



He Tangata, He Taiao, He Ōhanga

.....  
a values-based biosecurity risk  
assessment framework for Aotearoa

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# What makes a good risk-based decision in biosecurity?

John Kean, Melanie Newfield, Susanna Finlay-Smits,  
Christine Reed & Craig Phillips

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Presentation at:  
Society for Risk Analysis, Australia & New Zealand  
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Melbourne, Australia  
26-27 October 2022



# What makes a good risk-based decision in biosecurity?

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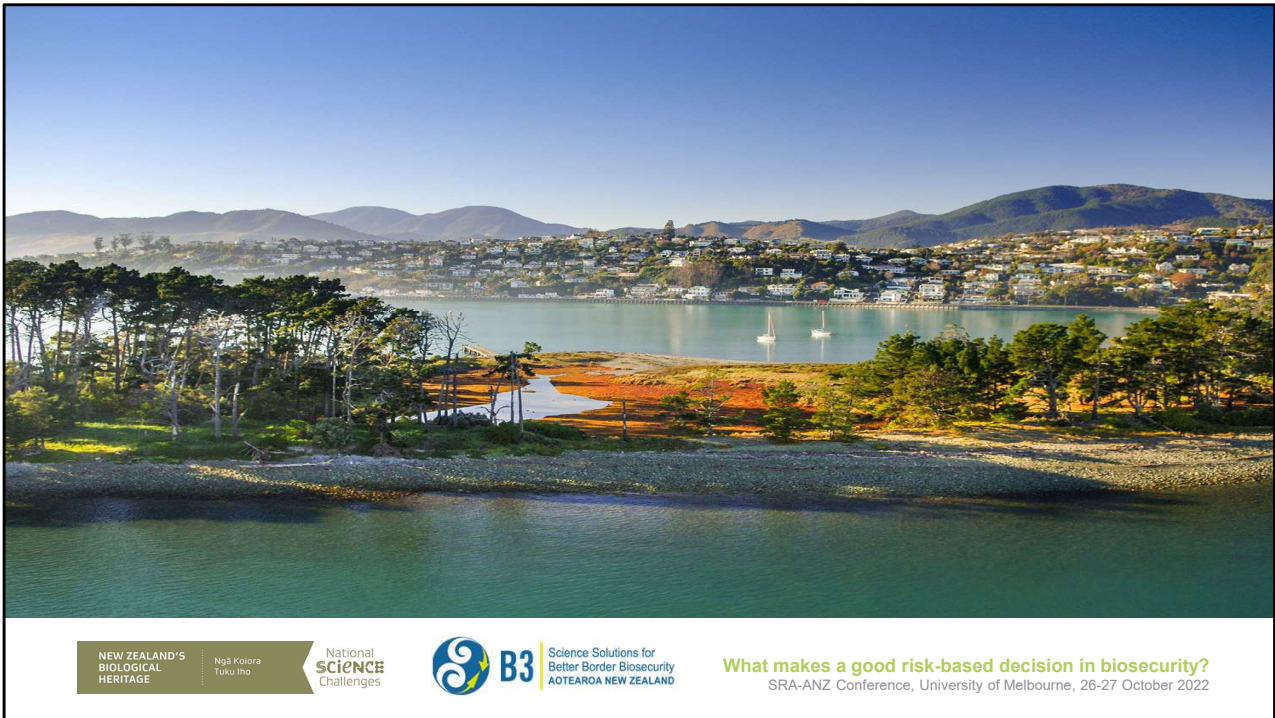
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Welcome to Nelson, a sunny coastal city at the exact centre of New Zealand. Nelson is popular with artists, artisans, hippies, and retirees. It is also a hub of tourism, being the gateway to some of NZ's most beautiful beaches, mountains and hiking.

But in May 2010, Nelson inadvertently welcomed the wrong overseas guest...



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*Pieris brassicae* is native to Europe, and like many other European tourists it found its way to Nelson, and really liked it there.



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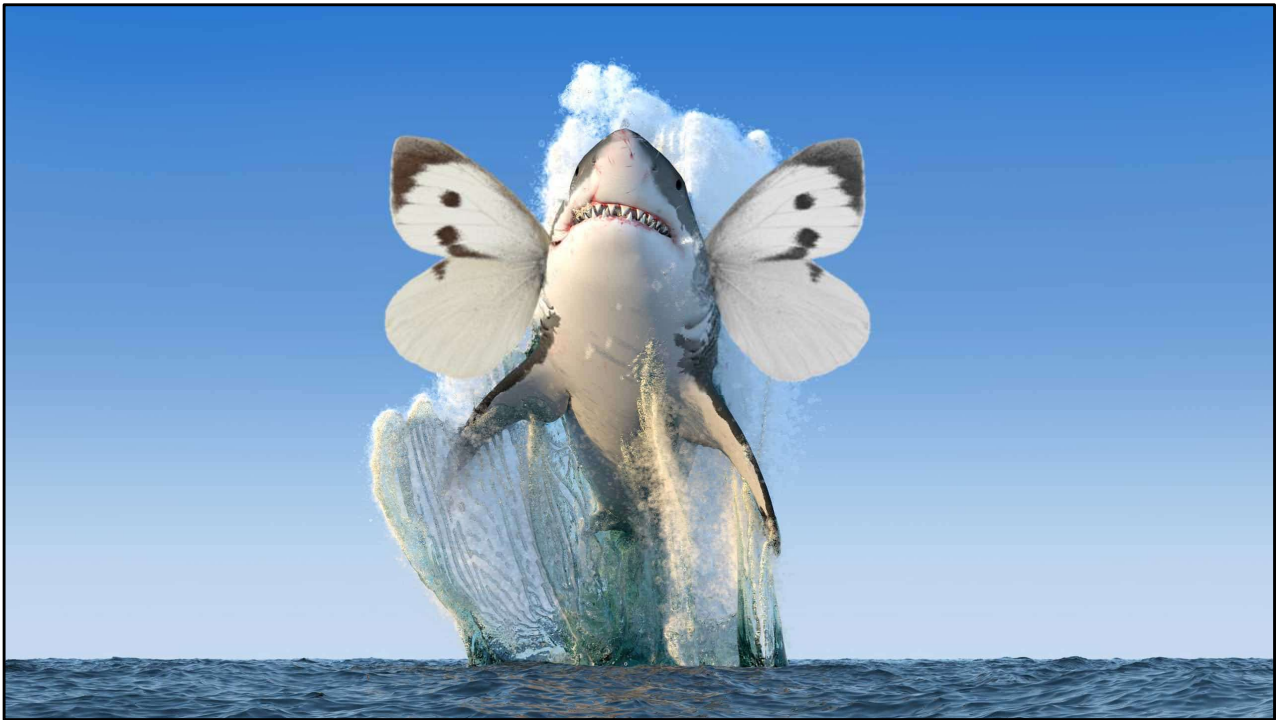
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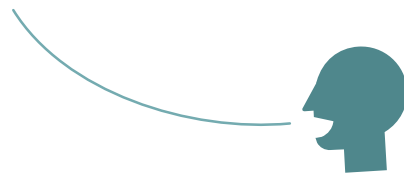
Unlike its smaller cousin *Pieris rapae*, the larvae of *Pieris brassicae* are communal. Hunting in packs, they seek out a wide range of host plants, particularly brassicas, and voraciously devour them. When they were discovered in 2010, this behaviour earned them the local name “The Great White Butterfly”



Obviously, such a threat requires some sort of response, but how do you decide what do in biosecurity situations like this?  
Let's take a step back for a moment.

*“Pest management isn’t actually about pests,  
it’s about people.*

*A pest is only a pest because people perceive it  
to be a pest and it’s impacting on values that  
they personally see as important.”*

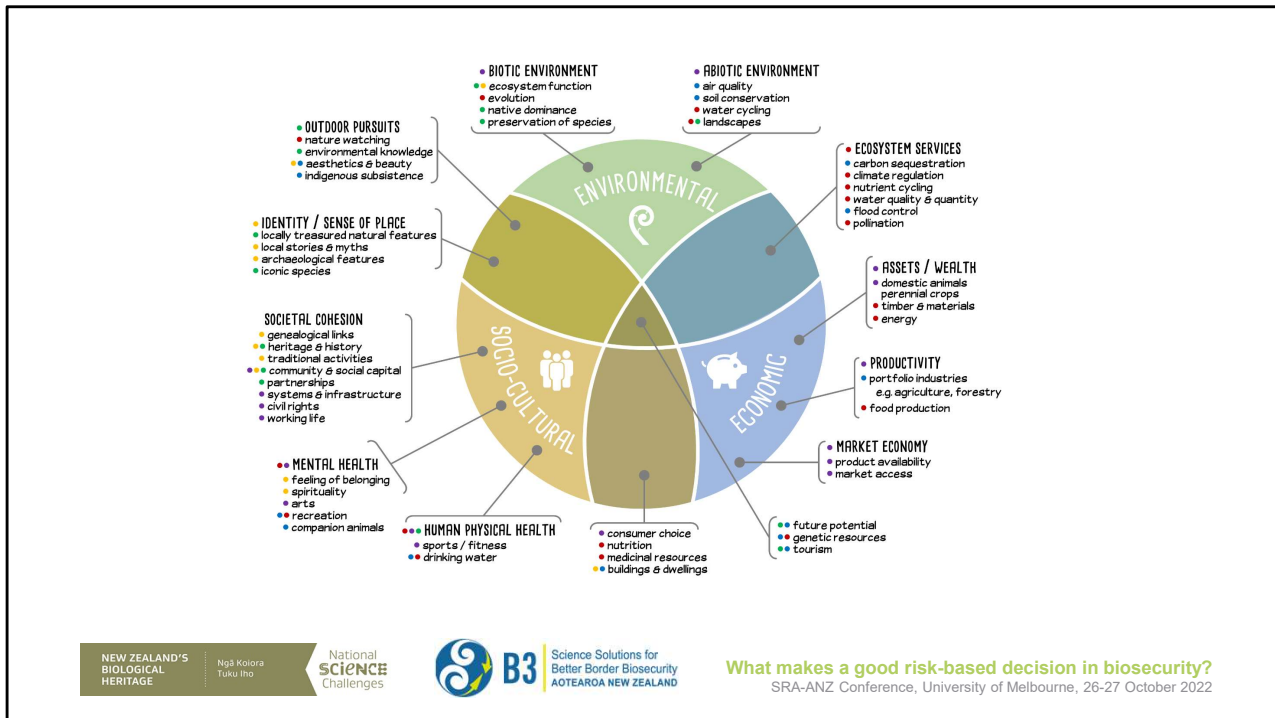


“Pest management isn’t actually about pests, it’s about people.”

This quote comes from one of the biosecurity decision makers that we interviewed. More about that later.

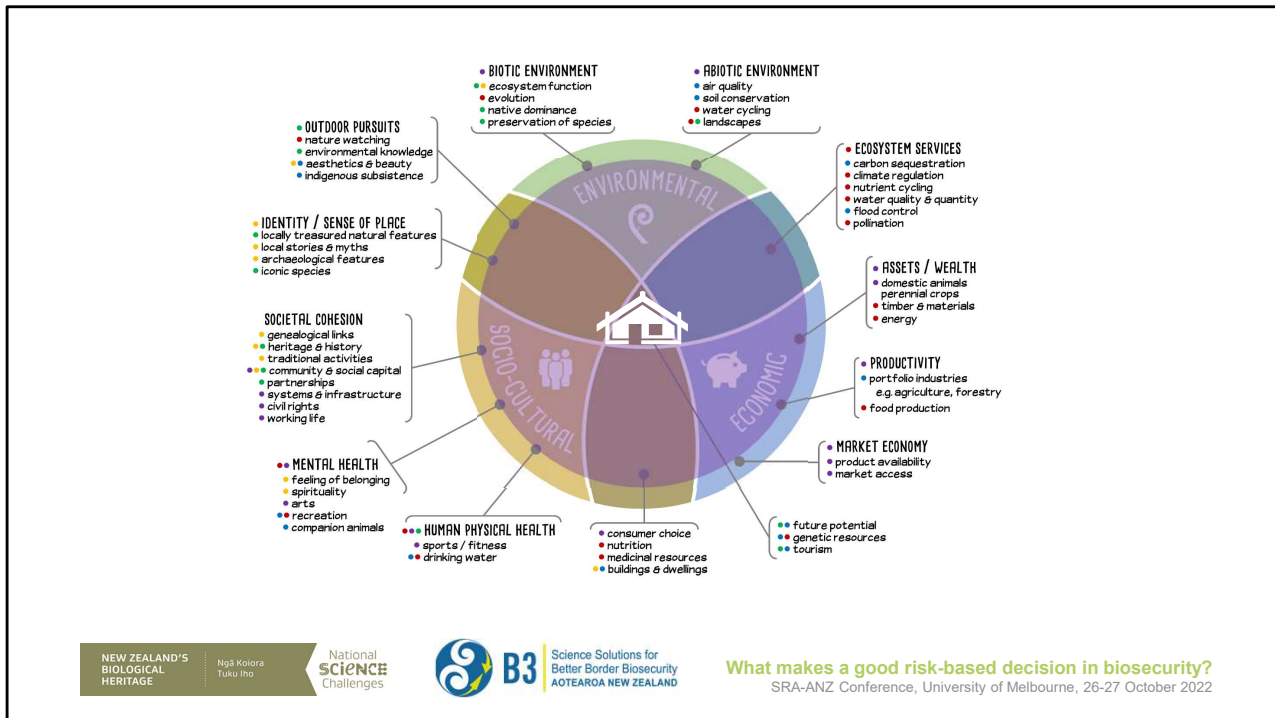
“A pest is only a pest because people perceive it that way. And they perceive it that way because it is impacting on values that they consider important.”

But what are those values?



Well, there are a lot of things that people care about. Often these are summarised as environmental, socio-cultural or economic values, but this glosses over a wide range of overlapping and interacting things that are needed for humans to thrive, that make life worth living, and even for nature to be nature in its own right.

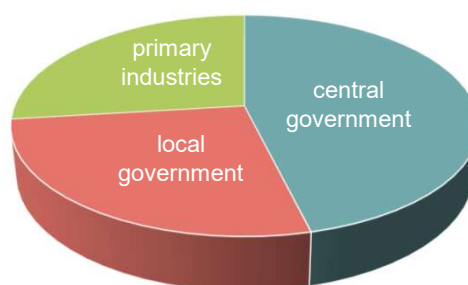




And of course, different people will care more about some things than others. But different cultures may have completely different types of values. For example, we are currently conducting some research to elucidate NZ Māori values with respect to biosecurity, and want to make sure that these are part of a risk assessment framework for making biosecurity decisions.

## Many risk assessment frameworks are available

- Reviewed 23 published risk assessment frameworks, 10 being specific to biosecurity
  - Many are for specific purposes, and can't easily be used elsewhere
  - Some frameworks mention holistic values but few address those in detail
- We interviewed 26 biosecurity decision makers - what risk assessment frameworks do they currently use?



There are many risk assessment frameworks available, including several specific to biosecurity risks like the great white butterfly. However, many are designed for specific purposes, and while some include holistic values, these are rarely addressed in any detail.

We were interested in which of these frameworks biosecurity managers are actually using in New Zealand. So we interviewed 26 biosecurity decision makers, from central government, local government and primary industries.

*“Ideally, all projects and all decision making should go through a process, but we're all busy people under the pump, and sometimes for those quicker things you just make a decision based on experience.”*

*“We haven't had much sort of formalised structure around stuff. People are making risk assessments and making decisions but it's an unconscious process to some extent.”*

*“If it feels right, it usually is.  
If it doesn't feel right, it's usually not.”*



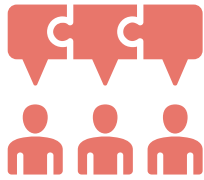
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What we found was surprising.

Although decision makers generally thought using a formalised process is a good idea, in practice they were often making biosecurity decisions using some “unconscious process”, their personal “experience”, and what “feels right”.

But what does this mean? If formalised frameworks aren't being used, then exactly how *\*are\** biosecurity decisions being made?

## So how *\*are\** biosecurity decisions being made?



### Collaboration

“Getting the right people in the room”

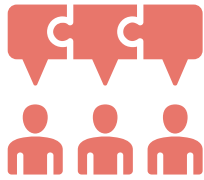
Trust is a key requirement, but might also be a barrier

Our interviews identified three main factors at play in current biosecurity decision making in New Zealand.

The first essential factor is seen to be collaboration: getting the right people in the room. But it's not always clear who the “right people” are, or what they are actually doing in that room.

Most of our respondents talked about “trust” as being of paramount concern. But building trust takes time and effort, so maybe it is the same old faces in the room every time. The trust barrier may make it hard to include new perspectives, and therefore to respond to biosecurity events that threaten new values.

## So how *\*are\** biosecurity decisions being made?



### Collaboration

“Getting the right people in the room”

Trust is a key requirement, but might also be a barrier

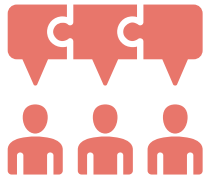


### Intuition / experience

“You’ve got to bring in your own gut feel, your own personal experience, advice from your colleagues”

As previously mentioned, biosecurity decision makers admit to relying a lot on their own intuition and personal experience. Presumably they trust themselves, but is this always warranted? We know that our own minds are unreliable narrators and suffer from a whole raft of cognitive biases.

## So how *\*are\** biosecurity decisions being made?



### Collaboration

“Getting the right people in the room”

Trust is a key requirement, but might also be a barrier



### Intuition / experience

“You’ve got to bring in your own gut feel, your own personal experience, advice from your colleagues”



### Adaptation

“We have to be able to go back and change our decisions once we’ve got more information”

Adaptation was the third major theme to emerge from our interviews about how biosecurity decisions are currently made in New Zealand. Biosecurity situations evolve all the time, requiring past decisions to be revisited and updated on the fly. In biosecurity, you can't just “spray and walk away”.



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Back in Nelson, the great whites were still rampaging across the landscape in hungry gangs.

Clearly, a decision was needed – should we accept this new species into our fauna, or should we declare war on it?

**Ministry for Primary Industries**  
Manatū Ahu Matua



- It has been present for several generations
- It has a wide host range
- In Europe it is migratory
- It looks very similar to *Pieris rapae*
- We have no specific detection tools
- No butterfly has ever been eradicated, anywhere in the world

→ Monitor for 2 years

→ Don't attempt eradication



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Well, NZ's biosecurity authority, the Ministry for Primary Industries, was not idle. They had been gathering data pertaining to the risk of the butterfly.

It was clear that it had been present for several generations before it was detected. It was already widespread through Nelson, thanks partly to its wide host range that includes weeds and the wild nasturtiums that proliferate around the city.

MPI noted with alarm that the butterfly is migratory in Europe, travelling hundreds of kilometers every year. There were no specific detection or control tools. And it even looks very similar to the ubiquitous small white cabbage butterfly. Could we be certain it hadn't already spread widely?

In addition, no butterfly had ever been eradicated, anywhere in the world.

Weighing up the risks against the costs and feasibility of eradication, MPI decided initially to monitor the population for 2 years. Things still looked grim after that, and MPI decided to focus their resources on other incursions.





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This was bad news for many of NZ's rare and endangered native cresses, like this Cook's scurvy grass (not actually a grass, but which was used by Captain James Cook to prevent scurvy in his crew)



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as well as another 70 plus native plants in the cress family, like this penwiper plant.



Department of Conservation  
*Te Papa Atawhai*

- Cresses comprise 3% of NZ's native flora
- NZ cresses have low glucosinolate levels
- 68 of the 79 NZ cress species are at risk from GWB
- Best in the world at eradicating vertebrate pests from islands

→ Attempt eradication

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NZ's Department of Conservation decided to have closer look at the risks. They noted that NZ cresses have relatively low levels of glucosinolate that protects European cresses against herbivory. And they concluded that the great white butterfly posed a threat to almost 3% of NZ's indigenous plant species, including many that are already on the verge of extinction from the appetite of the small white butterfly. They agreed with MPI that eradication would be difficult and costly, but hey, DOC is the best in the world at eradicating vertebrate pests from islands. Why not have a go at the butterfly?



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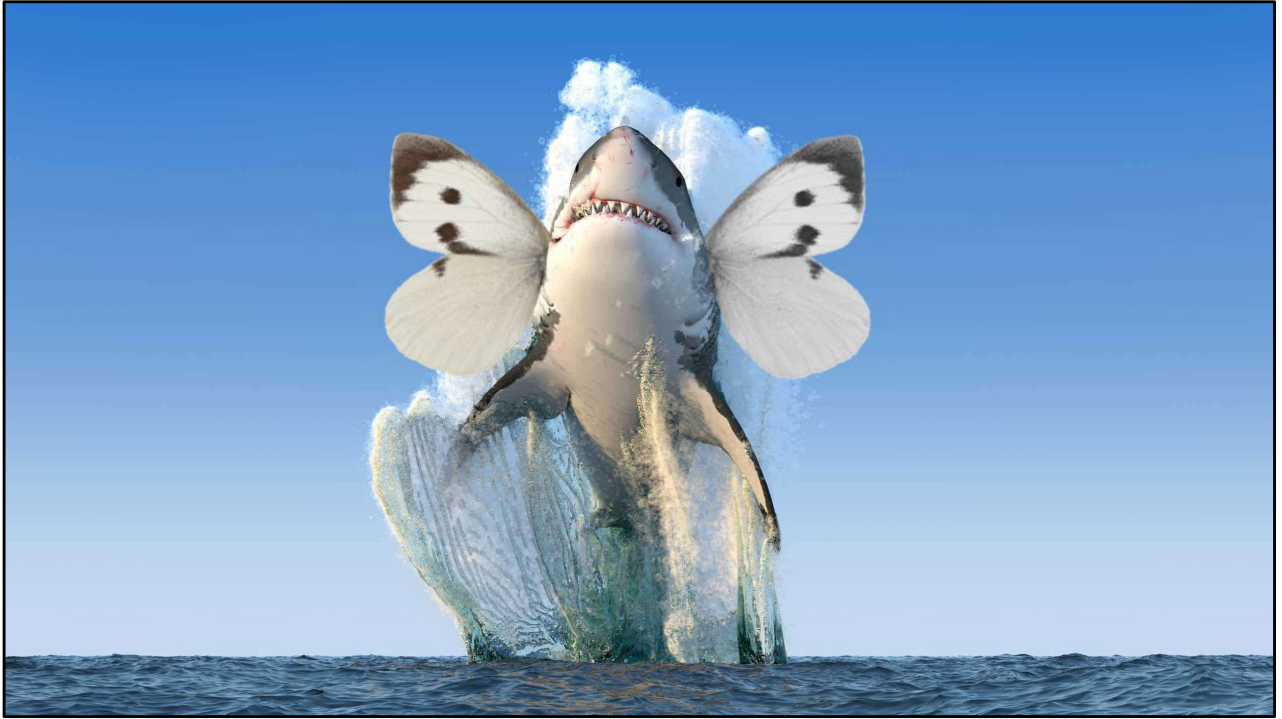
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And so DOC mobilised a small army, equipped with little more than keen eyes and a butterfly net or two, to take on the great whites



Need I remind you what they were facing?

**Ministry for Primary Industries**  
Manatū Ahu Matua

→ Don't attempt eradication

**Department of Conservation**  
*Te Papa Atawhai*

→ Attempt eradication

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So, here we have two different government agencies, using essentially the same information, coming up with two very different biosecurity management decisions. How can we judge the quality of these decisions, and who made the right call?

## How can we judge the quality of a decision?



**Normative approaches**  
balance the chance and  
value of all possible  
outcomes

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There is no current literature on what makes a good biosecurity decision. But work in medicine and conservation suggest it is a matter of perspective.

Three approaches have been identified.

Normative approaches emphasise rationality in the presence of uncertainty. A good decision is the rational outcome from balancing the chance and value of all possible outcomes. The process is important, but there's always an element of chance in how things turn out.

## How can we judge the quality of a decision?



**Normative approaches**  
balance the chance and  
value of all possible  
outcomes



**Prescriptive approaches**  
emphasise the process  
and stakeholder  
involvement

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Prescriptive approaches, which are used mostly in medicine, say a good decision is one that follows a procedure, involving stakeholder (patient) input and considering all of the evidence available for the particular case.



## How can we judge the quality of a decision?



**Normative approaches**  
balance the chance and  
value of all possible  
outcomes



**Prescriptive approaches**  
emphasise the process  
and stakeholder  
involvement



**Descriptive approaches**  
emphasise the outcome of  
the decision

And descriptive approaches recognise that most people tend to judge decisions on how the outcome works out. The roles of uncertainty and process in decision making matter less than the actual outcome.

## What makes a good biosecurity decision?

We interviewed 33 biosecurity system participants



- What makes a good biosecurity decision?
- What makes a good decision process?
- What characterises a good decision maker?

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But what do the biosecurity decision makers themselves think characterises a good biosecurity decision?

We interviewed 33 system participants, including many of the previous group. They represented central and local governments, primary industries, biosecurity infrastructure such as port companies, and environmental non-governmental organisations.

We asked them: What makes a good biosecurity decision? What makes a good decision process? And what defines a good decision maker? The answers we received tended to span across these three questions, so we didn't separate them out in the thematic analysis.

## What do participants think makes a good decision?

- 1 Prevention focus**  
Biosecurity aims to prevent harm while avoiding collateral damage

*“The whole thing is about not having the bugs in the country”*

*“while having minimal impacts that might disrupt people or systems in other ways.”*



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Eight major themes came through in the interview response.

The first was prevention focus. Biosecurity system participants were primarily focussed on preventing harm, including collateral damage caused by biosecurity management. This is understandable, but it was perhaps surprising that there was essentially no mention of a promotion focus – how biosecurity enables people, industries and the environment to thrive and grow. The mindset of biosecurity decision makers seems to be on maintaining the status quo in the face of multiple external biosecurity threats.

In Nelson, both MPI and DOC were focused on preventing damage by great white butterfly: in MPI's case primarily to vegetables and forage crops, and in DOC's case to rare native cresses.

## What do participants think makes a good decision?

### 2 “Good thinking”

Certain approaches to thinking about biosecurity decisions are a feature of good decision makers



Clear purpose



Big picture



Analytical



Long-term



Open-minded

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The second emergent theme was around “good thinking”. By this, participants meant that biosecurity decision makers should have a clear purpose, remember the big picture, be analytical and self-aware rather than emotional, consider the long-term consequences of their decisions, and be open to the views and ideas of others.

## What do participants think makes a good decision?

### 3 Participation

Good decisions involve a range of stakeholders other than the decision maker

*“You’ve got to make sure you’ve got the right people who are competent enough to challenge you as a decision maker so that you get their advice”*



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Biosecurity participants felt that a good decision involves input from a range of people other than the decision maker. These people should be involved early, but they must be trusted. This echoes the earlier results and suggests that decision makers need to maintain a network of stakeholders and advisors that they can draw on.

## What do participants think makes a good decision?

**4 Information**  
Good decisions are based on good information

**5 Transparency**  
The reasons behind a particular decision should be clear

*“Knowledge is strength”*

*“Risk assessments  
[are] the key to good  
decision making”*

*“It should be clear what  
the inputs are, what has  
been weighed up and  
for what purpose”*

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Slightly less dominant themes among participants included information and transparency.

Good information is needed to make good decisions. As one participant put it: “knowledge is strength”. Another pandered to the current crowd by saying “risk assessments are the key to good decision making.”

This information, and the way it has been weighed up, needs to be clear.

## What do participants think makes a good decision?

### 6 Timeliness

Biosecurity decisions must be made at the right time

*“You don’t want to rush the decision making but you also can’t get stuck in paralysis”*

### 7 Achievability

Good decisions are feasible to implement

*“It’s not worth throwing money at things that really aren’t feasible ”*

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When to make a decision was another key theme. Early action was often seen as desirable for minimising costs, but conversely some decisions are not as urgent as they may seem. MPI monitored great white butterfly in Nelson for two years before making the decision not to attempt eradication. A big part of their decision, and perhaps the main disagreement with DOC, was around the achievability of eradication.

## What do participants think makes a good decision?

### 8 Outcomes matter

Belief that decision quality can only be judged once the outcomes are known

*A good decision “achieves a good outcome for the stakeholders” or “a good outcome for the environment and the community”*



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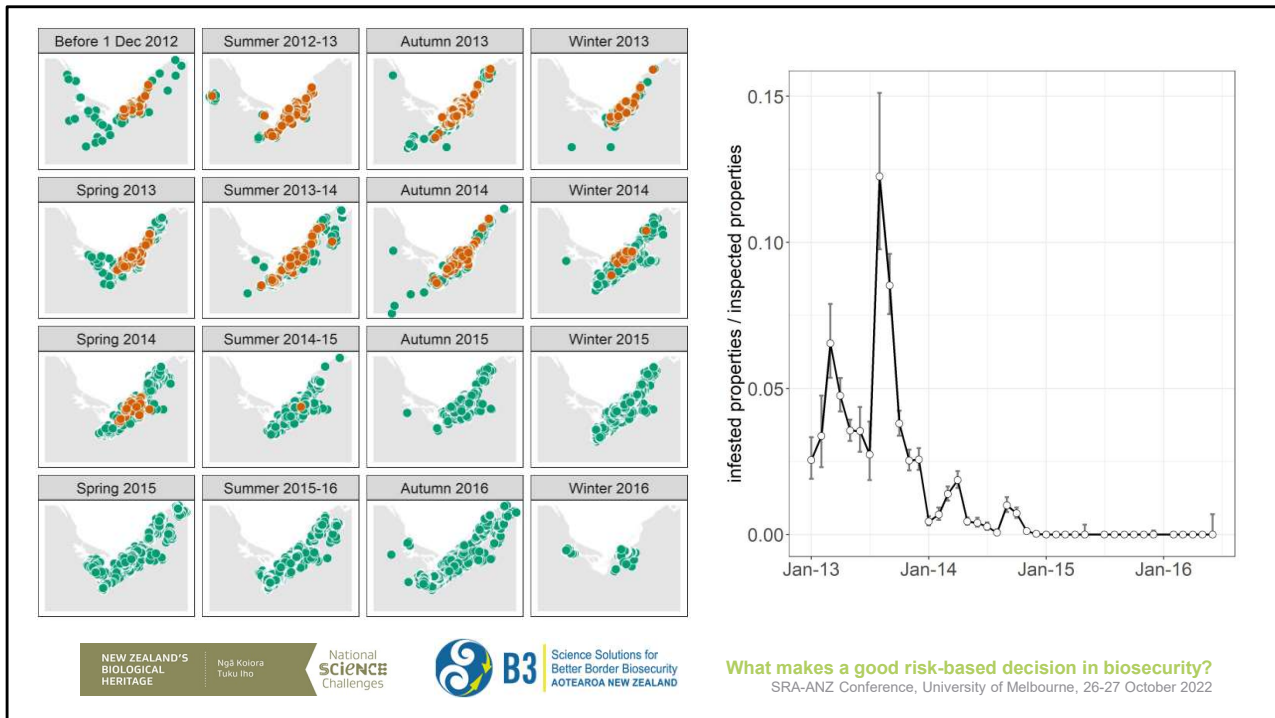
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Finally, many biosecurity participants were adherents of the “descriptive approach” to decision evaluation. For them the outcome was often more important than the process.





Outcomes matter eh? So what actually happened in Nelson? Can a few dudes with nets really take down a great white?



Well, it turns out that yes, they can.

Exhaustive ground searching, informed by modelling, geostatistics and expert advice (including from the next speaker), together with community awareness and public participation slowly reduced the great white butterfly population until it finally disappeared entirely. It was a remarkable result, the first ever eradication of an invasive butterfly.

PLoS ONE15(8): e0236791. <https://doi.org/10.1371/journal.pone.0236791>

RESEARCH ARTICLE

# Eradicating the large white butterfly from New Zealand eliminates a threat to endemic Brassicaceae

**Craig B. Phillips**<sup>1,2\*</sup>, **Kerry Brown**<sup>3</sup>, **Chris Green**<sup>3</sup>, **Richard Toff**<sup>4</sup>, **Graham Walker**<sup>2,5</sup>, **Keith Broome**<sup>3</sup>

**1** Biocontrol and Biosecurity Group, AgResearch, Lincoln, New Zealand, **2** Better Border Biosecurity research collaboration, [www.b3nz.org](http://www.b3nz.org), Aotearoa, New Zealand, **3** Department of Conservation, Wellington, New Zealand, **4** Entecol Ltd, Nelson, New Zealand, **5** Plant & Food Research, Auckland, New Zealand

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And if you want to know more, you can read that story in this 2020 paper in PLoS One.

Ministry for Primary Industries  
Manatū Ahu Matua



Department of Conservation  
*Te Papa Atawhai*



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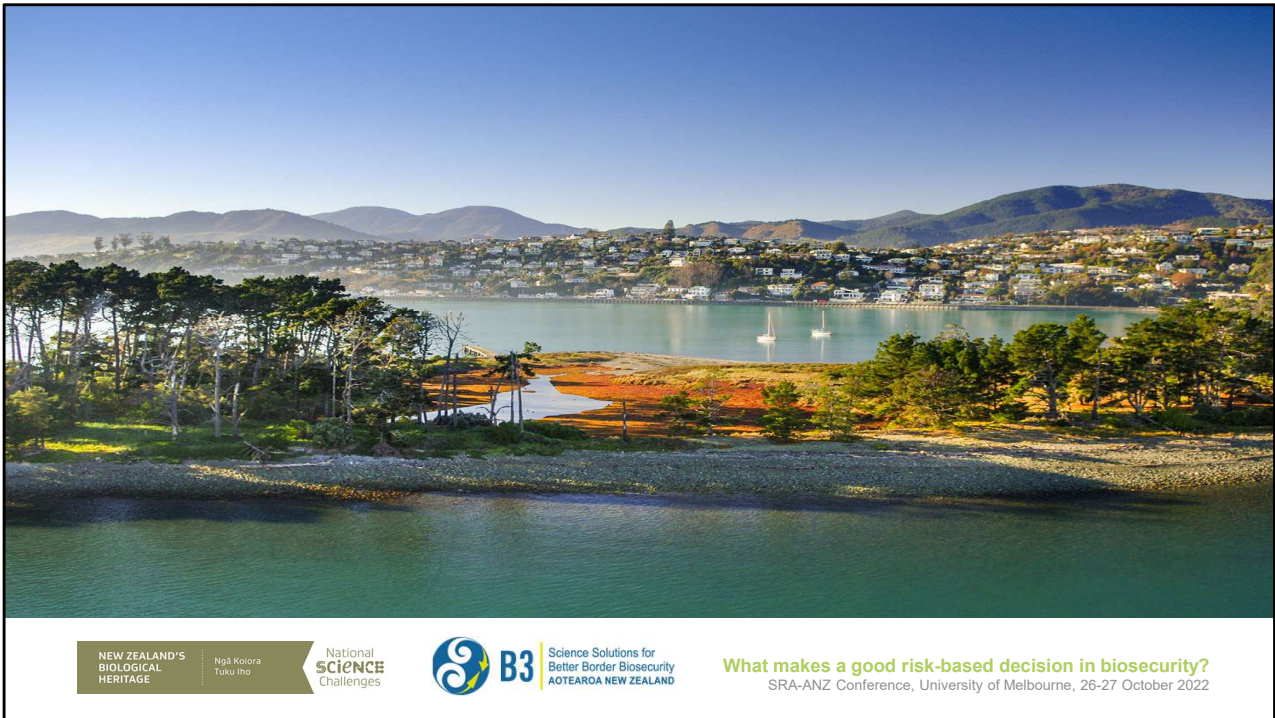
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For now, we are interested in who made the right decision – MPI or DOC?  
Obviously, if only outcomes matter then DOC was right to try, and eventually succeed, in eradicating the great white butterfly.  
But I don't think it's that simple. MPI made a measured, informed and transparent decision not to attempt eradication because of a lack of tools and the estimated low chance of success. DOC was more optimistic, and also perceived the risks from the pest to be significantly greater.  
Assessing biosecurity decisions is not straightforward, especially when decision makers value risks and consequences differently, as MPI and DOC did in this case.



However, I do think we are much closer now to understanding how biosecurity decisions are being made, and how biosecurity system participants think their decisions should be evaluated.

Our hope is that this information will lead to better, more inclusive frameworks for assessing biosecurity risk, and that involving decision makers in the process will lead to them actually using these frameworks. And of course, the frameworks must empower biosecurity decision makers to make objectively better decisions, to overcome their own cognitive biases, and to protect a wider range of social, environmental, economic and cultural values.

## Kia ora / thank you!

### Funding

- NZ Biological Heritage National Science Challenge
- Better Border Biosecurity (B3)

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Nicola Gourley, DOC



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Thank you.