PROCESS TO CO-DESIGN AN EVIDENCE-BASED BIODIVERSITY ASSESSMENT TOOL

Two sets of challenges need to be addressed when designing a sustainability assessment tool that can report farm performance information based on the set of management actions undertaken on the farm:

- Ability for practitioners to directly engage and improve their management practices, and therefore performance; and
- Robustly translating farm management actions into performance, with consistency across farms, locations, and sectors.

A co-design process aims to overcome these challenges by involving stakeholders and scientific experts throughout the development of an assessment tool. Using stakeholder input to draft the content of the tool can ensure relevance to practitioners, and transparency in decision-making throughout the tool's development can build trust in the tool and better understanding of its capabilities and output. Involving a panel of experts in a formal process of evaluating the effectiveness of farm management actions can minimise the risk of favouring particular management actions that are traditionally recommended or conventionally used but have limited guarantee of success, as well as clarifying how to deal with conflicting evidence for effectiveness of a management action.

The New Zealand Sustainability Dashboard (NZSD) project is developing an on-farm biodiversity assessment tool to provide a proof-of-concept for co-designing an evidence-based tool for New Zealand farmers and other stakeholders to assess their sustainability performance.

Adaptation of Overseas Tool

Our goal is to determine what is required to adapt an existing online biodiversity assessment tool (the Cool Farm Biodiversity Tool[1]) for use in New Zealand (NZ). Because the Cool Farm Biodiversity Tool was developed for farms in north-western Europe, some of its content is unlikely to be transferable to NZ and it may not reflect NZ priorities nor include special features of NZ ecology.[2] However, the process used to develop it and its predecessor, the

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[1] https://coolfarmtool.org/coolfarmtool/biodiversity/
[2] See "Developing a Simple On-Farm Biodiversity Tool" for more background on the adaptation of the Cool Farm Biodiversity Tool for NZ.

Gaia Biodiversity Yardstick, provides a valuable template for co-designing a farm biodiversity tool for NZ.[3]

The development of the tool consists of three work streams to be completed in June 2018:

1) "What goes in the tool?" – Tailoring the biodiversity groups, management actions and data-re-use strategies to meet NZ interests;
2) "How effective are management actions?" – Quantifying the expected benefits of a subset of relevant NZ farm management actions for each of the priority biodiversity groups; and
3) "Is the tool easy to use?" – Developing and testing an online prototype tool for biodiversity assessments on NZ farms.

What goes in the tool?

First, we identify the biodiversity groups, farm management areas, farm management actions and data management strategies that will be most useful and relevant to NZ farmers, managers and advisors to assist them in meeting their biodiversity planning, management and reporting needs. Determining what goes in the tool requires three steps:

- **Scoping relevant components:** The NZSD research team prepares candidate lists of biodiversity groups, management areas, management actions and data sharing strategies relevant to the NZ farming context to present to stakeholders for prioritisation. In other words, we want to know which types of species stakeholders are trying to enhance, where on the farm management efforts are prioritised, what farmers are doing to enhance biodiversity on their farms, and how farmers want their data stored and accessed for re-use.

- **Prioritising relevant management actions:** Working with a panel of biodiversity managers and advisors, we identify which biodiversity groups and management areas and actions from the candidate lists are most relevant and useful for inclusion in the NZ biodiversity assessment tool. The goal is to secure a panel consensus on how to balance the diverse range of stakeholder interests and needs, but select a subset of the possible biodiversity groups and management actions to keep the tool from being too long for farmers to complete in a reasonable amount of time.

- **Cross-checking farmer interests:** At the same time, we solicit anonymous feedback from farmers in a variety of sectors, via an online survey, about the kinds of biodiversity they are particularly interested in, where on their farm they would like to focus their efforts, and what management actions they currently implement or hope to implement in the future, as well as their opinions on sharing such information with third parties.

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[3] Dicks et al. unpublished

FOR MORE INFORMATION:
http://www.nzdashboard.org.nz/biodiversity-assessment-tool

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By considering the list of prioritised biodiversity groups and management actions in conjunction with results from the farmer survey, we can ensure that farmer needs and interests would be met by the content of the tool. This phase of the co-design process includes an important component to building trust in the tool – there is transparency in what is included vs. excluded from the tool's content, which is explicitly documented and can thus be revised in future developments or adaptations of the tool. Obtaining information from both biodiversity manager and farmer stakeholder groups on their data sharing and re-use preferences will enable us to facilitate conversations about how the tool's design can support reporting requirements while adequately protecting farmers' data, thus aiming to build trust in the tool while maximising its usefulness to both parties.

How effective are management actions?

Second, we quantify the expected biodiversity benefits for the prioritised farm management actions in the context of NZ ecology and farming systems. We engage a panel of taxon-experts to participate in a two-stage scoring process:

- **Opinion evaluation:** The expert panel assigns scores to each priority management action based on its importance in enhancing biodiversity as a whole and in enhancing biodiversity within each of the priority biodiversity groups identified by stakeholders. This assessment is based solely on the experts' opinion and expertise, but is done in multiple independent scoring rounds to achieve a consensus. Use of a panel and the consensus process reduces individual bias toward particular management actions and allows for greater weight to be given to expert opinions on the species group in which they specialise.
- **Evidence evaluation:** Synopses of the published scientific evidence available for the priority management actions are collated from the existing Cambridge Conservation Evidence Database[4] by the NZSD research team. The expert panel evaluates this evidence to assign scores, again via an iterative consensus process, to each management action based on its effectiveness in enhancing biodiversity as a whole and within each of the priority biodiversity groups.[5] This second stage of scoring allows management actions to receive a higher score when there is high-quality evidence of their effectiveness, but also allows us to identify where gaps exist in available evidence. These gaps will be noted to provide recommendations for future research.

This phase of the co-design process includes another important component of transparency that helps build trust in the tool, and in particular addresses the second challenge of developing sustainability assessment tools. The evaluation protocol for the management actions is clear and consistent, using a panel of experts to minimise biases, and the evidence used to assess management actions (or lack thereof) is explicitly documented. As

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[4] http://www.conservationevidence.com/
[5] A description of the process for evidence synthesis, including a case study of evidence for enhancing natural pest control, is in Dicks et al. 2016. *Biodiversity Conservation* 25:1383-1399.

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an additional output from the project, the collated evidence and expert assessment results are made directly available to stakeholders (e.g. in a report or a platform like the Cambridge Conservation Database), so that decision-makers can access this resource outside of the domain of a particular tool.

Is the tool easy to use?

Third, we develop an online prototype tool that translates the expert-scored effectiveness of each management action into a wildlife-friendliness aggregate score, both for overall biodiversity and for each of the priority species groups. Stakeholders are invited to evaluate the tool both for its content and for its ease-of use. An iterative tool-building and testing process will be used so revisions based on user feedback can be evaluated for their success in meeting stakeholder needs. The prototype tool development and testing process will follow these steps:

- **User-experience prototype:** The NZSD research team constructs a questionnaire using an interactive web-based platform (Shiny[6]) that contains the priority management actions and biodiversity groups identified by stakeholders. The prototype functions as an online self-assessment checklist that aggregates scores for each biodiversity group using results from the expert-opinion assessment of management actions.
- **Pilot testing with end-users:** Stakeholders, especially farmers, from a variety of sectors are invited to test the user-experience prototype and provide feedback on the tool format, content and usefulness. Of particular importance is an evaluation of the content and format of the tool's output, as well as options for the tool sovereignty, end-user support to use the tool and how the farm data generated by the tool should be saved and re-used.
- **Functional prototype:** The NZSD research team revises the prototype tool to incorporate user feedback from the pilot tests and add the biodiversity scores from the expert evaluation of scientific evidence.
- **Final testing with end-users:** Stakeholders are invited to test the functional prototype tool to provide a final round of feedback on format, content and usefulness as well as options for managing the tool's future sovereignty, end-user support and data re-use strategies. The NZSD research team documents the strengths and weaknesses of the prototype tool as well as any opportunities and challenges the end-users see it presenting in the future to inform any potential future developments.

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[6] https://shiny.rstudio.com/

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Bringing It All Together

Finally, we synthesise the lessons learnt from developing the proof-of-concept to inform the design of future evidence-based tools for wider sustainability assessments on NZ farms. In particular, we gain a template for the process of co-designing a sustainability assessment tool and a template for an online tool in the Shiny platform. Moreover, the biodiversity prototype tool can be updated as additional management priorities arise or new evidence for management action effectiveness becomes available, or tailored to meet needs of particular stakeholders who are keen to adopt it. Discussions among stakeholders during the development process will be used to determine the future developments and implementation of the tool, including where it will be hosted, how data will be stored and re-used, and possibilities for integration with other environmental reporting mechanisms.

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NEW ZEALAND SUSTAINABILITY DASHBOARD

The NZ Sustainability Dashboard is an online tool for sustainability assessment, monitoring, reporting and learning for the country's primary sectors. The NZSD aims to help stakeholders address market, regulator and business drivers for improvements in sustainability performance. The tool is being developed and tested in partnership with NZ's production sectors (including kiwifruit, wine, pastoral, forestry and aquaculture), Māori iwi and regulatory bodies. The six-year research project started in October 2012 and is jointly funded by NZ government and industry bodies. The NZ Sustainability Dashboard's environmental research stream is led by Landcare Research, a national research institute that drives innovation in the management of terrestrial biodiversity and land resources.

FOR MORE INFORMATION:
http://www.nzdashboard.org.nz/biodiversity-assessment-tool