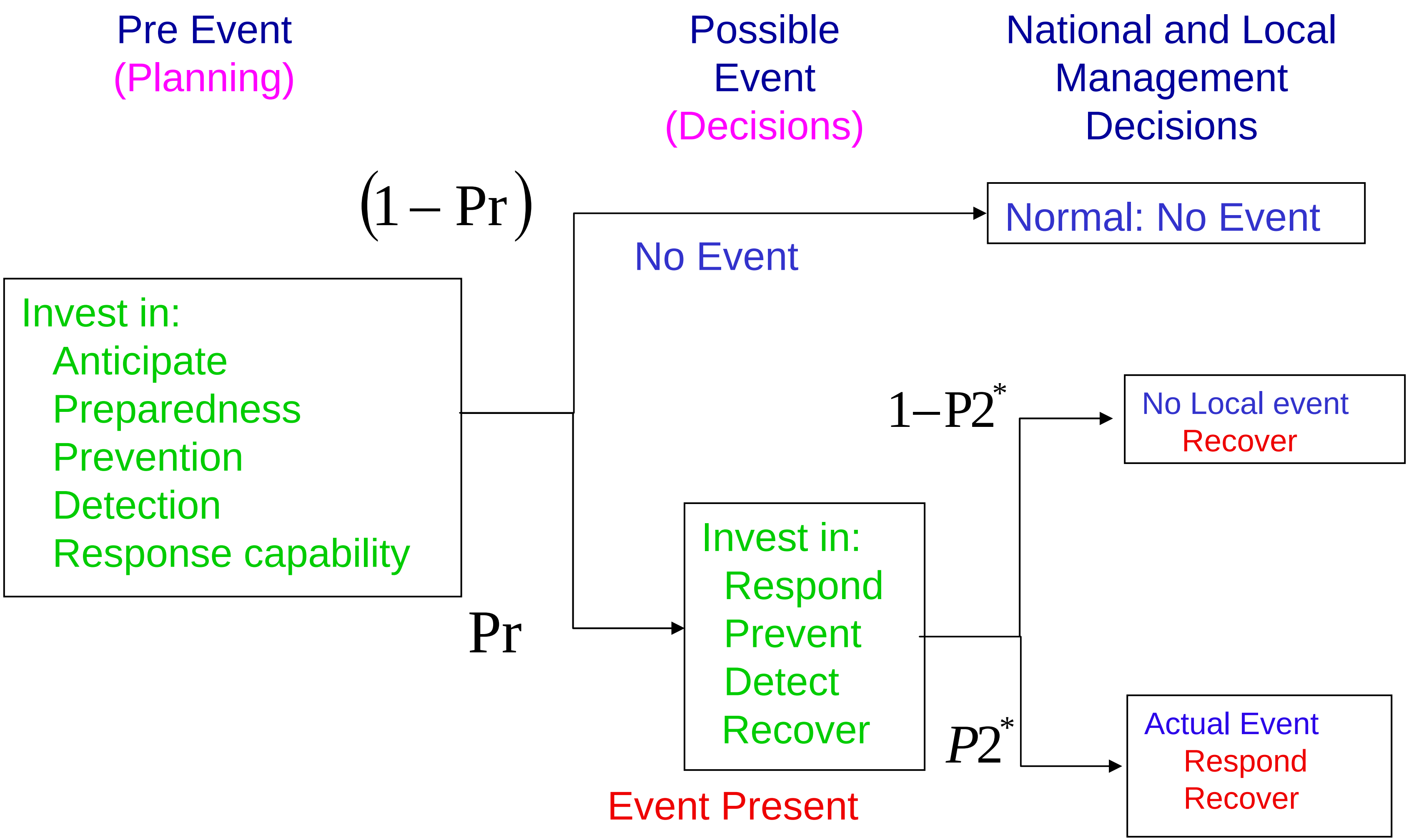
- Prevention -- actions undertaken to try to avoid event occurrence or decrease the probability
  - Anticipation
  - Rapid detection

- Preparedness – actions undertaken to reduce damages in case of introduction
  - Invest in Response capability
  - Invest in Detection capability

- Response – post event actions to manage the event and to avoid further economic losses.

- Recovery – post event actions to restore lost assets or demand shifts

Economic Model For Balance Study



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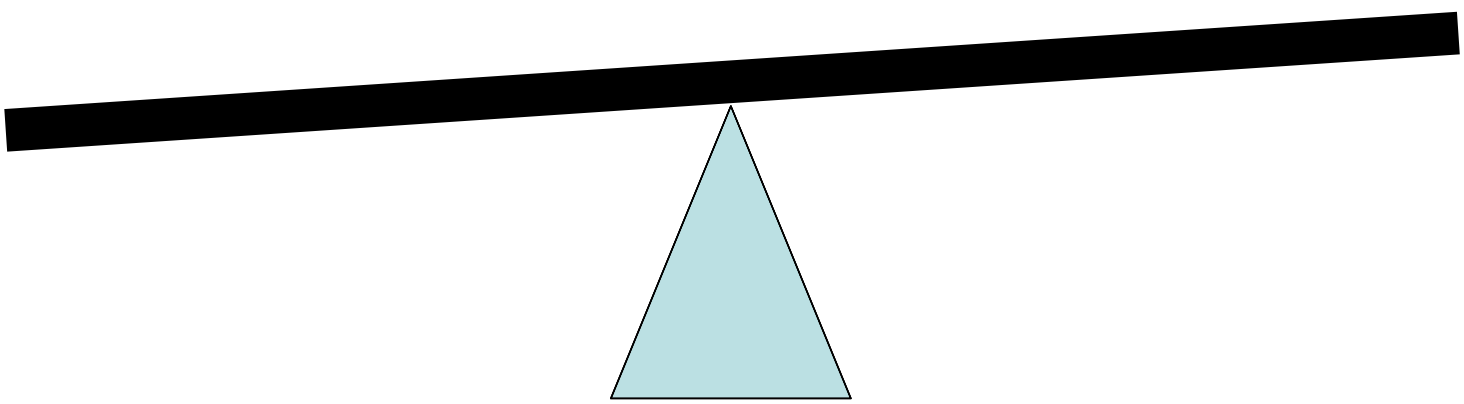
The Balance Problem
A study of Tilting Factors

Ex-Ante Invest

Anticipation
Prevention
Installation
Screening

Ex-Post Fix

Detection
Response
Recovery



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Example 1 - Animal Tracking

Fundamental decision - We can implement ear tagging for animals and facilitate movement tracking.

Such a system requires substantial upfront cost and many animals will be tagged without ever being tracked backwards

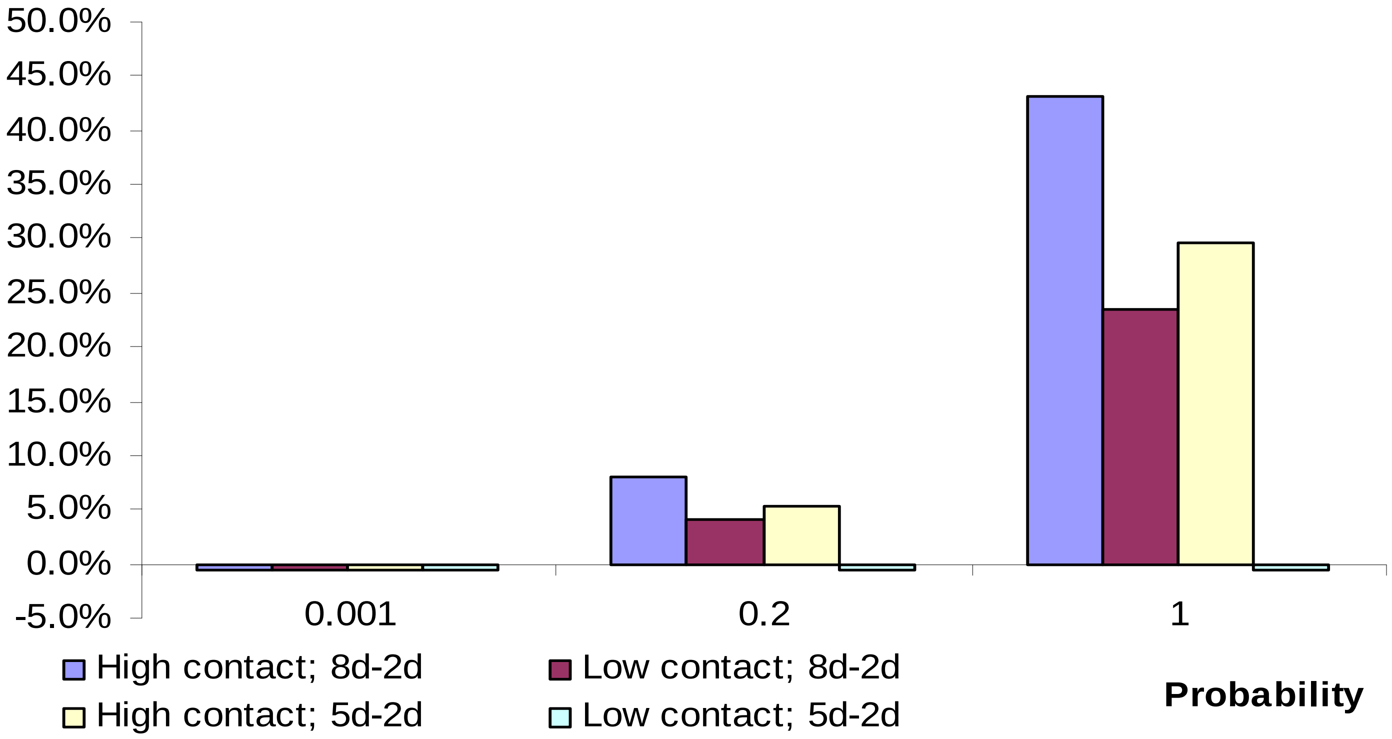
But under the infrequent highly damaging infectious disease outbreak

- Rapid method for tracking past movement of recently arriving cattle to see where they were and if they spread or caught disease elsewhere can have substantial value
- Allows us to get an early jump on disease containment

Balance problem is between upfront investment and the damages avoided with rapid tracking

Example 1 - Animal Tracking

Expected net benefits of tracking system as percentage of value of cattle production sector



Benefits depend on chance of threat, disease spread rate and tracking speed
Tracking reduces risk and increases resilience

Source: Elbakidze L., “Economic Benefits of Animal Tracking in the Cattle Production Sector ” *Journal of Agricultural and Resource Economics*, Forthcoming

Example 2 – Enhanced detection

Fundamental decision - We can implement routine inspection of herds to more rapidly detect initial incidence of disease

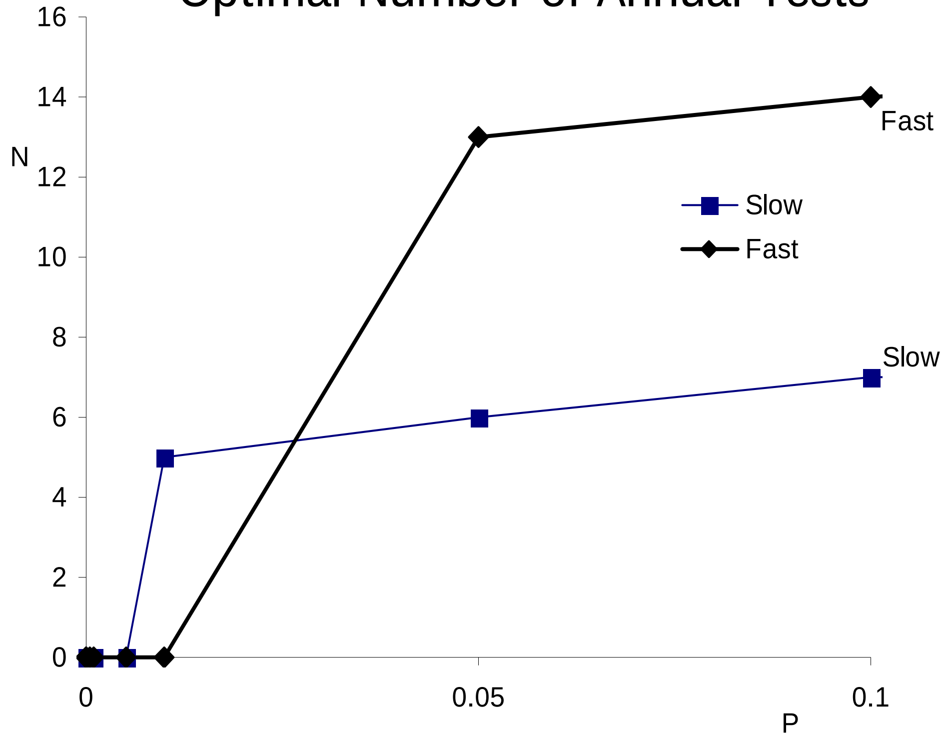
Such a system requires substantial cost of routine inspections and in many case animals will be inspected without anything ever being found

But if the infrequent highly damaging infectious disease outbreak is detected faster this allows us to get an early jump on disease containment and perhaps avoid or reduce scope of events which would result in millions of dead animals, trade dislocations and long recovery periods.

Balance problem is between upfront investment in surveillance/detection and the damages avoided with more rapid disease response

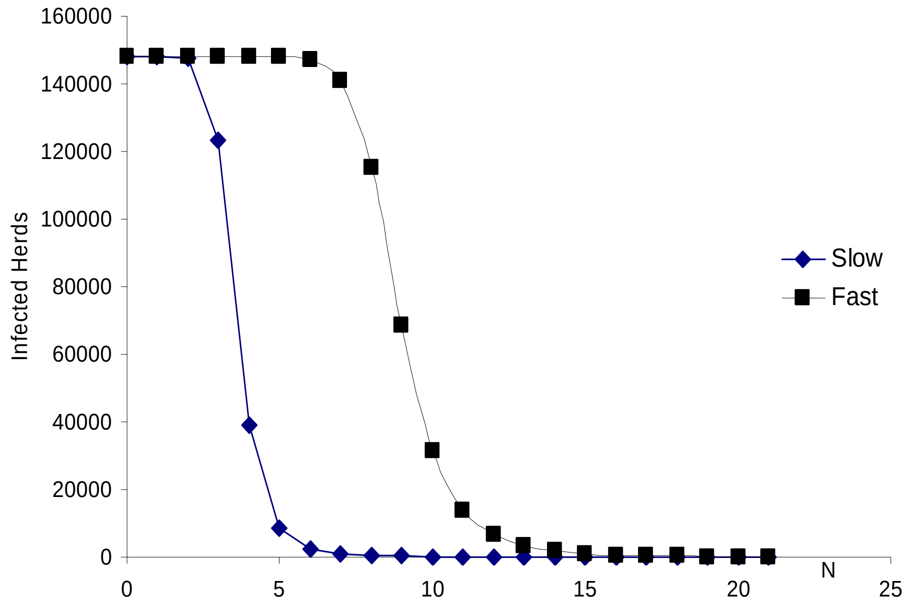
Example 2 - Surveillance and Detection

Optimal Number of Annual Tests



Probability

Number of infected herds as effected by surveillance under slow and fast spreads



Surveillance tests

Optimal detection frequencey can be zero and depends on chance of threat, disease spread rate and detection effectiveness plus co benefits

Surveillance reduces risk and increases resilience

Source: Elbakidze L. and B. McCarl, "Animal Disease Pre Event Preparedness versus Post Event Response: When is it Economic to Protect?" *Journal of Agricultural and Applied Economics*. 38, 2, (August 2006):327-336

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Example 3 – Hurricane protection

Fundamental decision – Some argue hurricanes are becoming more frequent and that protection should be increased

Such a system requires substantial cost of protection and in many case protected area will never be struck

But if the infrequent highly damaging hurricane arrives and the protections are in place this allows us to reduce scope of events which would result in millions of dollars of loss.

Balance problem is between upfront investment in protection and the damages avoided with more rapid disease management

Example 3 – Hurricane protection

Agriculture is subject to hurricane damages with crops and animals lost in events

Some argue that hurricane freq and intensity is shifting. So should agriculture plant less vulnerable crops and provide livestock protection

We looked at protection increases if hurricanes become more intense or probability of strikes grows

Shift will not always pay off so look at money lost from shift vs infrequent benefits when hurricane strikes

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Example 3 – Hurricane protection

We examined damages under an increase in hurricane intensity finding losses of $375 million when it rises by 1 category and $561 million for 2 categories.

Changes in cropping patterns can harden the sector with corn, cotton and oranges reduced in the strike zone and increasing elsewhere reduces sector wide damages by 8.02%.

Crop mix shifts enhances resilience and reduces risk

Source: Chen, C.C., and B.A. McCarl, "Hurricanes and possible intensity increases: Effects on and reactions from U.S. Agriculture," Draft paper TAMU, 2007.

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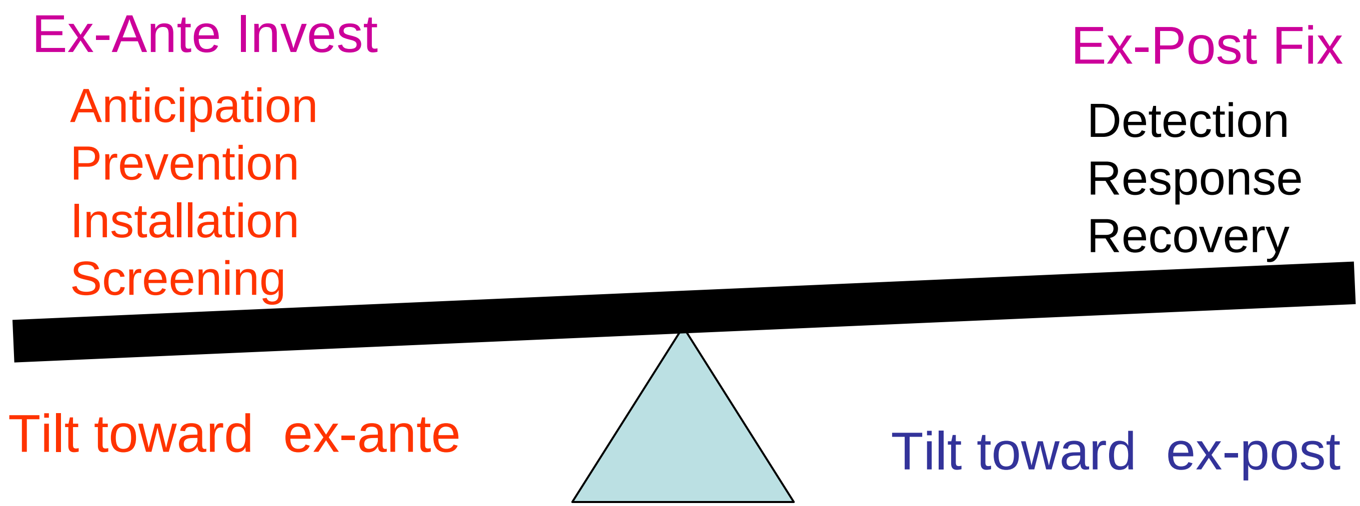
The Balance Problem
H0: Tilting Factors



Tilt toward ex-ante	Tilt toward ex-post
Event is more likely	Event is less likely
Ex-ante Activity has multi benefits	Ex-ante Activity is single purpose
Ex-ante Activity is more effective	Ex-ante Activity is less effective
Ex-ante Activity is cheaper	Ex-ante Activity is expensive
Ex-post treatment more costly	Ex-post treatment less costly
Fast spreading disease	Slow spreading disease
More valuable target	Less valuable target
Big demand shift -- health	Little demand shift -- health

For more information

http://agecon2.tamu.edu/people/faculty/mccarl-bruce/Biosecurity.htm