

# Co-designing evidence-based tools for environmental assessments

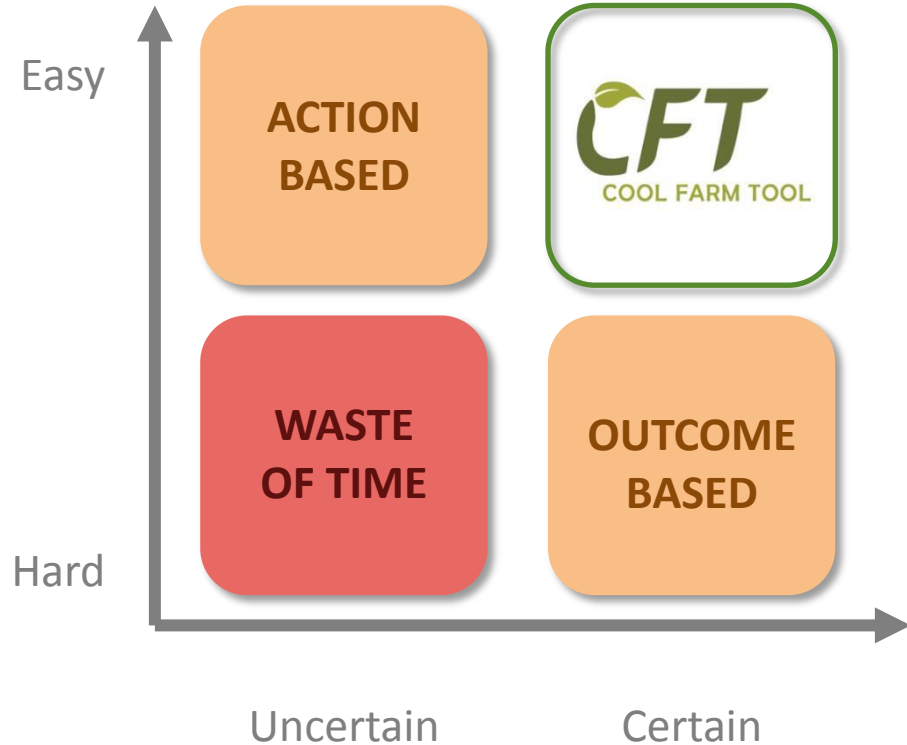
A PROOF-OF-CONCEPT FOR NZ FARM BIODIVERSITY



Manaaki Whenua  
Landcare Research



# ADDRESSING THE CHALLENGES OF MEASURING BIODIVERSITY



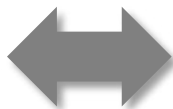
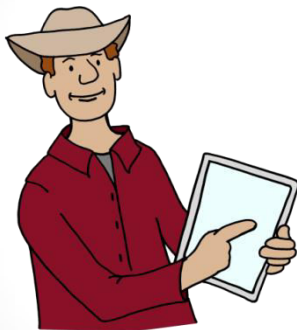
# BIODIVERSITY TOOL MEETS MULTIPLE NEEDS...



***How nature-friendly  
are my farm actions?***



***What actions  
should I do next?***



**Access market &  
meet consumers'  
expectations**



**Help tell the NZ  
biodiversity story**



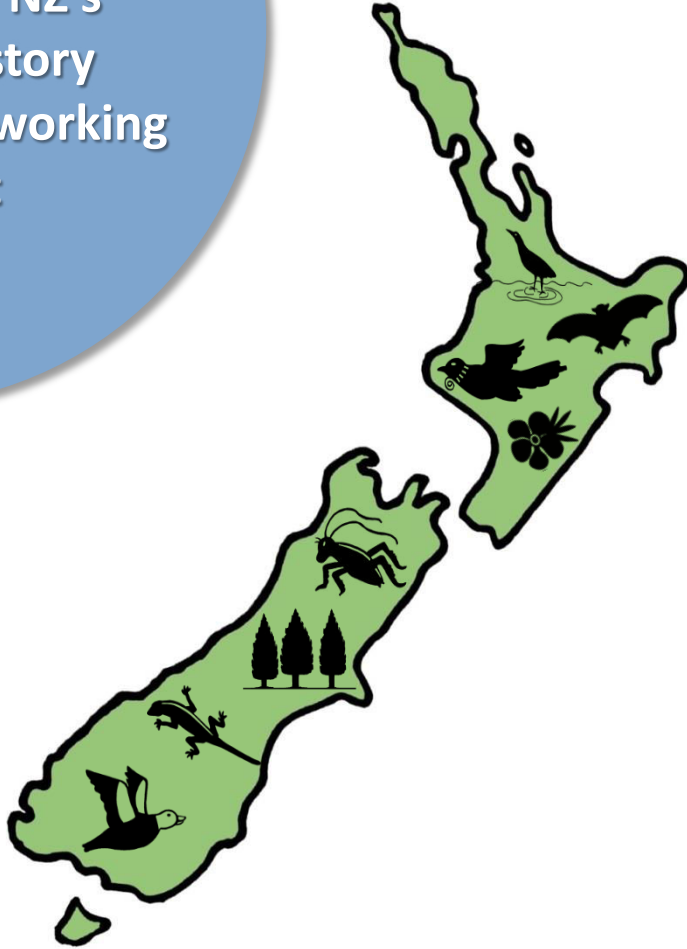
**Meet my industry's  
reporting  
requirements**



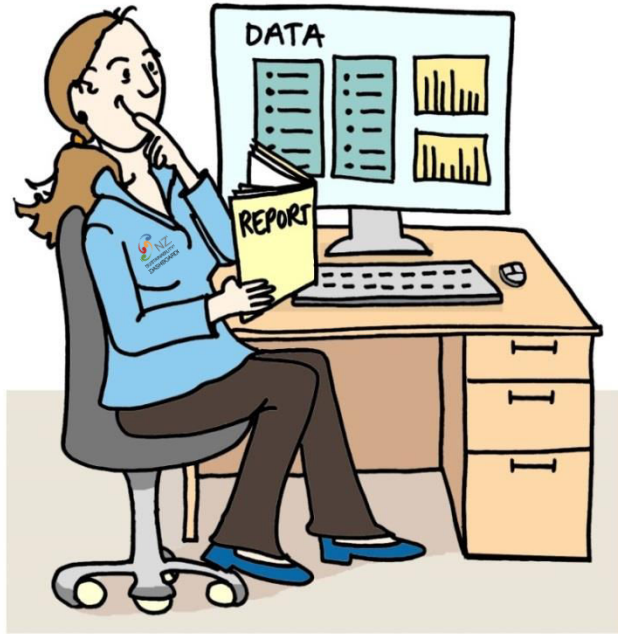
**Submit my farm  
environment plan**



Ability to tell NZ's  
biodiversity story  
& how NZ is working  
to enhance it



# START WITH COMPREHENSIVE LIST OF OPTIONS ...

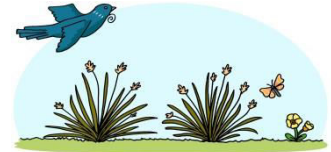


**Conservation  
Evidence**  
*Evidence to improve practice*



Biodiversity groups

- ❖ A
- ❖ B
- ❖ C
- ....



Management actions

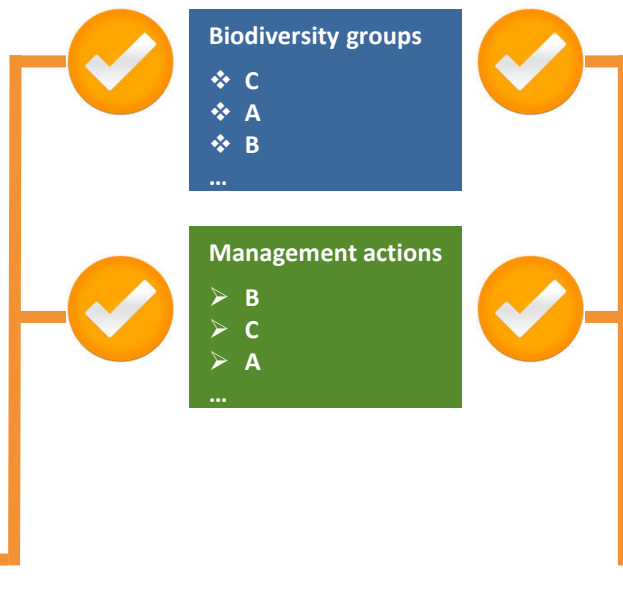
- A
- B
- C
- ...





A staff member from Dairy NZ was also involved

## ABILITY TO TELL NZ'S BIODIVERSITY STORY



200+ farmers, growers & other interested parties

\* Our online prioritisation exercise drew on the experience of individuals from certain organisations; the results reflect those responses, rather than the policy or perspective of their organisation.



**NATIVE BUSH  
PLANTS**

**1**



**NATIVE WETLAND &  
AQUATIC PLANTS**

**2**



**NATIVE GRASSLAND  
PLANTS**

**3**



**NATIVE FOREST  
BIRDS**

**4**



**NATIVE BIRDS OF  
OPEN HABITATS**

**5**

**6**

**WETLAND BIRDS**



**7**

**SOIL LIFE**



**8**

**BENEFICIAL INSECTS**



**9**

**NATIVE AQUATIC  
ANIMALS**



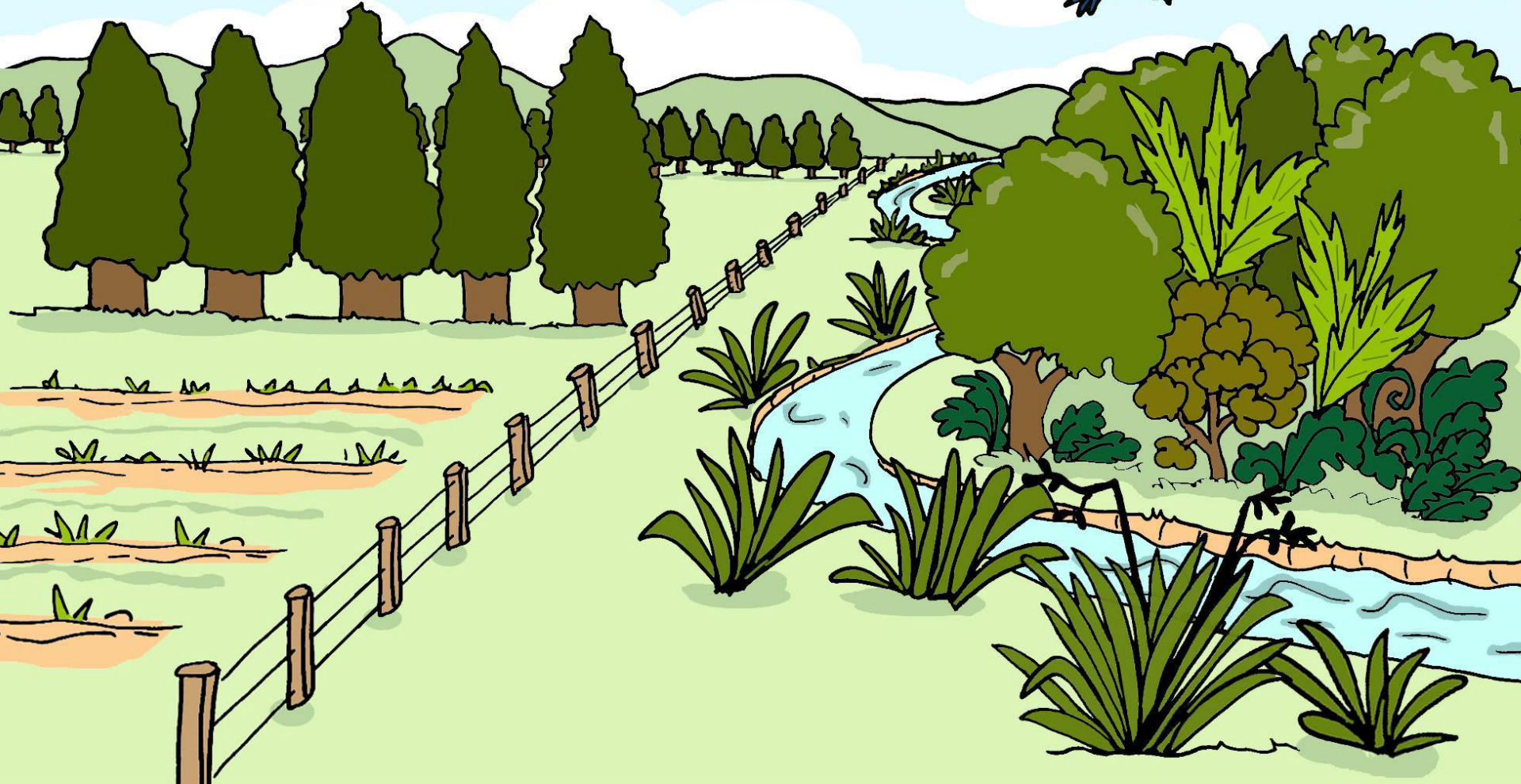
**10**

**LIVESTOCK, CROP  
& VARIETY**



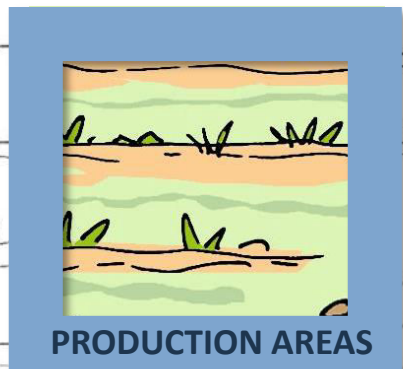


# 35 MANAGEMENT ACTIONS OF INTEREST

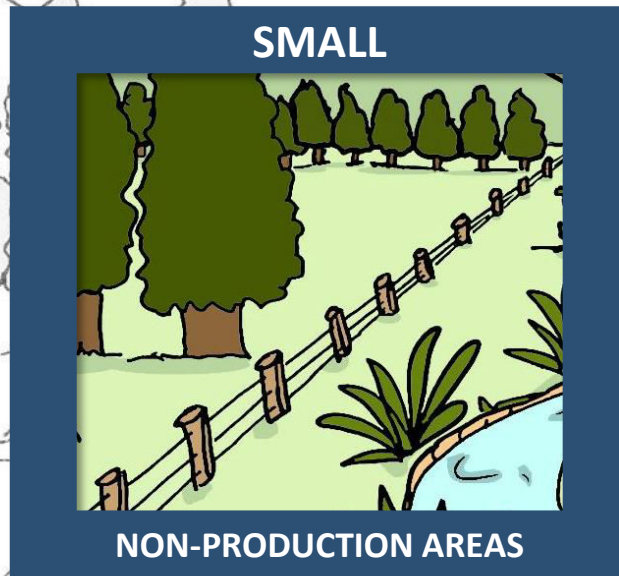




# 35 MANAGEMENT ACTIONS OF INTEREST



**37%** OF ACTIONS



**31%** OF ACTIONS



**31%** OF ACTIONS

# DESIGN A NZ-RELEVANT MANAGEMENT ACTION CHECKLIST



Online surveys &  
prioritisation exercise



Management actions

- B
- C
- A
- ...



# TARGET GROUPS TO TELL NZ'S BIODIVERSITY STORY



Online surveys &  
prioritisation exercise



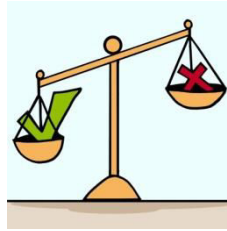
Biodiversity groups

- ❖ C
- ❖ A
- ❖ B
- ...



NZ-relevant biodiversity  
performance scores

**SPECIALIST  
JUDGEMENT**



**LATEST SCIENTIFIC  
RESEARCH**





# SPECIALIST PANEL FOR JUDGEMENT SCORES



Specialists from University of Canterbury and Massey University also participated in the assessment.

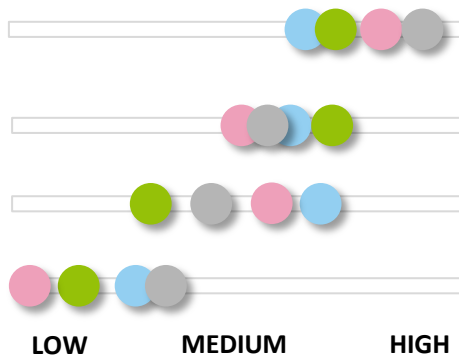
10 of 23 invited specialists participated



# INDIVIDUAL JUDGEMENT-BASED BIODIVERSITY SCORES



INDIVIDUAL SCORES



For target biodiversity group

1. How **beneficial** is action?
2. How **harmful** is action?
3. How **certain** are you about your answers to questions 1 & 2?





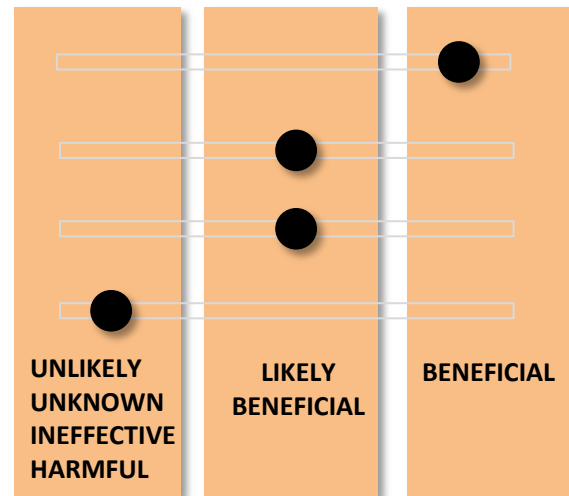
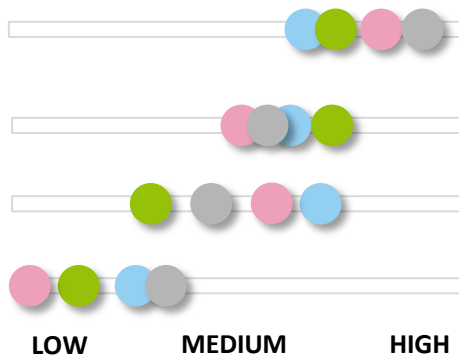
# CONSENSUS ON JUDGEMENT-BASED BIODIVERSITY SCORES



INDIVIDUAL SCORES



CONSENSUS SCORES





# CONSENSUS ON JUDGEMENT-BASED BIODIVERSITY SCORES

## ConservationEvidence

*Evidence to improve practice*

BIODIVERSITY BENEFIT CATEGORY	SCORES		
	Benefits	Harms	Certainty
Beneficial	$\geq 60$	$< 20$	$\geq 60$
Likely to be beneficial	$\geq 60$	$< 20$	40 – 60
	40 – 60	$< 20$	$\geq 40$
Trade-offs between benefits & harms	$\geq 40$	$\geq 20$	$\geq 40$
Unknown effectiveness	Any score	Any score	$< 40$
Unlikely to be beneficial	$< 40$	$< 20$	40 – 60
Likely to be ineffective or harmful	$< 40$	Any score	$\geq 60$
	$< 40$	$\geq 20$	$\geq 40$



# JUDGEMENT-BASED BIODIVERSITY SCORES SUMMARY

*43 actions × 11 biodiversity groups = 473 cases*

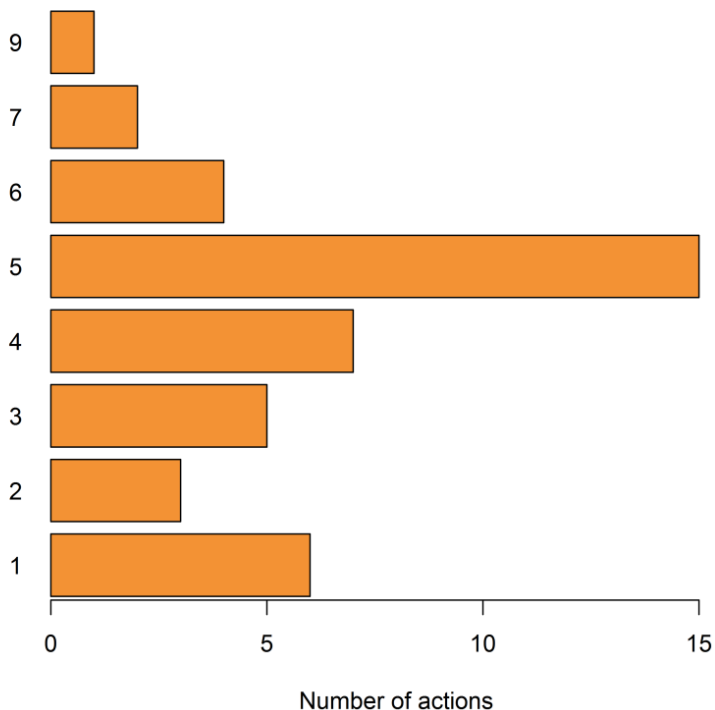


BIODIVERSITY BENEFIT CATEGORY	% CASES	TOOL SCORES
Beneficial	17%	2
Likely to be beneficial	20%	1
Trade-offs between benefits & harms	1%	0
Unknown effectiveness	5%	0
Unlikely to be beneficial	44%	0
Likely to be ineffective or harmful	13%	0



# JUDGEMENT-BASED BIODIVERSITY SCORES SUMMARY

HOW MANY BIODIVERSITY GROUPS BENEFIT?



- All actions benefit  $\geq 1$  group
- No actions benefit all groups
- TOP ACTION: Control deer, goats, pigs and other animals that alter habitat on farm, especially in natural habitats





# EVIDENCE: 'THINK GLOBAL, ACT LOCAL'



## ConservationEvidence

*Evidence to improve practice*

 Amphibian Conservation 129 Actions	 Bat Conservation 78 Actions	 Bee Conservation 59 Actions
 Bird Conservation 455 Actions	 Control of Freshwater Invasive Species 139 Actions	 Farmland Conservation 119 Actions

Capitalise on:

- Existing global database
- Evidence evaluation protocols
- Opportunity to build NZ capability



- Add NZ scores & evidence
- Address key evidence gaps (global reviews & local research)



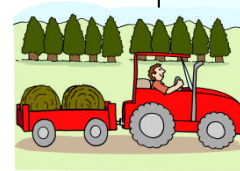
UNIVERSITY OF  
CAMBRIDGE



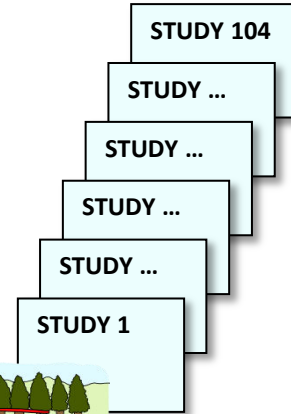
# GATHER BEST-AVAILABLE SCIENTIFIC EVIDENCE FOR EACH ACTION



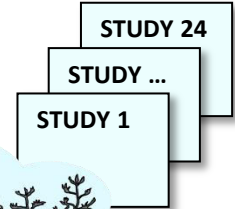
**Conservation  
Evidence**  
*Evidence to improve practice*



**Tillage  
methods**



**Shelterbelts  
present**







# SOURCE OF EVIDENCE



AFRICA  
ASIA  
AUSTRALIA  
EUROPE  
NORTH AMERICA

## ConservationEvidence

*Evidence to improve practice*

 Amphibian Conservation 129 Actions	 Bat Conservation 78 Actions	 Bee Conservation 59 Actions
 Bird Conservation 455 Actions	 Control of Freshwater Invasive Species 139 Actions	 Farmland Conservation 119 Actions



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CAMBRIDGE

NO NZ STUDIES!





# AVAILABLE EVIDENCE IS PATCHY



NATIVE BUSH  
PLANTS

1



NATIVE WETLAND &  
AQUATIC PLANTS

2



NATIVE GRASSLAND  
PLANTS

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NATIVE FOREST  
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LIVESTOCK, CROP  
& VARIETY





# AVAILABLE EVIDENCE IS PATCHY

## Conservation Evidence

*Evidence to improve practice*

Tillage  
methods

Shelterbelts  
present

SOIL LIFE



**65**  
STUDIES

**3**  
STUDIES

BENEFICIAL INSECTS



**22**  
STUDIES

**18**  
STUDIES

NATIVE GRASSLAND  
PLANTS



**19**  
STUDIES

**3**  
STUDIES

NATIVE BIRDS OF  
OPEN HABITATS

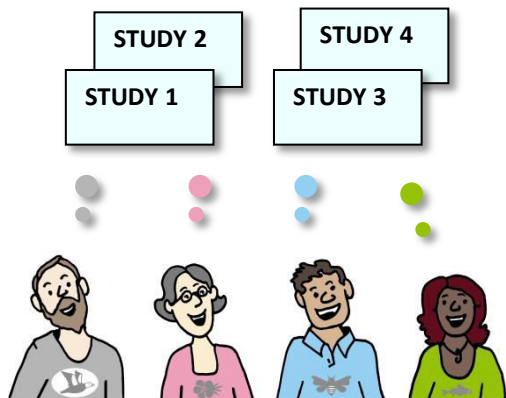


**10**  
STUDIES

**2**  
STUDIES



# SPECIALIST PANEL FOR EVIDENCE SCORES



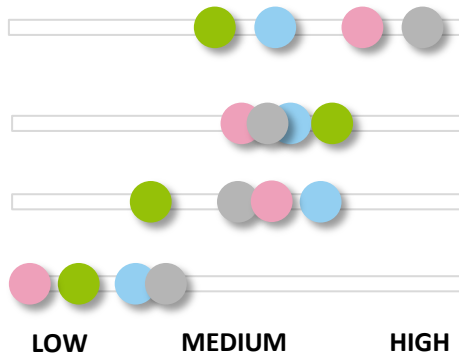
6 of 25 invited specialists participated  
(invitees included 10 judgement-panel members)



# INDIVIDUAL EVIDENCE-BASED BIODIVERSITY SCORES



INDIVIDUAL SCORES



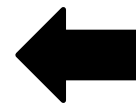
For target biodiversity group

1. How **beneficial** is action?
2. How **harmful** is action?
3. How **certain** is evidence for benefits and harms?
4. How **relevant** is evidence to NZ?



# CONSENSUS ON EVIDENCE-BASED BIODIVERSITY SCORES

BIODIVERSITY BENEFIT CATEGORY	SCORES			
	Benefits	Harms	Certainty	Relevance
Beneficial	$\geq 60$	$< 20$	$\geq 60$	$\geq 60$
Likely to be beneficial	$\geq 60$	$< 20$	40 – 60	$\geq 60$
	40 – 60	$< 20$	$\geq 40$	$\geq 60$
Trade-offs between benefits & harms	$\geq 40$	$\geq 20$	$\geq 40$	$\geq 60$
Unknown effectiveness	Any score	Any score	$< 40$	Any score
	Any score	Any score	Any score	$< 60$
Unlikely to be beneficial	$< 40$	$< 20$	40 – 60	$\geq 60$
Likely to be ineffective or harmful	$< 40$	Any score	$\geq 60$	$\geq 60$
	$< 40$	$\geq 20$	$\geq 40$	$\geq 60$







# BENEFITS CATEGORIES

## Tillage methods

Trade-off  
harms | benefits

**BENEFICIAL INSECTS**



Trade-off  
harms | benefits

**SOIL LIFE**



Unknown

**NATIVE GRASSLAND  
PLANTS**



Unknown

**NATIVE BIRDS OF  
OPEN HABITATS**



Unknown

**BIODIVERSITY OVERALL**

## Shelterbelts present

Trade-off  
harms | benefits

Unknown



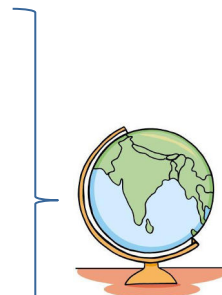
Unknown



Unknown



Unknown



# SPECIALIST JUDGEMENT VS. LATEST EVIDENCE



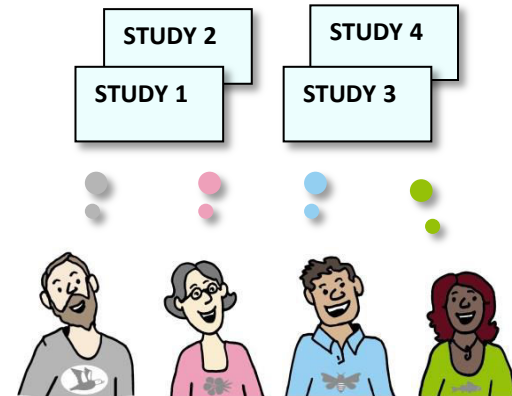
For our 10 actions-biodiversity cases:

- Only 1 remained unchanged
- 5 initially considered 'unlikely beneficial' re-classified as 'unknown effectiveness'

Being objective is a challenge....

Hence:

- Make evidence transparent to build trust
- Allow others to draw their own conclusions



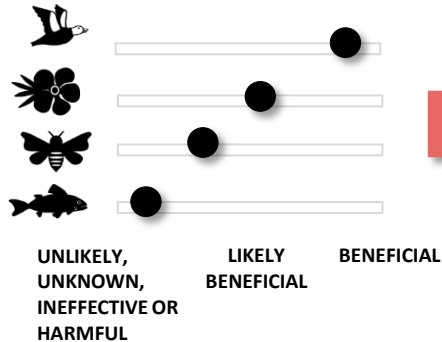
# USE SPECIALIST-EVALUATED SCORES TO REPORT LIVE RESULTS



Specialist judgement  
& latest research



*How nature friendly  
are my farm actions?*



## ***How nature-friendly are my farm actions?***

This tool makes it easy to assess and report on how biodiversity-friendly your farm management actions are.

Simply fill in the action checklist to learn which biodiversity groups are likely to benefit - live results will be displayed as you go. You can also download the results as a PDF report for your records.

The tool is designed for a farm-level assessment. The actions are grouped according to where on the farm they are implemented: production areas, small non-production areas or large non-production areas. An overall biodiversity score is provided for each of those areas, along with individual scores for each of the 10 biodiversity groups.

You can use the tool to assess the effectiveness of your current farm actions or to explore the likely impact of changing those actions.

*Note: The tool will not save your results on your computer or elsewhere.*

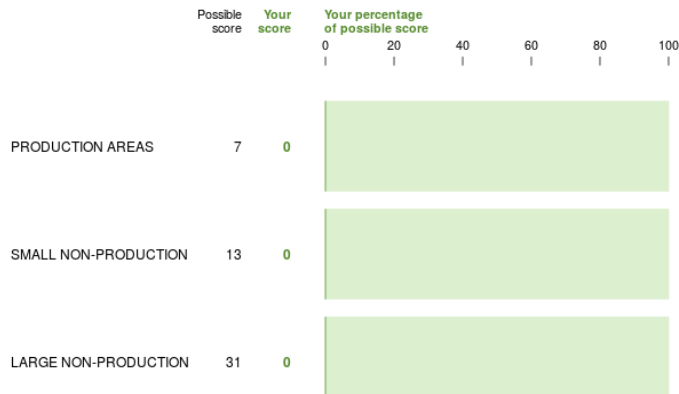
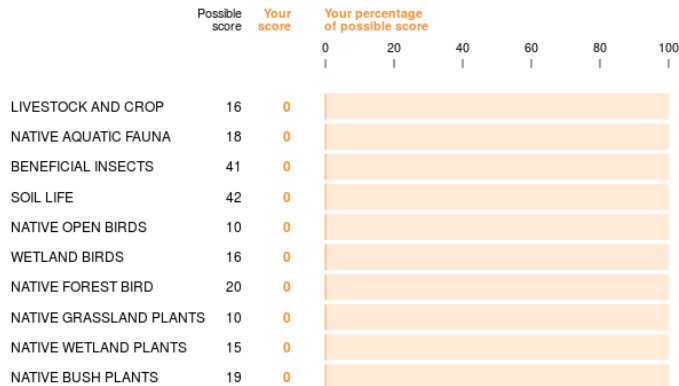
[Learn more about the tool and its development.](#)



Production Areas

Small Non-production Areas

Large Non-production Areas

**Do you grow more than 1 type or variety of crop?**☐ Yes☐ No**Do you farm more than 1 type or breed of livestock?**☐ Yes☐ No**Do you grow a mixed pasture sward in your paddock (such as mixed grasses, or grasses and clover, etc.)?**☐ Yes☐ No**What nature-friendly practices do you follow to manage agricultural pests on your farm?**☐ Provide semi-natural habitats near crops so beneficial insects can help with pest control, such as beetle banks☐ Use biological control methods☐ Practice cultural controls, such as mechanical/physical control of weeds and crop disease prevention (such as selecting resistant crop varieties, planning rotations, avoid leaving crop residues in which diseases or pests could develop)☐ Pesticides (including herbicides) are used only when and where they are needed as determined through monitoring of pests or crop damage and if recommended by an agronomist or crop advisor☐ Only selective pesticides targeted to the specific pest or weed are used, and which are compatible with biological control**What practices do you use to improve soil health in production areas of your farm?**☐ Minimise bare ground, such as by planting cover crops in arable fields, maintaining ground cover in orchards and vineyards, or maintaining vegetation cover in paddocks☐ Predominantly use shallow tillage or no tillage as the main method of cultivation☐ Maintain or increase soil organic matter, such as by leaving straw or crop residues, growing green manure crops, or adding compost or organic mulches☐ Add the right amounts and types of fertilisers (including organic inputs), and only in response to a demand for nutrients (such as that indicated by plant or soil testing, or assessment of paddock requirements) and at appropriate timings and frequency to minimise leaching and runoff☐ Minimise soil compaction and pugging by carefully managing machinery and livestock**OVERALL BIODIVERSITY IN MANAGEMENT AREA****BIODIVERSITY GROUP ACROSS THE FARM**[Download Report](#)

Production Areas

Small Non-production Areas

Large Non-production Areas

Do you grow more than 1 type or variety of crop?

☒ Yes☐ No

Do you farm more than 1 type or breed of livestock?

☒ Yes☐ No

Do you grow a mixed pasture sward in your paddock (such as mixed grasses, or grasses and clover, etc.)?

☐ Yes☐ No

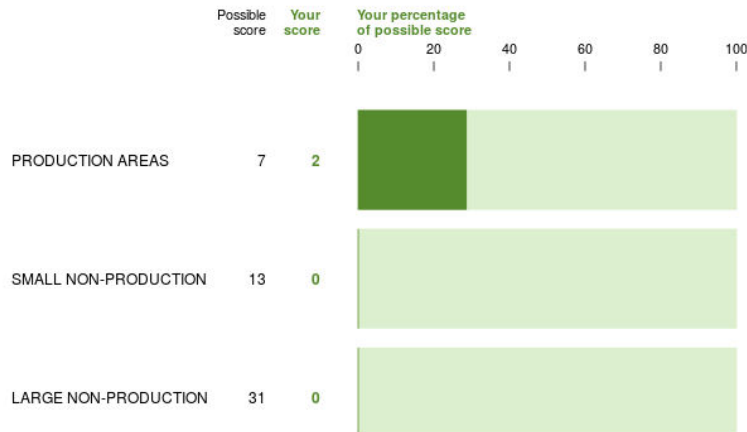
What nature-friendly practices do you follow to manage agricultural pests on your farm?

☐ Provide semi-natural habitats near crops so beneficial insects can help with pest control, such as beetle banks☐ Use biological control methods☐ Practice cultural controls, such as by mechanical/physical control of weeds and crop disease prevention (such as selecting resistant crop varieties, planning rotations, avoid leaving crop residues in which diseases or pests could develop)☒ Pesticides (including herbicides) are used only when and where they are needed as determined through monitoring of pests or crop damage and if recommended by an agronomist or crop advisor☒ Only selective pesticides targeted to the specific pest or weed are used, and which are compatible with biological control

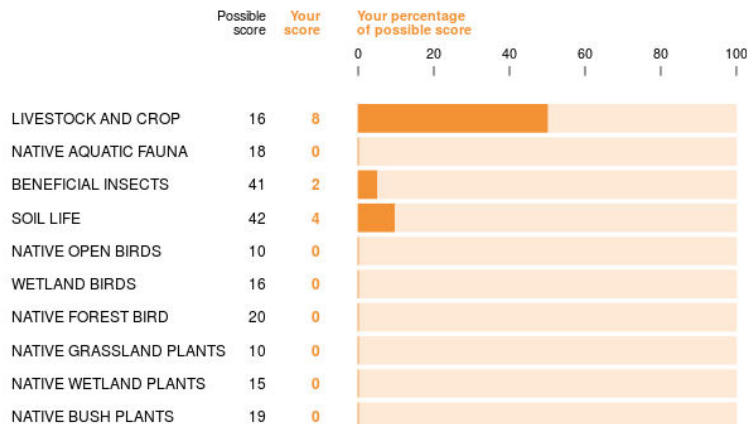
What practices do you use to improve soil health in production areas of your farm?

☐ Minimise bare ground, such as by planting cover crops in arable fields, maintaining ground cover in orchards and vineyards, or maintaining vegetation cover in paddocks☐ Predominantly use shallow tillage or no tillage as the main method of cultivation☒ Maintain or increase soil organic matter, such as by leaving straw or crop residues, growing green manure crops, or adding compost or organic mulches☐ Add the right amounts and types of fertilisers (including organic inputs), and only in response to a demand for nutrients (such as that indicated by plant or soil testing, or assessment of paddock requirements) and at appropriate timings and frequency to minimise leaching and runoff☒ Minimise soil compaction and pugging by carefully managing machinery and livestock

## OVERALL BIODIVERSITY IN MANAGEMENT AREA



## BIODIVERSITY GROUP ACROSS THE FARM







## DOWNLOAD REPORT

# On-Farm Biodiversity Assessment Report

## Biodiversity Assessment Questionnaire

The actions you implement on your farm to enhance biodiversity are:

Do you grow more than 1 type or variety of crop?

- ✓ Yes
- No

Do you farm more than 1 type or breed of livestock?

- ✓ Yes
- No

Do you grow a mixed pasture sward in your paddock (such as clover, etc.)?

- Yes
- No

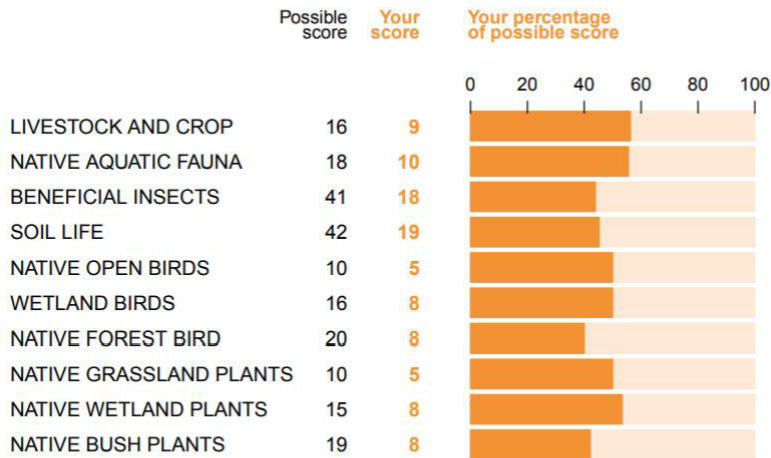
What nature-friendly practices do you follow to manage a paddock?

- Provide semi-natural habitats near crops so beneficial insects can move between banks
- Use biological control methods
- Practice cultural controls, such as mechanical/physical controls (such as selecting resistant crop varieties, planning rotation of crops so diseases or pests could develop)
- ✓ Pesticides (including herbicides) are used only when and where necessary, through monitoring of pests or crop damage and if recommended
- ✓ Only selective pesticides targeted to the specific pest or weed, with biological control

## Scores for Biodiversity Groups

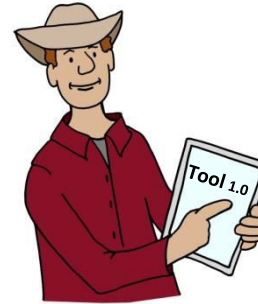
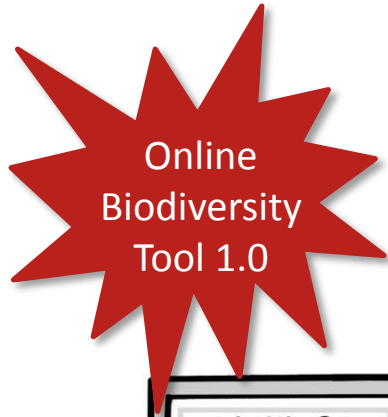
Your scores for enhancing biodiversity of particular groups of species are displayed in the following graph as a percentage of the total possible score if you implemented all actions in this assessment. Descriptions of each biodiversity group are available below.

## BIODIVERSITY GROUP ACROSS THE FARM



- **Livestock, crop, and variety:** Genetic diversity of livestock and crops, diversity of forage and green manure crops grown
- **Native aquatic animals:** Animals native to New Zealand that need water for breeding, shelter or feeding
- **Beneficial insects:** Invertebrates that help agriculture by providing services like pollination or pest control
- **Soil life:** Animals, bacteria and fungi that live within the soil, and are mainly found below ground
- **Native birds of open habitats:** Native birds that mostly use open areas (grasslands or open shrublands) for breeding and feeding
- **Wetland birds:** Birds that mainly use wetlands for breeding and feeding, including riparian areas
- **Native forest birds:** Native birds that require woody plants (such as forest, dense scrub or shelterbelts) for breeding and feeding

# DELIVER A PROTOTYPE TOOL THAT IS USEFUL AND EASY TO USE



**Stakeholders test &  
recommend improvements**



*“... a lot more will be achieved by providing environmental information for land managers so they can make decision themselves ... So this tool is a great idea.”*

Livestock farmer

*“... great potential to make a significant and lasting improvement in on-farm biodiversity, and I support it wholeheartedly.”*

Livestock farmer



*“It’s great that this is being tackled proactively at a national level across all industries...”*

Horticultural industry manager

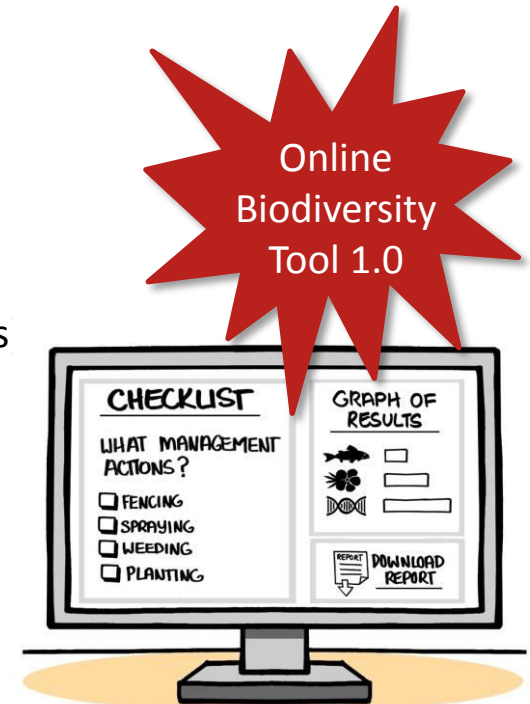
*“This looks like an interesting project which if successful would be very good for all land-based primary industries”*

Livestock industry manager

# TOOL EASY TO USE & USEFUL?



- Some tool navigation issues
- Questions easy to understand and relevant but ...
  - Some not specific enough (e.g. agrichemicals use; tillage)
  - Fine-tuning (e.g. size of small vs. large non-production areas)
- Simplicity of tool had appeal but...
  - Want access to underlying scores and evidence
  - Educational resources to inform what next



# BIODIVERSITY TOOL MEETS MULTIPLE NEEDS...

*'Benchmarking against  
self and others'*



***How nature-friendly  
are my farm actions?***

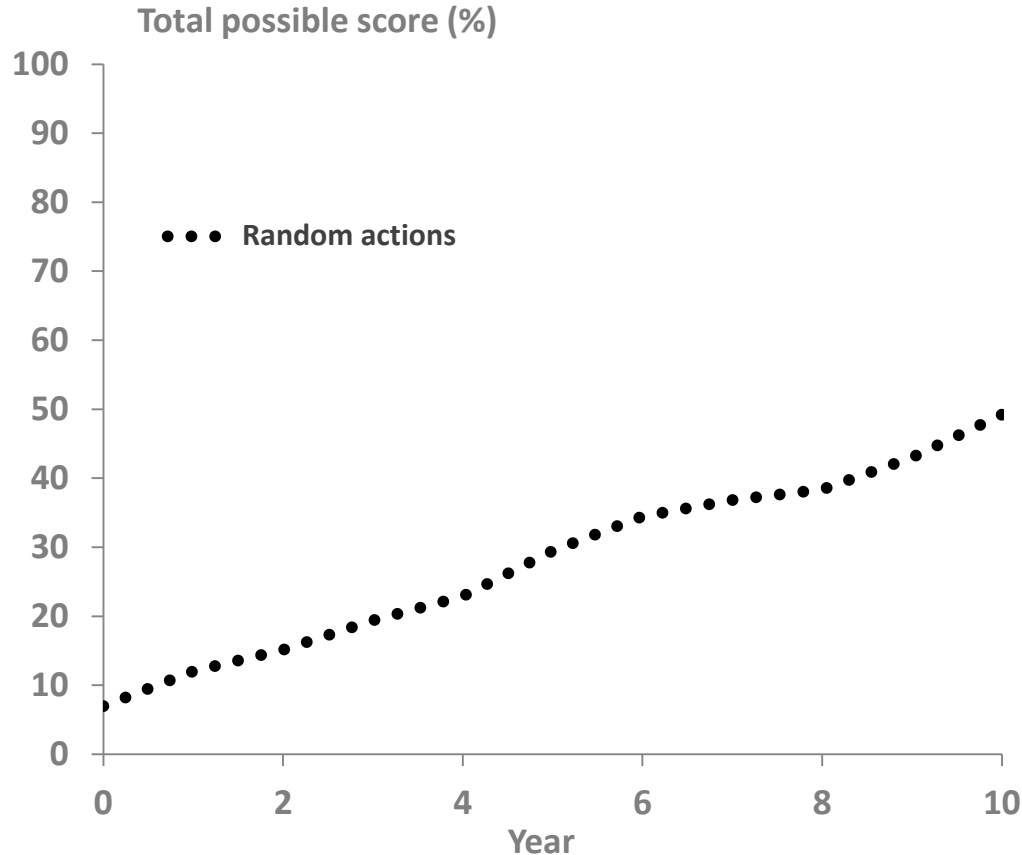


***What actions  
should I do next?***

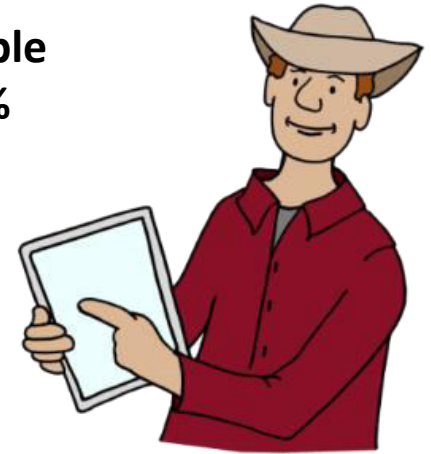
*'Prioritise actions to achieve  
greatest benefits'*



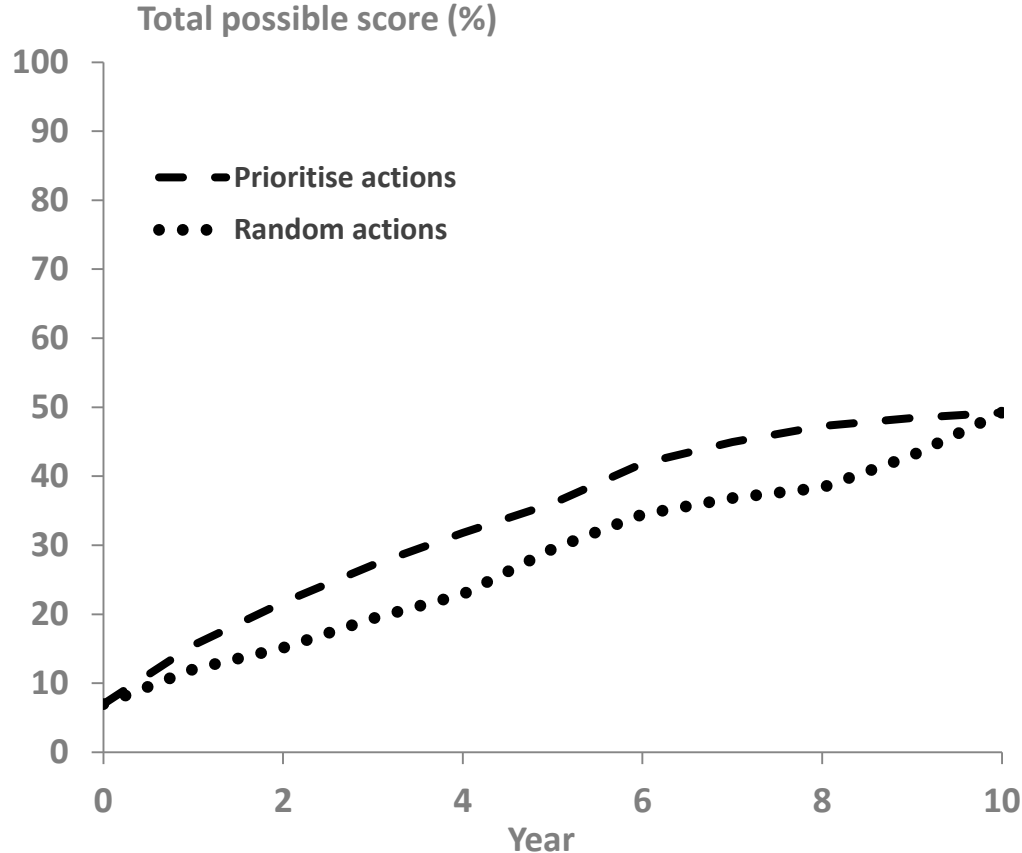
# WHAT IS FEASIBLE ON MY FARM BASED ON EXISTING HABITATS?



**Total possible  
score = 49%**



# WHAT ORDER SHOULD I IMPLEMENT THOSE ACTIONS?

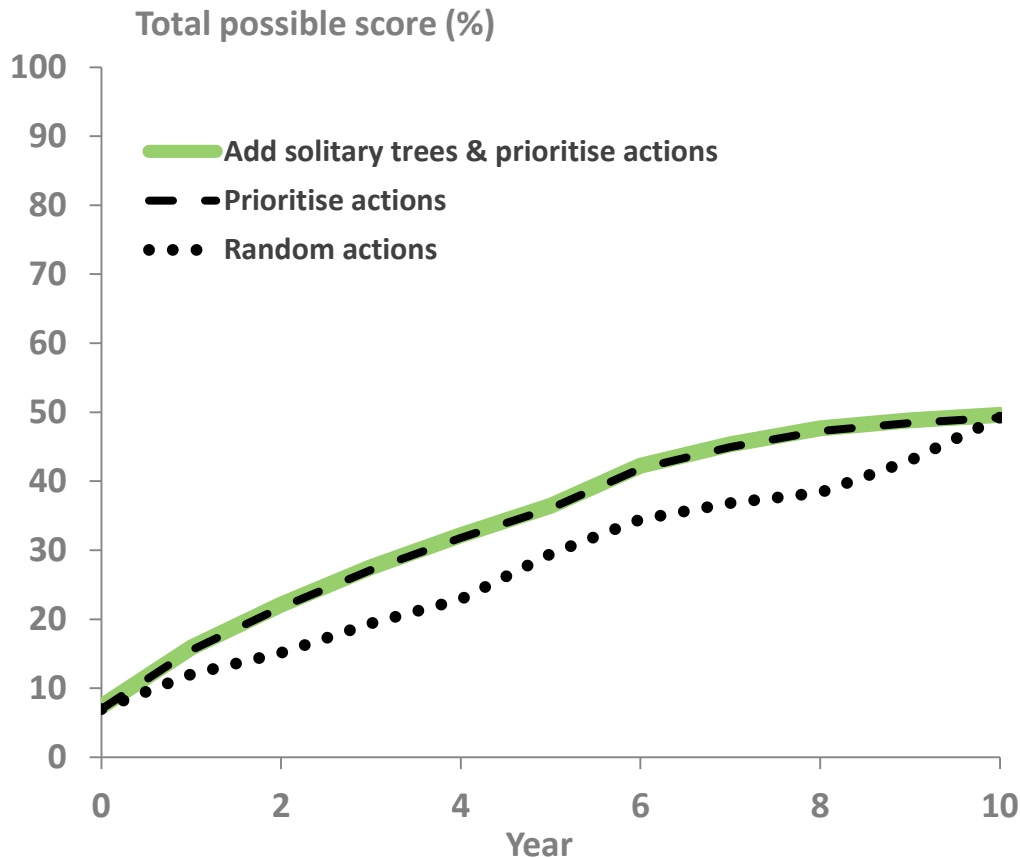


Accumulate  
benefits  
faster

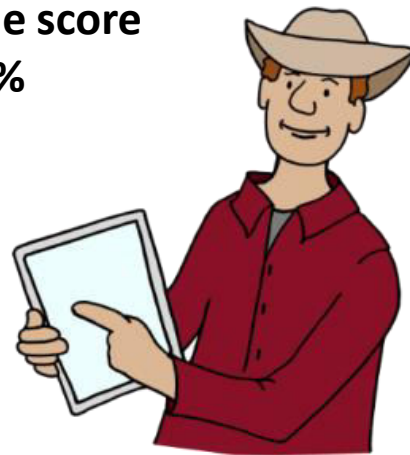




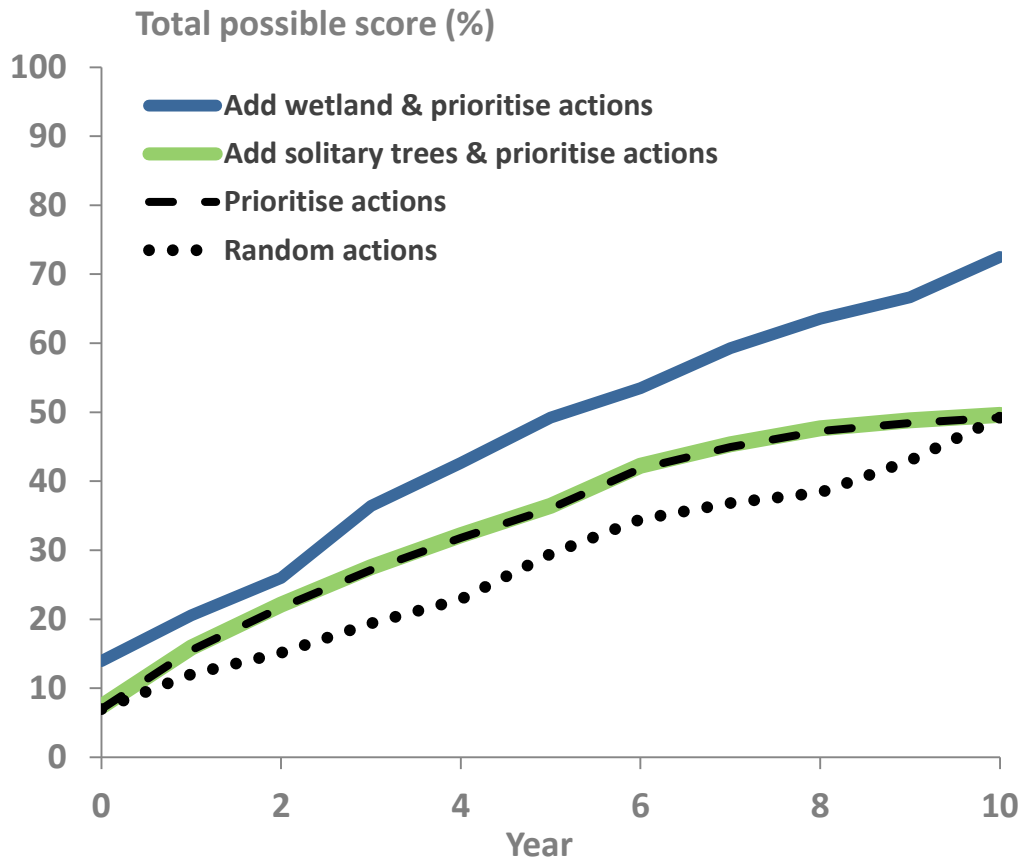
# WHAT CAN I DO NEXT TO ADD VALUE TO MY FARM?



Total possible score  
increase = 1%



# WHAT CAN I DO NEXT TO ADD VALUE TO MY FARM?



**Total possible score  
increases to 72%**



# BIODIVERSITY TOOL MEETS MULTIPLE NEEDS...

*'Benchmarking against  
self and others'*



***How nature-friendly  
are my farm actions?***



***What actions  
should I do next?***

*'Prioritise actions to achieve  
greatest benefits'*



**Access market &  
meet consumers'  
expectations**



*'Safeguard social  
license to operate'*

**Help tell the NZ  
biodiversity story**



*'Inform & support  
farm management  
strategies'*

**Meet my industry's  
reporting  
requirements**



**Submit my farm  
environment plan**



*'Inform farm  
environment plans'*

# ENSURING TOOL USEFUL .... FUTURE GOVERNANCE?

- Where will tool most usefully be housed?
- What kinds of support are required to get uptake?
- How comfortable are users with sharing data?
  - What uses?
  - Who decides?

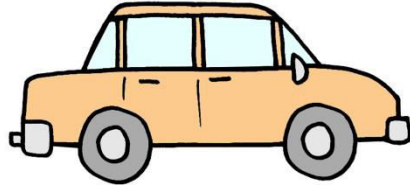
TODAY'S WORKSHOP



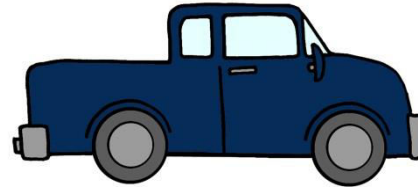
# KEEPING IT REAL ...



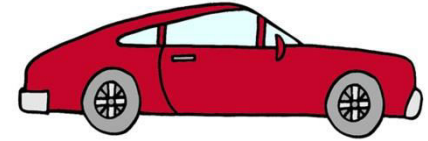
What is available



What we aimed  
to deliver



What you would  
ideally like now



What the super  
keen aspire to

# FUTURE IMPROVEMENTS?



- Link to existing:
  - Spatial layers, databases and tools
  - Educational material
- Tailor questionnaires and scores to different contexts
- Provide greater resolution of information
- Ability to prioritise actions for desired outcomes, include:
  - Costs of actions
  - Exploring trade-offs between different sustainability outcomes
- Assessments at multiple spatial scales (e.g. catchment)
- Field-test tool predictions

**CHALLENGE**

Ensure uptake by  
delivering tools that  
are useful & relevant

**TOOL FEATURE**



Ability to tell  
NZ's biodiversity story  
& how NZ is working  
to enhance it

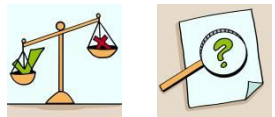
**OUTCOMES**

Stakeholders co-design  
a tool that incorporates  
what matters to them

**BY-PRODUCTS**

Understand & alignment  
with stakeholder values

Provide cost-effective  
solutions to evidence  
complacency



Scores biodiversity  
performance based on  
the latest research and  
expert judgement

NZ specialists work together  
to ensure best use of global  
scientific evidence

Overcome evidence barriers &  
identify key knowledge gaps

Narrow the gap  
between practice  
& performance

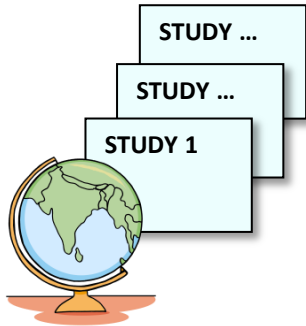


Easy to evaluate  
how friendly farm actions  
are for different kinds  
of biodiversity

Stakeholders empowered  
to make informed decisions

Ensure tool governance  
meets user needs

# EVIDENCE EVALUATION PROCESS PER ACTION ...

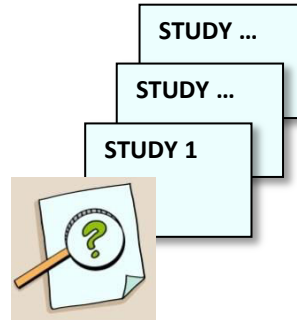


**\$6M**

Global biodiversity  
research investments



**Conservation  
Evidence**  
*Evidence to improve practice*



**1%**

of original  
research costs



 **NZ**  
SUSTAINABILITY  
DASHBOARD

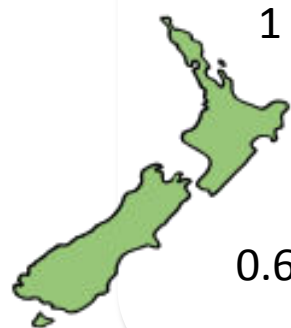


**0.5%**

of original  
research costs



# CODESIGN PROCESS INVOLVED ...



1 FTE direct

4 Core research team

0.6 FTE in-kind

300 NZ stakeholders

16 NZ biodiversity specialists



**MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT**  
HIKINA WHAKATUTUKI



0.1 FTE in-kind

6 Researchers|managers

\$\$M

Global studies & evidence synthesis investment



## LEARN MORE

[www.nzdashboard.org.nz/biodiversity-assessment-tool.html](http://www.nzdashboard.org.nz/biodiversity-assessment-tool.html)

## TEST OUR TOOL

[landcare.shinyapps.io/BiodivPrototype/](http://landcare.shinyapps.io/BiodivPrototype/)



## ACCESS REPORTS | DATA | GRAPHICS

[datastore.landcareresearch.co.nz/organization/nzbat-farms](http://datastore.landcareresearch.co.nz/organization/nzbat-farms)



## CONTACT US

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Manaaki Whenua  
Landcare Research

