



Ranking 'hitchhiker' pests for surveillance

- Decision tree analysis

Why surveillance for hitchhiker pests?

- Used to be interested in animal diseases for trade purposes i.e. OIE list 'A' and 'B'
- Broader scope for MAF
 - Trade
 - Economics
 - Health
 - Social and cultural values
 - Environment

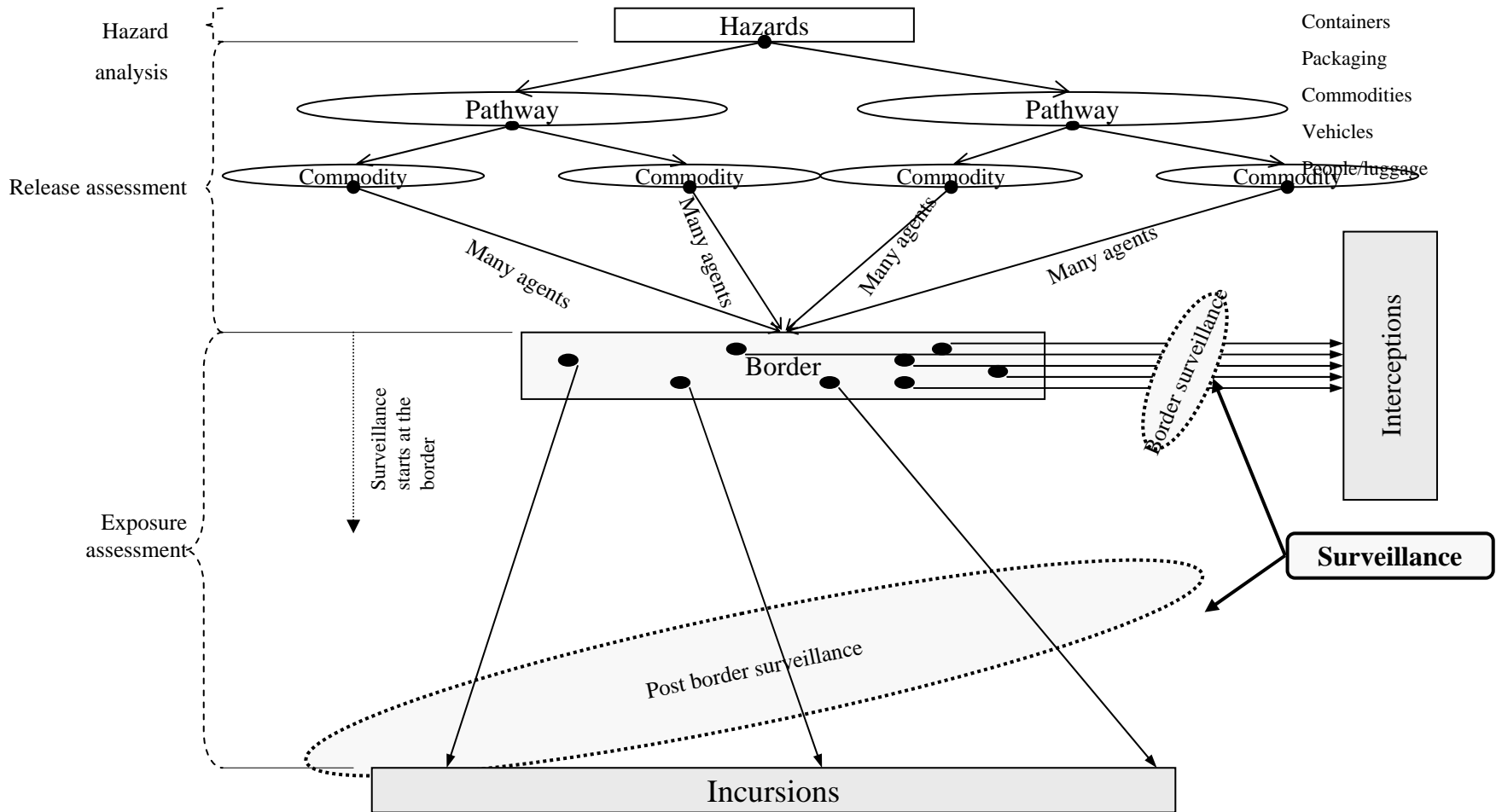
How do hitchhikers enter?

- Enter as passengers rather than commodity-specific
- Typically on containers, vegetables, logs, soil, hay, household goods, sport equipment
- Containers a particular risk
 - Large numbers, empty returns from high risk countries typically poorly examined and stored within NZ for weeks
 - NZ container survey showed empties were a risk

Border and 'residual' risk surveillance

- NZ profiles commodities and containers based on risk e.g. item, port of destination
- There will always be 'residual risk'
- Surveillance manages 'residual risk'

Surveillance within a risk analysis framework



Increase efficiency of surveillance

- Efficiency of surveillance for hitchhikers can be increased by targeting
 - Pathways of entry and dispersal
 - Preferred habitats
 - Animals of interest e.g. RIFA
 - Embarkation ports of risk
 - Preferred habitats (important when sub-optimal conditions)
 - Best surveillance techniques (baits, visual, pheromones)
 - Best times to look
 - Communication to enhance passive surveillance

Target surveillance - pest of interest

- Rank hitchhiker pests - 'invasive attributes'
 - Potential or known invasive behaviour
 - Impact if established
- Barriers to success
 - What attributes to score?
 - How to analyze scores?

Useful or not?

- Decision trees well accepted for invasive weeds
- For animal pests respectable science but not well validated or applied
- Methods explored
 - Chi square, logistic regression, categorical (yes/no) decision trees, discriminant analysis, CART
- Jury out:
 - Some say useful, others say insufficient knowable



Yet!

Some animals are highly
invasive and some are not

Decision tree to select environmental pests

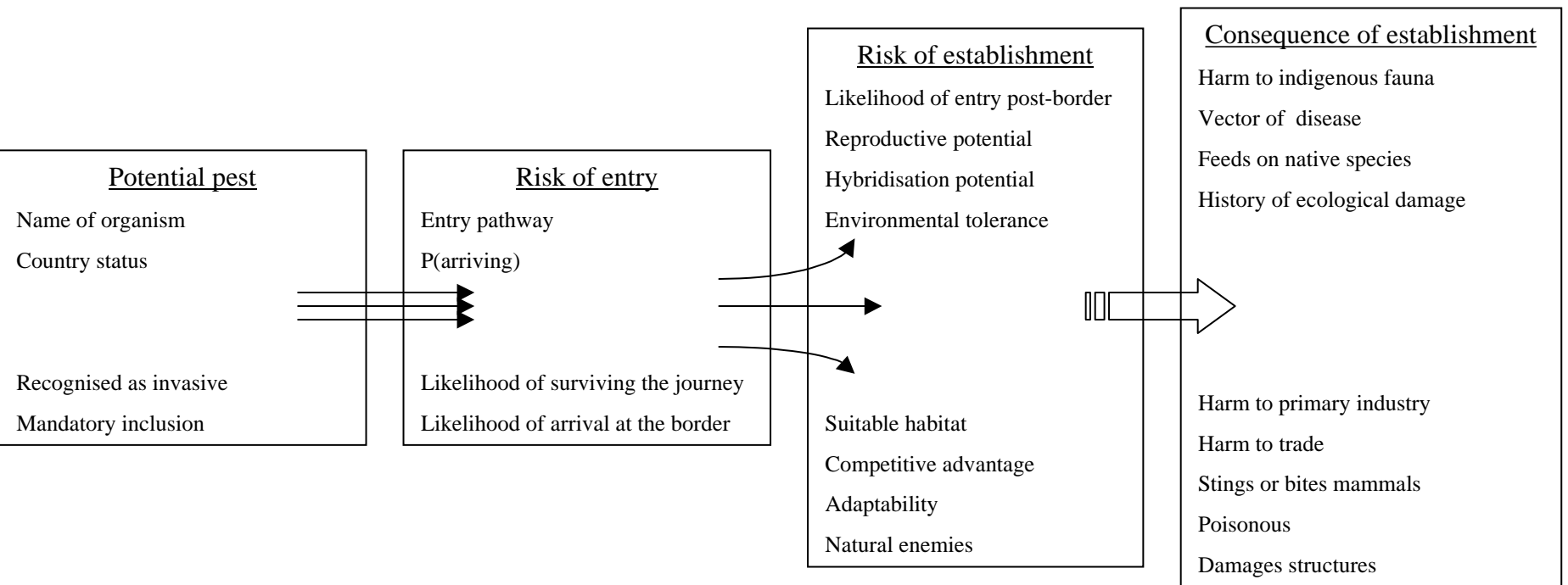
- Choose animal species to score
 - Range from high to low invasive potential
- List attributes to score
- Expert scoring and rating of invasive potential
- Identify most parsimonious list of variables associated with invasive potential
- Design decision tree
- Test model using new data

Animal species to score

- Design and test model using **invasive ants**
 - serious threats
 - well studied
 - MAF had commissioned an ant PRA, and scoring was added to the specification
- Number of ant spp used to design model = 7
- Number of ant spp used to test model = 94

Attributes to score

- Attributes were those logic suggested based on an 'OIE model of surveillance'



Scoring and ranking invasive potential

- Attributes were scored by a technical expert
 - Yes / no
 - High / medium / low
- Invasive potential ranked by a technical expert (mini risk analysis)
 - High / medium / low



HAZARD ANALYSIS (pest ID)	RELEASE ASSESSMENT (arrival)	EXPOSURE ASSESSMENT (establishment)	CONSEQUENCE ASSESSMENT (harmfulness)
Scientific name: <input type="text" value="Anoplolepis spp"/>	Pathway: <input type="text" value="Container"/>	P('life stage' incursion): <input type="text"/>	Destroys/displaces iff (1-3): <input type="text"/>
International invasive index: <input type="text"/>	P(arriving): <input type="text"/>	Reproductive potential (1-3): <input type="text"/>	Transmits disease (1-3): <input type="text"/>
P(not established): <input type="text"/>	P(surviving pathway): <input type="text"/>	P(survival in NZ): <input type="text"/>	Hybridisation potential (1-3): <input type="text"/>
	P(evading detection): <input type="text"/>	Environmental tolerance (1-3): <input type="text"/>	Harm to humans (1-3): <input type="text"/>
	P(evading destruction at the border): <input type="text"/>	Habitat range (1-3): <input type="text"/>	Harm to primary industry (1-3): <input type="text"/>
Mandatory inclusion (0,1): <input type="text"/>		Competitive advantage (1-3): <input type="text"/>	Harm to trade (1-3): <input type="text"/>
OVERALL RISK SCORE (0,1,2): <input type="text"/>		Adaptability (1-3): <input type="text"/>	
ACTION CATEGORY: <input type="text"/>		Presence of natural enemies (1-3): <input type="text"/>	
COMMENTS: <input type="text"/>			

DELPHI

Best guess

Data

How to analyse?

Selecting attributes to use

- Started with 22 attributes
- Objective = most parsimonious list
 - Include
 - Chi-square association with 'invasive potential' score
 - Considered important by stakeholders
 - Considered significant from other studies
 - Exclude
 - Redundant attributes
- Ended with 11 variables for decision tree

Invasive potential attributes **selected** and **discarded**

Established

Natural enemies in NZ

Mandatory inclusion

Feeds on native species

Likely to survive

Disease vector

Likely to reproduce

Poisonous

Stings or bites mammals

Competitive advantage

Harm to trade

Damages structures

Recognised as an invasive species

Harm to primary industry

Life stage likely to enter

Hybridisation potential

Harms indigenous flora and fauna

History of ecological damage

Susceptible habitat

Excluded using correspondence analysis

Genus	species	Decision tree	PRA	Decision tree	PRA
Acanthomyops	spp.	include	exclude	1	0
Anoplolepis	gracilipes	include	include	1	1
Anopolepis	custodiens	include	exclude	1	0
Anopolepis	steingroeveri	include	exclude	1	0
Aphaenogaster	senilis	include	exclude	1	0
Atta	spp.	exclude	exclude	0	0
Camponotus	abdominalis floridis	include	exclude	1	0
Camponotus	ferrugineus	include	exclude	1	0
Camponotus	herculeanus	include	include	1	1
Camponotus	nearcticus	include	exclude	1	0
Camponotus	pennsylvanicus	include	exclude	1	0
Camponotus	planatus	include	exclude	1	0
Camponotus	rasilis	include	exclude	1	0
Camponotus	tortuganus Emery	include	exclude	1	0
Camponotus	spp.	include	include	1	1
Cardiocondyla	spp.	exclude	include	0	1
Crematogaster	spp (general)	include	include	1	1
Crematogaster	spp (US pests)	include	include	1	1
Formica	spp.	include	include	1	1
Hypoponera	opaciceps	exclude	exclude	0	0
Hypoponera	punctatissima	exclude	include	0	1
Iridomyrmex	anceps	exclude	include	0	1
Iridomyrmex	purpureus sp. Group	exclude	include	0	1
Iridomyrmex	rufoniger sp. Group	exclude	exclude	0	0

for 1 = tree risk

tree	risk		
	exclude	include	
exclude	Obs 32 22 54		
	Expected 29.30 24.70		
	Cell Chi-Sq 0.25 0.30		
include	Obs 19 21 40		
	Expected 21.70 18.30		
	Cell Chi-Sq 0.34 0.40		
	51	43	94

Overall Chi-Square 1.28

P-Value 0.2578

Degrees of Freedom 1

Conclusions

- Decision trees seems intuitively more useful than adding weighted or unweighted scores
 - Wildlife disease example (NZ)
- Develop the model using the 95 PRA examples
 - 33% to develop model
 - 67% to test the model

END