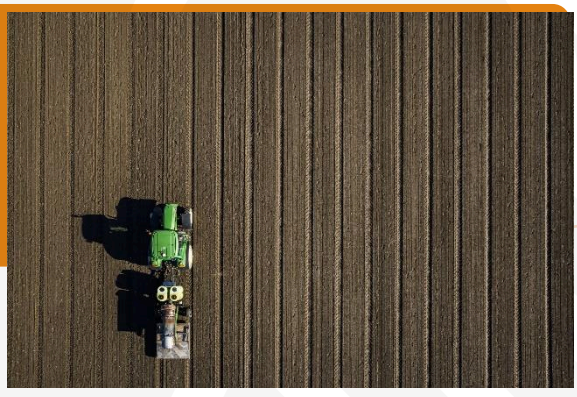
Prepared for:

Signals for land stewards

Final report

June 2023



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Contents

Summary

What are signals?

Signals are information that comes from off and on farm. Signals that aren't considered relevant are 'noise'. Signals are more likely to instigate and facilitate change if they:

- come from a trusted source
- are clear, have consistent messaging, and enable autonomy of choice
- take into account the farm context (resource constraints), and
- link to a farmer's values, goals and drivers.

Off-farm signals

Political, environmental, social, technological, legal, economic

Political

Off-farm signals coming from proposed policies or actions

- proposed policy changes (e.g. wintering rules)
- Government/political perspectives

Economic

Off-farm signals coming from the economy

- Product prices, inflation, interest rates
- Incentives (e.g., premiums, market access, subsidies for early adoption)
- Penalties (e.g., fines)
- Costs of practice change, infrastructure change
- Labour availability

Social

Off-farm signals coming from people around the farm team

- Norms (e.g., good practice norms, practices that define a good farmer)
- Peer pressure, benchmarking data
- Information on farming from others such as advisors, contractors, and friends at off-farm events
- Consumer preferences
- Perceptions/expectations from wider society
- Tikanga

Technological

Off-farm signals coming from new technologies

- Relative advantage
  - Complexity
  - Trialability
  - Compatibility
  - Observability
- Examples: irrigation, soil moisture monitoring

Environmental

Off-farm signals coming from the natural environment

- Weather forecasts
- Climate events – flooding, extreme rainfall, shifting seasons, droughts
- Monitoring data from region (e.g., council / catchment water quality measurements, water table monitoring)
- Mātauranga Māori

Legal

Off-farm signals coming from legislation

- regulatory requirements (e.g., health and safety, water management), and
- laws (e.g., employment law) from district, regional or national level.

On-farm signals

Natural, physical, human, financial, social, political and cultural capitals

Animals, plants, soil, water

On-farm signals from animals, plants, soil and water

- On-farm observations (e.g., Plant condition, soil condition such as pugging and erosion, animal behaviour, water condition, bird life)
- On-farm test result (e.g., soil tests)
- Observations of the farm state from others such as employees, advisors, contractors, and friends

Technological

On-farm signals coming from current practices

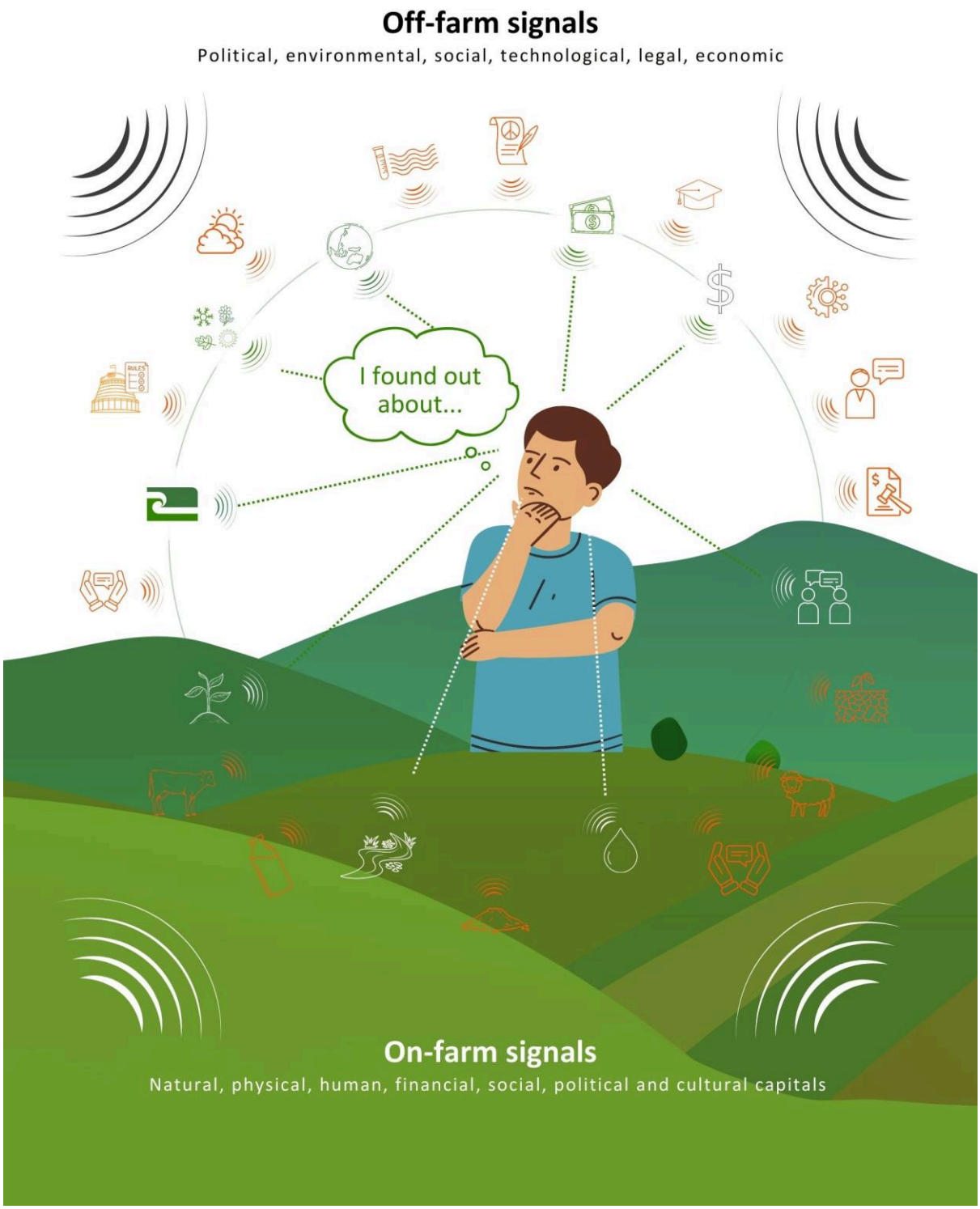
- Lifespan of existing infrastructure on-farm, fit for purpose of existing infrastructure
- On-farm technology and fit for purpose of technology related to the practice change

Farm management

On-farm signals from farm management

- Farm finances
- Operating structure and mechanism (e.g., owner operator compared to contractors etc.)
- Staff, number and skills
- Traditions
- Connections to power

Identifying signals



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Moving from signals to change

Stage 1 - signals reach farmer

Farmer is influenced by signals (off- and on-farm) based on their unique situation. Not all signals reach the farmer.

Stage 2 - signals trigger farmer's thinking

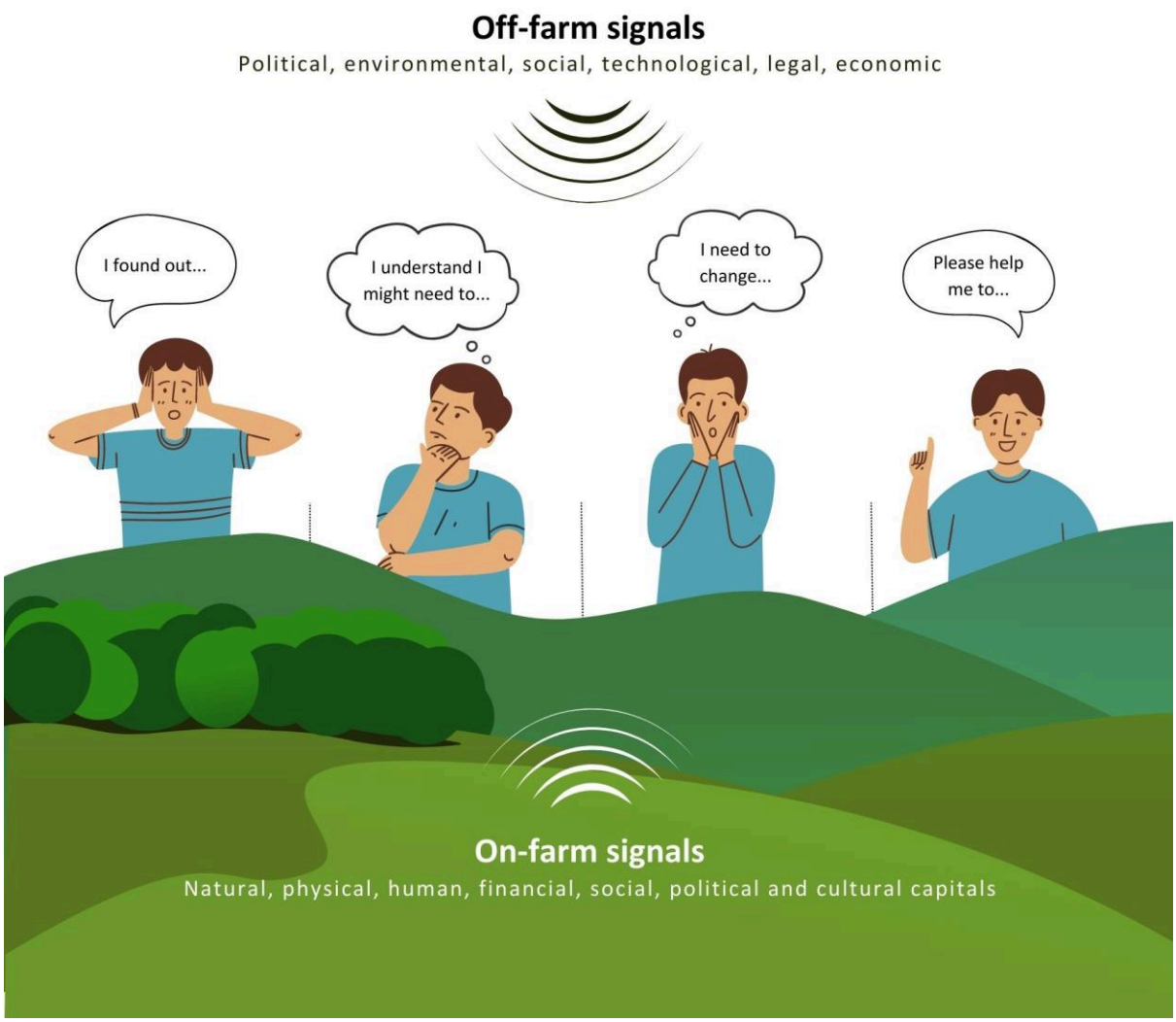
Signals that have reached the farmer trigger an understanding of the need for on-farm change.

Stage 3 - signals change farmer's mindset

Signals enable a mindset change and a commitment to on-farm change is made.

Stage 4 - signals follow-up and change support

Ongoing support is needed for farmer to change.



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Introduction

Background

The objective of Our Land and Water, set by Government, is to enhance the production and productivity of New Zealand's primary sector, while maintaining and improving the quality of the country's land and water for future generations. This is a future where there are mosaics of land uses that are more resilient, healthy and prosperous than they are today. However, to achieve this future, new ways of thinking and interacting with land and water are required. This change needs to occur quickly.

Both land stewards and their stakeholders want to drive change on-farm to achieve social, environmental, and business outcomes. As such, many people and organisations are providing land stewards with information, resources, and expertise about what and how to change on-farm. The result is a vast range of signals from government policy, markets, the natural environment, social and cultural interactions, and other sources of information, which range in levels of effectiveness.

Within this context, the Signals for Land Stewards project began, with the aim of answering the question: **What are the signals that New Zealand land stewards respond to most, when making land use decisions?**

This project

OLW Signals for Land Stewards is a project with a focus on understanding the broad range of signals land stewards receive and that could be used when designing interventions for supporting change on-farm. In this context, signals are information from the environment that either *enable or prevent* a farmer from moving along a *constructive change process* (whether they are at the beginning of that process or further along their journey). As such, signals can come from the external environment or *off-farm* (e.g., regulations, market prices, climatic conditions, opinions of community including other farmers, rural professionals such as advisors, bankers, accountants, scientists) and they can come from *on-farm* (e.g., succession, animal behaviour, plant condition, soil erosion). The term "land steward" is defined as the people making decisions about the uses of land, including farm owners, farm leasees, farm staff, contract milkers, sharemilkers, trustees (e.g., Māori Trusts), and families; from a range of farm types (e.g., pastoral, horticultural). We also refer to land stewards as farmers.

The aim of the project is to support land stewards in relation to practice change associated with improved environmental outcomes, particularly water quality. To achieve this aim, the project was designed to:

1. Identify the signals that elicit a constructive response[1] from land stewards
2. Investigate how these signals interact with one another
3. Determine which, if any signals, should be prioritised
4. Determine how these signals could best be used to prompt change in the behaviour of land stewards

The output of this work was envisaged to be a guide that would draw on a wide range of research and practical experience. The guide would provide advisors, policymakers and researchers with a structured

[1] Defined as moving towards positive change, i.e., towards the vision of OLW for resilient, healthy and prosperous land uses.

way of considering these signals and using them effectively as part of an extension programme, i.e., incorporating them in a way that would be most likely to bring about adoption (practice change).

As this project has progressed, the target audience for this guide has been further refined to focus on advisors who design and implement extension programmes, and then further to junior advisors. This was because identifying which signals will be influential is likely to be part of an experienced advisor's skill set, however for junior advisors, more guidance is required.

Project methodology

The project was split into four stages, as outlined below. The literature review, completed in July 2022, informed the initial development of the framework which outlines how to influence constructive practice change in farming. This was then refined using information gathered from land steward and advisor interviews, as well as feedback from workshops. Subsequently, the guide, a key output of the project, was created. In this report we aim to detail all four stages of the project, our findings, and the rationale for the conclusions and decisions we made for understanding signals.

A detailed overview of the methodology used for the literature review can be found on page 9, while the methodology for the interviews can be found on page 16.

Literature review on behavioural change
Complete

Framework development
Complete

Interviewing and workshopping
Complete

Guide development and dissemination
Complete

Limitations

At the beginning of this project, we envisaged that we would produce a prioritised list that highlighted which types of signals are most influential. What became clear was that the combination of individual land steward, their farming business, and wider context creates a heterogenous mix where a range of signals are needed because there is no one signal that will influence and enable change. After considering this, we deemed that the most useful output would be a framework and guide which provides a means of identifying which signals are important for a given farming business, land steward, and context (in other words, a dynamic list rather than a prioritised list).

It is also important to notice that signals are not the only factor that determines on-farm practices. Our research suggests that while signals are a key trigger for eliciting changes in mindsets, ongoing support is required to see measurable, positive practice change occur on-farm. Our research also suggests that an in-depth investigation into the characteristics[2] of signals would result in a more robust signals framework, and as such some attributes that we have encountered so far are outlined on page 26.

This report

The purpose of this report is to detail the key findings from all four stages of the project. The report is therefore organised into the following sections:

[2] Characteristics of signals are defined as traits of signals or their brokers that have an impact on the effectiveness of a signal.

- Findings from the literature review
- The development of the signals framework
- Findings from interviews/workshops
- Discussion of signals and signal attributes
- Possible future amendments to the signals framework
- Appendices (containing interview framework, data etc.)

Project findings

Literature review

Overview

A literature review of relevant research into on-farm behaviour change was undertaken. This highlighted the large body of research available on land steward (farmer) behavioural change. There are a range of frameworks available, with past and current research from academics spanning the globe.

Originally, it was assumed that literature would contain information on signals that influence change. However, the review identified that while there are some references to external factors that influence land stewards, few researchers have done this comprehensively, and none do so under the term 'signals'. As a result of this, there is also a lack of research that provide guidance on how to decide which signals can be used to influence different land steward segments to achieve particular outcomes (change), and how to incorporate these into extension interventions (design to promote on-farm change).

Methodology

Relevant literature was collected, prioritised and described between May and June 2022. Literature included both academic and grey literature, mainly from Australia and New Zealand. An initial list of research questions was developed to categorise the literature. This was used to identify gaps in the literature and refine the focus of the review. The result was a conceptual framework (see Figure 1) which clearly defines a methodical approach to investigating signals and their likelihood to influence constructive practice change in farming. The literature review encompasses both part two and part three of the conceptual framework.

The conceptual framework was envisaged to include the following:

Part 1 – Framing the problem – The advisor/researcher/policymaker first identifies the main stakeholders and their expectations and clarifies the problem and outcomes to be achieved.

Part 2 – Situation analysis – The advisor/researcher/policymaker determines the target audience, identifies which signals are relevant for, and will influence change amongst this audience.

Part 3 – Intervention design – The advisor/researcher/policymaker then uses the information from Parts 1 and 2, applies this to the decision-making process, to identify which signals will have the greatest influence and how to design the intervention.

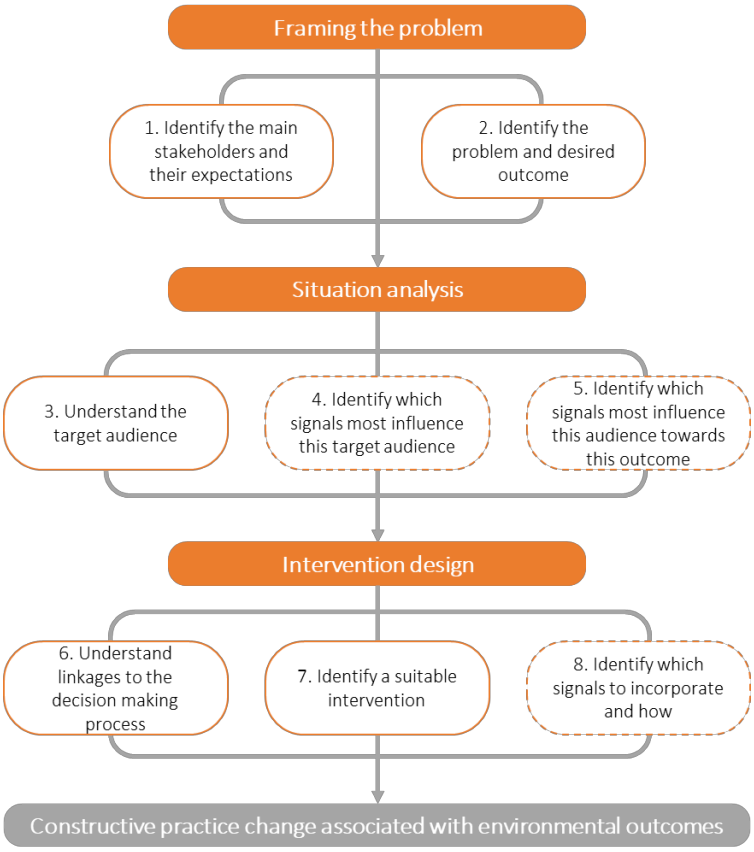

Figure 1: Framework to influence constructive practice change associated with environmental outcomes

Findings

The literature review revealed that there was little in the existing literature on signals, and how or whether these influenced practice change. Reviewing the literature in this space revealed that external factors influencing farmer decision making were:

- Referenced but not called signals. Instead, they were called factors (Rose et al., 2018), enablers and barriers (Eagle et al., 2016), principles (Vanclay, 2004) or motivations for change (Turner et al., 2017). In the business literature, signals were referred to as macroenvironmental factors (Aguilar, 1967).
- Poorly defined as signals. Some researchers had created a categorisation of the factors influencing farmer decision making. However, external factors influencing farmer decision making were often mixed with other concepts such as intrinsic drivers, best practice drivers or other labels (Rose et al., 2018).
- Scattered throughout the literature (Rose et al., 2018). We were not able to find a comprehensive or robust list of categories, or one which spoke to the prioritisation of external factors.
- Generally used to explore specific adoption issues or inform future research, rather than being able to provide practical advice to an advisor, researcher or policymaker (e.g., Eagle et al., 2016; Journeaux et al., 2016; Turner et al., 2014 & 2017).

Another key shortcoming that the literature review revealed is that much of the literature focuses on the cognitive processes and actions of individuals. Individual behaviour is seen as the problem in this

scenario. Identifying barriers to changing individual behaviour is the solution, e.g., trying to increase their interest in ecological and environmental outcomes, or change their attitude to risk (Kuehne et al. (2017). In reality, there are legitimate reasons for non-adoption (e.g., the change is too complex, not easily divisible into manageable parts, not compatible with the farming context (Kaine, 2009). Moreover, there are prevailing power structures and macroenvironmental factors that also impact on the likelihood of change (Turner et al., 2020).

One of the most relevant pieces of research found was the work undertaken in the EU focused on the micro–Agricultural Knowledge and Innovation System or microAKIS (Sutherland & Labarthe, 2022). The EU have a mandate that member states must set up and maintain a Farm Advisory System to ensure farmers have access to knowledge and services. In 2020 this mandate was extended, the assumption being that those agricultural advisory services, particularly those funded and regulated by public bodies are important contributors to innovation and sustainability in the agriculture sector. However, this represents a paradox because after years of divestment and privatisation leading to diversity, fragmentation and the emergence of complex new formations within the agricultural advisory services, EU policy still focuses on traditional service providers. This is similar to the situation in New Zealand, where the MAF advisory service was closed, and the private sector has replaced it over time.

The microAKIS is defined as "*the knowledge systems that farmers personally assemble, including the range of individuals and organisations from whom they seek services and exchange knowledge, and the processes involved in the formation and working of the system, including the way farmers translate these resources into innovative activities (or not)*" (Sutherland & Labarthe, 2022 p. 461). An illustration of the microAKIS is outlined in Figure 2.

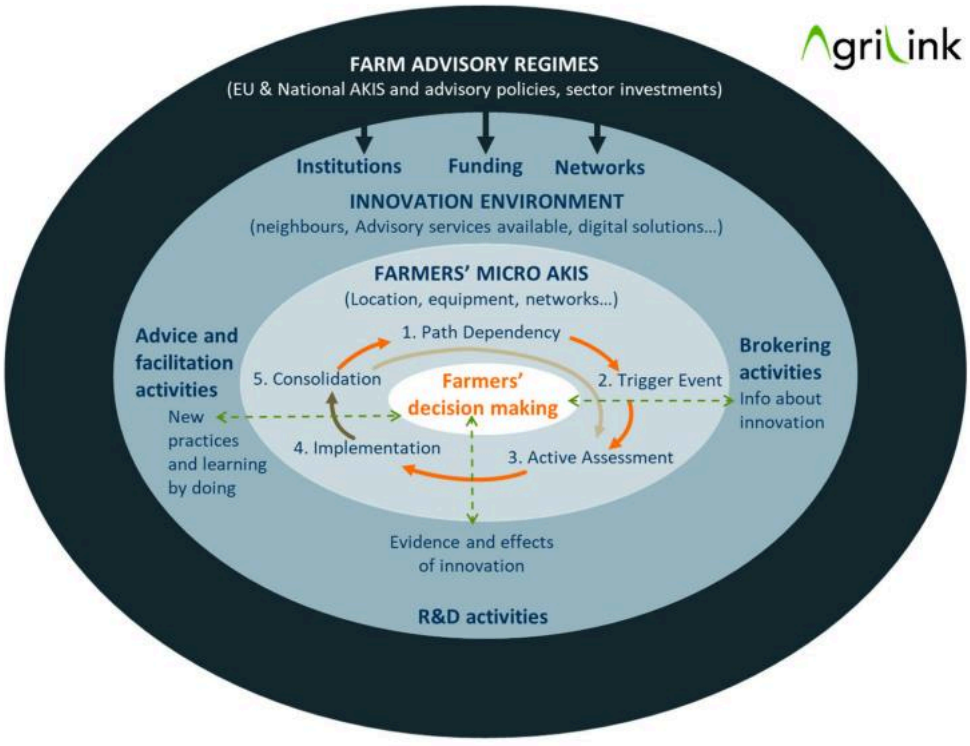

Figure 2: The microAKIS conceptual framework from Sutherland & Labarthe (2022)

At the heart of the microAKIS concept is the decision-making conceptualisation developed by Sutherland et al. (2012). This was built based on a series of research projects in the UK and Europe focused on land use decision making. The triggering change cycle (see Figure 3) was derived from

empirical data, but then grounded in existing theories beyond what was available through the research data.

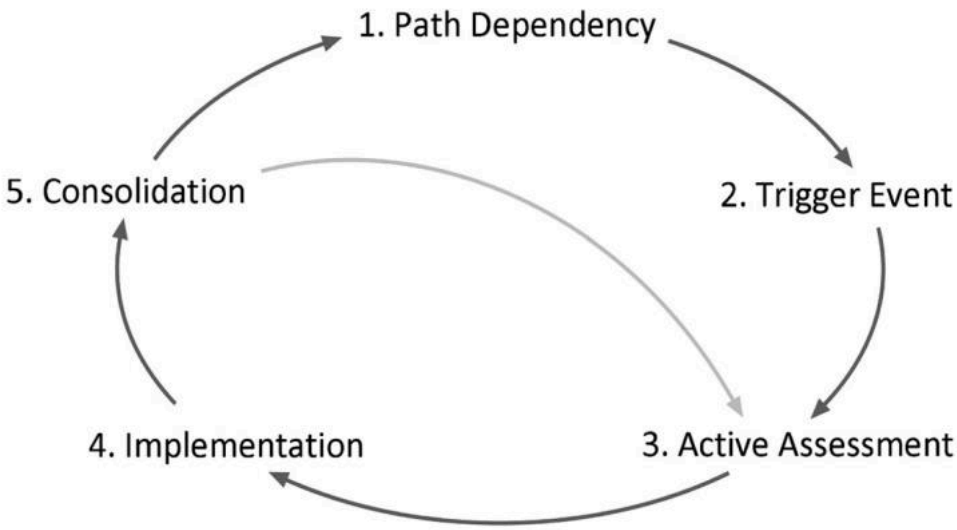

Figure 3: The triggering change cycle, conceptualised by Sutherland et al. (2012)

The concept of microAKIS and the decision-making conceptualisation reinforces our view that adoption is a multi-stage process from awareness to final adoption, or in innovation systems language, from the Trigger Event to Consolidation. The research highlights that land stewards use different advisors at different stages of the innovation process.

The trigger event is important as it initiates change. However, it may be a single event or information source, or it may be the cumulation of information over time that initiates change. Information is then used to assess options for change, plan and execute the implementation of the change and consolidate (evaluate, refine or drop the change) the change. As such, signals play a wide range of roles in the process and a range of different types of advisors may be important sources of information (or signals) throughout the process. In addition, the work outlined by Sutherland & Lararthe (2022) shows that different farmers use different networks to source information. Their research suggests there is a diversity of different networks used by farmers such as new entrants.

Most research focuses on the conventional actors in the advisory system, extension organisations and consultants, but often does not look at embedded advisors who provide advice as part of their primary service (accountants, input suppliers, bankers). This is despite research showing that privatisation has led to a diversity of advice providers, fragmentation of the advisory system and the emergence of complex new formations for advisory services.

We must also consider the innovation environment of farmers. This is the second layer (outlined in Figure 2) and incorporates the supply side (advice providers) of the microAKIS analysis from an infrastructural perspective. The outer layer of the model includes the policies and institutions that frame the supply of services and knowledge networks. This will include various funding schemes (vouchers, R&D programmes, multi-actor innovation networks etc.) and rules (certification of advisors, accreditation of organisations, compulsory training programmes). All of these formal and informal institutions define farm advisory regimes and impact on farmers' innovation environments and hence their microAKIS and decision making. Many of these could also be considered signals for enabling (or preventing) change on-farm.

Given the lack of literature on signals in the context of land steward decision making, there was limited evidence to collate and apply learnings as we developed a framework for trying to understand signals.

Framework development

Overview

To develop a framework for exploring signals, we first reconsidered the definition of signals in the context of the literature review. We then adapted several typologies from the literature to develop a draft framework for exploring signals. We then tested this framework with a series of interviews with land stewards and advisors. We were then able to identify strengths and gaps in the framework and refine it.

Signals definition

The literature review revealed that existing research exploring on-farm change alluded to what we have defined as signals. The original signals definition at the beginning of this project was "*information from the natural environment, culture and society, farm activities, industry group directives, markets and incentive schemes, regulations, prices, peers, advisors, policymakers, researchers etc*." However, based on the literature review it became clear that a more specific definition was required for what signals are, as well as helping define what they are not.

Other factors related to enabling on-farm constructive practice change, revealed in the literature review included intrinsic drivers, signal brokers and noise. A brief description of these, as well as a logical flowchart showing how to categorise different drivers was developed and is outlined below:

- Intrinsic driver: In the literature this is most commonly referred to as the characteristics of the adopter (Pannell et al., 2006; Kuehne et al., 2017). These are naturally existing and / or relatively long-term characteristics of the farm or land steward which will prevent or enable a land steward to move towards constructive change by modifying how a land steward will respond to signals. This includes their goals which can encompass economic, social and environmental outcomes (Pannell et al., 2006), age, gender, experience, attitudes, beliefs and perceptions of control (Rose et al., 2018) and the context of the farm such as location, debt levels, climate etc (Kaine 2009).

- Signal: Information from on- or off-farm that could enable or prevent a land steward from moving along a constructive change process. Information can come from the farming system or the operating environment. The operating environment is the environment in which a farm operates in and is relevant to the land steward. As such it is subjective and different land stewards will have different operating environments. Movement along a constructive change process does not depend on where they are in that journey (e.g., they could be at the beginning of that process or further along their journey).

- Signal broker: the source or channel through which the land steward hears or learns about a signal, and which can influence the likelihood that a signal enables or prevents a land steward from moving along a constructive change process.

- Noise: Information from on- or off-farm that on reaching the land steward, does not enable or prevent a land steward from moving along a constructive change process, as it is considered irrelevant or unimportant.

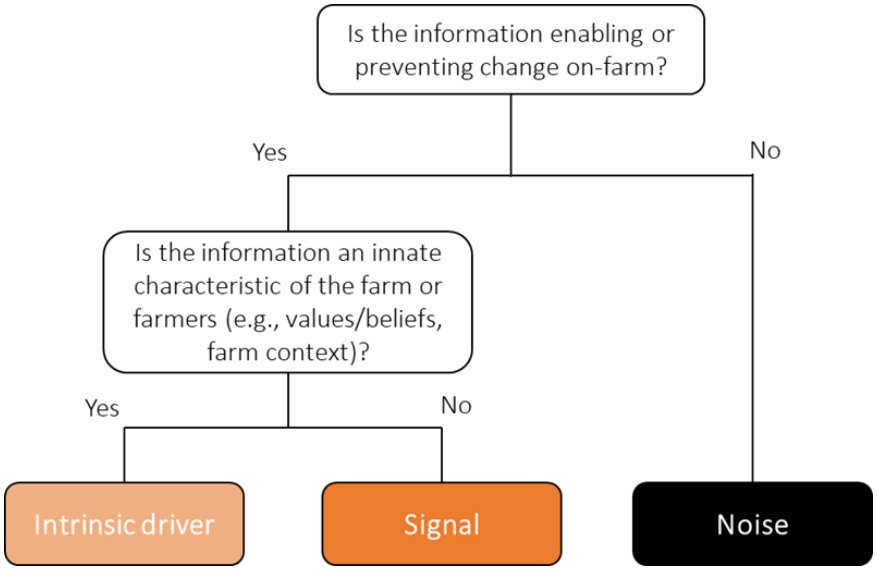

Figure 4: Flowchart to identify signals versus intrinsic drivers and noise.

Signals framework

The chosen typology for the signals themselves is based on two key existing frameworks which were identified in the literature review, namely the PESTEL and Community Capitals Framework (CCF). Initially we had planned to just use PESTEL as the basis for the signals typology. However, it became clear as we tested the framework with the interview data that we needed to investigate on-farm signals at a more granular level. PESTEL was not appropriate for this, given it was developed to consider information from the macro-environment. A brief description of the two frameworks is provided below:

- PESTEL – The macroenvironment consists of broad factors that impact on organisations. The PESTEL framework was designed to be able to identify future trends in the political, economic, social, technological, environmental and legal environments, and how these might affect organisations. In effect PESTEL is a means of identifying key drivers of change to be identified and helps organisations consider strategies that may be required to deal with these (Johnson et al., 2006; Stanford-Billington & Cannon, 2010). We have used PESTEL to develop a framework for ***off-farm*** signals.
- Community Capitals Framework (CCF) – CCF was developed in the community and economic development space as a means of identifying different assets in each capital, the types of capital invested and interactions between these. There are seven different types of capital identified: natural, cultural, human, social, political, financial, and built capitals (Emery & Flora, 2006). We have used the CCF to develop a framework for ***on-farm*** signals.

The resulting framework for this project highlights a total of thirteen types of signals, comprised of six off-farm signals and seven on-farm signals. A precise description of how these categories are intended to be applied, specific to the context of influencing constructive practice change in farming in New Zealand, is included below:

Off-farm signals:

1. Political signals are defined as information coming from proposed government policies or actions focused on environmental outcomes. These signals will include any other government signal such as spending on R&D in the environmental space.

2. **Economic** signals are defined as macro-economic factors such as exchange rates, business cycles and economic growth. These signals will include market drivers and product prices.

3. **Social** signals are defined as signals that come from people, culture and demographics, for example ageing populations in many Western societies. This includes the perceptions and views of people around the farm team, as well as society, and global and consumer trends.

4. **Technological** signals are defined as innovations such as the internet, nanotechnology or the rise of new composite materials. In the farming context, these signals would include new innovations and technologies relevant to agriculture.

5. **Environmental** signals are defined as information from the natural environment. These signals could be the state of the local catchment, district, regional, and NZ wide environmental states. These signals include global climate change, as well as 'green' issues, such as pollution and waste.

6. **Legal** signals are defined as legislative constraints or changes, such as health and safety legislation or restrictions on company mergers and acquisitions. This includes off-farm signals coming from regulatory requirements (e.g., health and safety, product safety) and laws (e.g., employment law) from district, regional or national level.

On-farm signals:

1. **Natural** capital signals are defined as information about the weather, information about the water and soils including the state of the farm waterways and wetlands in terms of water quality, and natural plant and animal life.

2. **Human** capital signals are defined as information about the quantity and quality of labour on-farm. This includes information about their skills and abilities such as leadership and management capability.

3. **Social** capital signals are defined as information about the connections among people and organisations that the land steward has, including the ties that build community cohesion.

4. **Financial** capital signals are defined as information about the financial resources available to invest in the farm, support entrepreneurship, and to accumulate wealth. We have said this includes information about the profit and debt levels on-farm.

5. **Built** or **physical** capital signals are defined as information about the improvements on the farm such as the type, quality and age of the infrastructure on farm, as well as the soil fertility, livestock, pastures and forage crops.

6. **Cultural** capital signals are defined as information about traditions and language, which influences what voices are heard.

7. **Political** capital signals are defined as information about access or connections to power or power brokers. It also refers to the information on individual ability to contribute to the wellbeing of the community.

With a framework defining and describing different signals, we were then able to explore the concept of signals and the perspectives and influence of these amongst land stewards and advisors. The framework also formed the basis of the guide to signals for advisors.

Interviews

Overview

The literature review and initial signals framework was used to help inform the design of interviews to help identify the signals that elicit a constructive response from land stewards, explore the interactions between these signals, determine which, if any, should be prioritised, and explore how these could best be used to prompt a change in the behaviour of land stewards. This resulted in a series of semi-structured interviews with land stewards and advisors, with a focus on three key extension programmes (initially called case studies). The extension programmes were:

- **Extension 350 (Northland Inc):** Extension 350 was a seven-year long extension programme that ran in Northland between 2015 – 2022. It was designed to lift the profitability, environmental sustainability, on-farm performance and wellbeing of Northland farms. The project involved a target farmer working with an advisor, and a group of other associate farmers who participated in meetings to observe the process and changes made.
- **West Coast Wintering (Westland Milk):** New rules around intensive winter grazing came into effect on 1 May 2022, as part of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F). For West Coast dairy farmers there were a range of extension initiatives put in place, including the winter grazing plan from DairyNZ and support from dairy processors (Westland Milk).
- **Shed Talks (Environment Canterbury):** Shed Talk events are held on local farms to help communities connect with their local Environment Canterbury team and show what can be done to protect mahinga kai and biodiversity in the area.

The interview stage provided a valuable opportunity to test the developed framework with relevant parties. Using both land stewards and advisors insights into practice change in farming, in the context of water quality, we were able to gauge the usefulness of a signals lens, and further refine and develop the framework, ensuring that it is relevant to the New Zealand context. Interview data also gave us stories to populate the guide.

Methodology

A set of research questions and sub-questions were developed to determine whether there were signals involved and/or trigger events, as outlined by Sutherland et al. (2012). This provided the basis for the seventeen interviews which were conducted between September 2022 and January 2023. Interviewees were identified through project team connections, and included:

- Land stewards who had worked with some of the advisors also interviewed within an extension programme. The intention of interviewing the land stewards that advisors had worked with, was to determine whether advisors were able to detect and analyse the signals that influence the land stewards they worked with.
- Advisors who had experience researching, designing and/or implementing extension programmes.

The interviews had an average duration of about one and a half hours for each advisor interview and half an hour to an hour for each land steward interview. The methodology for these interviews was approved by the Scarlatti ethics committee.

We felt that ideally, land stewards and advisors would be interviewed without biasing them with the signals framework. To do this, we followed an interview guide, for land stewards that did not mention signals. Instead, we interpreted the data gathered in the light of signals. Similarly, for advisors we asked about what they felt influenced change on-farm and the process they took to design and implement an extension programme to see if they considered signals, before mentioning signals or showing them any resources.

Land steward interviews

Interviews were conducted with nine land stewards. Each of these land stewards were associated with one of the extension programmes outlined above.

Efforts were made to include:

- Land stewards associated with extension programmes that had ended
- Land stewards associated with on-going extension programmes
- Māori land stewards

Land stewards were asked about the journey they took when considering and undertaking a change on-farm, including what influenced them. This was done without prompting for any particular influences, to see what they mentioned naturally. They were then asked specifically about influences and the relative strength of each, and finally about the support required to help them implement on-farm change.

Advisor interviews

Interviews were also conducted with seven advisors who had experience researching, designing and / or implementing extension programmes that had an environmental focus (or a water quality focus where possible). Efforts were made to include:

- Advisors with a range of experience levels
- Māori advisors
- Advisors associated with extension programmes that had ended
- Advisors associated with on-going extension programmes.

Interviews with the advisors typically began with a high-level discussion of the advisor's approach to designing and implementing extension. This was done without prompting to see which steps were mentioned naturally, and what on- and off-farm information was assessed. Advisors were then asked what external influences they thought had influenced the land stewards they worked with within a particular extension programme (if relevant) before the interviewer explained the term signals and showed the advisor the signals resources. The advisors filled these in when they had a relevant extension programme in mind. Finally, they were asked for feedback on the value of assessing signals and on the resources.

The advisors interviewed included:

- An experienced agri-science communicator
- An extension project leader

- An environmental advisor focused on irrigation schemes
- An advisor associated with a catchment group
- A CRI researcher whose speciality is understanding adoption of innovations in agriculture
- Those associated with the extension programmes listed in Table 1.

An outline of the interviews providing more details can be found in the appendix from page 33.

Interview findings

Identifying signals

The signals that land stewards respond to most varies depending on the context for the land use decision. We found that it was possible to identify and understand the different signals that were influencing on-farm decisions and determine whether these were enabling or preventing change. Signals appear to firstly enable mindset change and then on-farm action. This process is complex as there are perceived and real barriers to change. On-farm change is reliant on dismantling these barriers. The process of dismantling these barriers differs depending on the individual.

We were able to develop a framework designed to identify critical signals influencing land stewards. The framework has been adapted from the literature and confirmed using the data we collected interviewing land stewards and advisors about on-farm decisions. The framework highlights two types of signals, off-farm signals from the farm operating environment and on-farm signals from the farming system. These are further divided into different categories.

We explored these signals and interaction between land stewards, advisors and signals where the advisor was running an extension programme to bring about change in relation to water quality. Our research indicates that there are series of signals that influence on-farm change.

On-farm change is a multi-stage process from awareness to final adoption. Our research indicates that on-farm signals, combined with an off-farm signal such as a legal or political signal, tend to elicit the greatest and most constructive response. However, these signals are simply a trigger for starting a journey to change, and support is required for change to occur on-farm.

A key finding of the interviews is that signal effectiveness is also important to consider. We found that:

- Combinations of signals tend to be more effective
- Trusted brokers of information play an important role in enabling land stewards' response to signals
- A signal is more likely to influence practice change if it links to a land steward's intrinsic drivers
- Support is required for signals to be effective.

Off-farm signals

For off-farm signals, the interview stage providing encouraging data, as we were able to use the framework to identify a range of off-farm signals that were enabling change on-farm. For example, Farmer M, a farmer in Northland, part of the E350 extension project:

> *Farmer M has a developing dairy enterprise and a developing beef enterprise. He was involved in the E350 extension programme as a target farmer. He first began thinking about fencing waterways when Fonterra started talking about fencing waterways becoming a condition of supply* [economic signal]. *For M, because the dairy enterprise provides the highest return on investment of the two farm enterprises, this business takes priority in terms of money and time. So, he felt he needed to be compliant to be able to keep supplying milk* [economic signal].

Similarly, Farmer D:

> *D runs a large dairy farm on the West Coast. There are winter crops grown on the farm in a rotation including swedes, kale, turnips and rape. There is no supplementary feed used in the current farm system. Typically, a small number of cows were wintered on the farm with the remainder going to graziers. Recently, the grazier D uses has changed and following some investigations into other options and discovering the higher price for grazing* [economic signal] *he is now having to consider becoming fully self-contained. Alongside this change, D has had to consider how to manage his winter grazing because of the intensive winter grazing regulations* [legal signal]. *The previous system of utilising a stoney stand-off block adjacent to a waterway is no longer allowed under the new regulations.*

The following table (Table 1) provides an overview of off-farm signals identified by land stewards and advisors as enabling change on-farm. Advisors tended to emphasise social signals as most often enabling change on-farm, whereas land stewards perceived on-farm signals, combined with an off-farm signal prompted action on-farm.

Table 1: Overview of identified off-farm signals using the signals framework

Signals framework	Farmer interview data	Advisor interview data
Political signals are defined as information coming from proposed government policies or actions focused on environmental outcomes. These signals will include any other government signal such as spending on R&D in the environmental space.	• Possible regulatory changes/new rules	• Upcoming rules • Political leaning of government
Economic signals are defined as macro-economic factors such as exchange rates, business cycles and economic growth. These signals will include market drivers and product prices.	• Requirements to supply (e.g., Fonterra requiring stream fencing to supply milk) • Funding (e.g., for planting) • Product prices • Costs such as transport, new practices/technologies	• Funding • Cost of inputs (e.g., water price for irrigation) • Product prices • Inflation • Interest rates • Incentives

Social signals are defined as signals that come from people, culture and demographics, for example ageing populations in many Western societies. This includes perceptions and views of people around the farm team, as well as society, and global and consumer trends.	• Trusted sources of information (e.g., via an extension programme, peers or advisor) • Consumer preferences	• Influence of others, peer pressure • Trusted sources of information • Benchmarking data • Support from trusted sources • Social norms • Consumer preferences
Technological signals are defined as innovations such as the internet, nanotechnology or the rise of new composite materials. In the farming context these signals would include new innovations and technologies relevant to agriculture.	• Alternatives to current management (e.g., herd home or composting barn)	• Science based information
Environmental signals are defined as information from the natural environment. These signals could be the state of the local catchment, district, regional, and NZ wide environmental states. Thes signals include global climate change, as well as 'green' issues, such as pollution and waste.	• Water quality monitoring data from water bodies near farmers (e.g., lake, stream)	• Weather forecasting • Monitoring data • Climate change
Legal signals are defined as legislative constraints or changes, such as health and safety legislation or restrictions on company mergers and acquisitions. This includes off-farm signals coming from regulatory requirements (e.g., health and safety, product safety) and laws (e.g., employment law) from district, regional or national level.	• New regulations/rules from Regional Council	• Current rules

On-farm signals and intrinsic drivers

Exploring and identifying on-farm signals has been less straightforward. Although the framework developed helped us identify specific on-farm signals, there were instances where there was a mix of on-farm signals and other influences. It became clear that using the capitals framework meant we were combining some elements of intrinsic drivers, something we had separated from signals. Consider Farmers P and A from Northland and Farmer D from the West Coast:

P and A are brothers who were target farmers in the E350 project. Their operation runs 210 breeding cows and winters up to 600 cattle in Northland. They employ a farm manager. Both brothers work off-farm. P and A indicated that previously that they had taken a long time to implement any changes on-farm. This was because they felt they needed to make sure they had all the information and ensure everyone was happy (both brothers and their farm manager) before committing to a change [intrinsic driver / human capital signal]. *They felt the farm wasn't big enough or profitable enough for them to work full-time on-farm* [financial & human capital signal].

*Farmer D is on the West Coast. D has trialled a number of crops in order to diversify their farm system however due to their 4.5 meters annual rainfall and the prevailing wind [*location/climate context – intrinsic driver*] many crops failed [*physical capital signal*]. When considering other wintering options such as herd homes or composting barns* [technological signal] *it become quite apparent that due to the need for supplementary feed these options are not feasible for D as the cost of bringing in supplementary silage is considerable* [economic signal]*, and it is quite difficult to access expertise because of where they are located* [intrinsic driver].

The distinction between intrinsic driver and signal is not always clear. Some of the interview data revealed shortcomings of our signals framework and definitions. It is also worth noting that a given factor may be a signal in one context but an intrinsic driver in another. For example, we have considered a land steward's debt levels to be an on-farm financial capital signal, although this could also be considered a characteristic of the adopter and thus, an intrinsic driver. Another signal where the boundaries were blurred was thinking about social and cultural capital signals. For example, Farmer W in Canterbury:

W is a Canterbury based farmer, who recently moved from another region. They participated in Environment Canterbury's Mahinga Kai Extension Programme. As they were settling into farming in a new region [intrinsic driver] *they wanted to gain a Canterbury perspective and hear how other farmers do things here* [social signal]. *They felt it was rewarding to hear from other farmers and learn about a new region. Understanding the region and how things are different to what they had known before isn't really required by anyone, but W decided they wanted to do that for themselves, not because they had to* [intrinsic driver]. *W is also a community leader and wants to be able to do "the right thing", leading by example* [social + cultural capital signal and intrinsic drivers].

Ideally the framework for signals would clearly identify each signal type. While there could be multiple signals being received by a land steward, these are more easily identifiable when considering off-farm signals than some on-farm signals. Further research will be required to help determine whether all the currently defined on-farm signals are relevant and useful for the signals framework.

The following table (

Table 2Table 1) provides an overview of on-farm signals identified by land stewards and advisors as enabling change on-farm. The limited number of dimensions referenced by advisors stands out. Land stewards tended to outline their thinking in more complex ways, with built or physical capital signals most often mentioned as enabling change on-farm. In contrast, advisors needed prompting to consider on-farm signals.

Table 2: Overview of identified on-farm signals using the signals framework

Signals framework	Farmer interview data	Advisor interview data
Natural capital signals are defined as the weather, information from water and soils including the state of the farm waterways and wetlands in terms of water quality, plant and animal life.	• Life in the water (e.g., the bugs in the waterway) • State of soils	• None identified
Human capital signals are defined as the quantity and quality of labour on-farm. This includes their skills and abilities as leadership. This category has some overlap with intrinsic drivers and so is not as clearly defined as some of the other signals.	• Farm team • On-farm labour	• None identified
Social capital signals are defined as the connections among people and organisations that the land steward has, including the ties that build community cohesion.	• Skills and experience of farm team/labour • Staff wellbeing • Relationships within farm team	• None identified
Financial capital signals are defined as the financial resources available to invest in the farm, support entrepreneurship, and to accumulate wealth. We have said this includes the profit and debt levels on-farm.	• Debt levels/available cash • Costs • Productivity/profitability	• Farm management
Built or **physical** capital signals are defined as the type and age of the infrastructure on farm, as well as the livestock and pastures.	• State of feed (e.g., pasture, crops, bought in feed) • Current infrastructure • Production levels • Stock health • Stock shelter	• Technology/practices on farm related to the practice change • Farm management • On-farm observations
Cultural capital signals are defined as traditions and language and influences what voices are heard.	• Leading by example	• None identified
Political capital signals are defined as access or connections to power or power brokers. It also refers to	• None identified	• None identified

the ability of people to being able to contribute to the wellbeing of their community.		

Discussion of signals and signal attributes

A bicultural perspective on signals

One of the extension programmes used as a focus was the Environment Canterbury (ECan) Shed Talks which highlight mahinga kai and biodiversity in the region. This programme includes kōrero from both Māori and non-Māori advisors from ECan and industry.

Mahinga kai is the traditional value of all natural resources and their ecosystems, as well as the tikanga practices involved in producing, gathering, and protecting them. These mahinga kai Shed Talks include an introduction to Ngai Tāhu history in Canterbury and provide some context for working as one into the future. The extension is focused on facilitating change via projects in rivers, across different catchments and supporting restoration work, replanting of wetlands and actions to enhance the wairua (which includes spirit) and mauri (which includes life essence) of te taiao/the environment.

Based on the interview data we believe there were some differences in perspectives on signals and the signals amplified when comparing non-Māori advisors with Māori advisors. These differences were:

- From a Māori perspective, signals need to link to values. This was a much more holistic perspective. Rather than being focused on how effective signals were (e.g., through monitoring how many farmers attended talks, how many made changes) there was a focus on linking the need for on-farm change to the big picture 'why' and attaching that to their values. This means that it was very much about the person receiving the signal and appealing to the person receiving the signal rather than just focusing on the signal (e.g., a legal signal indicating regulatory changes). This respects people's autonomy and self-efficacy.

  Through his shed talks M [advisor] teaches mātaranga Māori or te ao Māori which acknowledges the interconnectedness and interrelationship of all living and non-living things. Alongside describing Ki uta ki Tai or from mountains to sea he creates a spatial understanding of sustainable resource management across the catchment. From this big picture view people are then able see how they 'fit' into this interlinked world and begin to appreciate that they can make small changes that can have a big impact. "If I can connect things back to something they (the audience) value, such as that tranquil place on your farm you love to stop at, then people begin to change their thinking."

  G [advisor] shares some of his perspectives when working with Māori farmers. He acknowledges them as tangata whenua. He takes time to make connections. This means having an initial visit (and understand a farmer's intrinsic drivers/goals) before addressing any issues in subsequent visits. Cultural awareness means understanding the need for connection is critical and being humble Is important.

- A recognition that external signals are not solely able to enable change. Change needs to come from within. Designing an extension programme with this perspective was unique as it involves discussion of what existed on the land in the past, what the land is like now, and where people want their land and people to be in the future. Small changes on-farm can have a positive impact to the overall mana of the catchment and that this impact can have direct and in-direct benefits to the individual themselves, their family, farm team as well as the wider community.

For M, being a cultural land management advisor is making people aware that if they just change certain things or how they utilise the land, the river, the water, that can have a beneficial knock-on effect for not only water quality and mahinga kai, but also for different recreational and community groups."

For G, he does not mention the Crown, government or rules when talking about water quality, but instead links actions to improving the mauri of the water. This links into the idea that doing the right thing helps improve the wellbeing of everyone in the community.

- Use of storytelling. A Māori perspective acknowledges we are all part of the story. We all have an impact on the environment.

  M's approach to delivering this knowledge very much comes from his upbringing and his way of life and katiakitanga, using storytelling to journey back to what was here in the past, what is here today, and what it could be in the future.

  G likens going to a farm as bringing them a present. The present is the same, but the wrapping paper and ribbon might change depending on the farmer. It gets customised to suit the receiver. E.g., if he knows they're all about the data, he takes the data. Others might want to hear about what customers want and so that's what he'll talk about. But it all comes back to protecting and enhancing water quality.

Signal effectiveness

- **Our research indicates that combinations of signals tend to be more effective.** For example, an on-farm signal, combined with an off-farm signal such as a legal or political signal, tend to elicit the greatest and most constructive response. This is illustrated by Farmers P and A.

  Their water system was 40 years old [physical capital] *and had been put in by their father. They also found out when they did the sustainability improvement plan that the Regional Council had funding to help them fund some of the actions required* [economic signal]. *It meant they didn't have to fund it all from their own pocket* [economic signal].

  We believe that this is useful for advisors to understand as highlighting and emphasising a combination of signals would help prompt practice change.

- **Trusted brokers of information play an important role in enabling land stewards' response to signals.** Trusted brokers can translate and amplify signals, which can help to overcome a primary barrier in a change journey. Often brokers are advisors but could also be other information sources. Brokers can provide the on-going support required for change on-farm. Extension programmes can be a source of trusted brokers, as extension activities are often where experts and peers with experience are identified. For example, Farmer M:

  M found that being able to get expert help made a difference (e.g., for the reticulated water supply, they used a contractor to do research on the technical specs – tank capacity, pump capacity, and set up). They also believe that seeing other farms in the project and what they were doing to get farm team involved in change on-farm was really helpful. They believe that hearing from other farmers makes change an easier sell.

  Advisor If farmers don't trust the advisor or the advice, then no action will happen, or not enough will happen"

- A signal is more likely to influence practice change if it links to a land steward's intrinsic drivers. While this is an obvious finding, it is an important one. If a signal aligns with a land steward's values and goals, it is therefore relevant to them and more likely to influence change (see further details in the next section). For example, Farmer R who was receptive to signals that helped him leave the farm in a better state:

  R is a farm manager in Canterbury who participated in Environment Canterbury's Shed Talks. He likes to always leave a farm in a better state than when you got there. This is because he's usually thinking about future opportunities (and his next job).

- Support is required for signals to be effective. We cannot rely solely on signals for on-farm change to occur. The literature and our data show that change is a process, and that support is needed throughout. Farmers P and M on the West Coast highlighted the need for this:

  P suggested that farmers need to look at how others are doing things and get advice from them in order to make sure you get it 'right for your system'. This was what they saw as a support network. Also, having economic information on the cost-benefit of different systems, which would include operational costs like trucking in feed as it is critical to know that the system would cover its costs.

  M contacted farmers around the country who he had heard were running similar systems, and arranged to visit them in their part of the country to see how they were doing things, and to hear from them about what the benefits and challenges were

Attributes of signals

For signals to be effective in enabling on-farm change, they need to be clear, certain and relevant. To enable change, a land steward should receive relevant and consistent signals, and the source of the signal must be trusted as this helps overcome a primary barrier to signal effectiveness. The primary barrier is that a signal needs to be clearly communicated to the recipient in such a way that they are motivated to change behaviour. While not a focus for this project, we think a more in-depth investigation into these attributes would result in a more robust framework for signals.

Trusted brokers of information play an important role in enabling land stewards' response to signals. Trusted brokers can translate and amplify signals. Brokers can provide the on-going support required for change on-farm.

Our research indicates that the consideration of signals in the change process varies amongst advisors and extension programmes, highlighting that understanding extension and behaviour change is not highly valued. This leads to a lack of training of advisors that move into these roles.

The attributes identified contextualise a signal and can have as much influence on the way in which that signal is received as the signal itself. Each attribute can influence the likelihood that a signal enables or prevents a land steward from moving along a constructive change process. The key attributes we have discovered so far are:

- Relevance: The signal needs to be considered relevant to the farm, land steward and wider context. It also needs to be compatible with or complement the intrinsic drivers of the land steward receiving the signals. When signals are clearly communicated in this way, they are far more likely to positively influence the recipients thinking, leading to constructive practice change. For example, Farmer P on the West Coast:

P was looking for a way to increase the production on the farm (to pay off any investment), without having to necessarily intensify – a part of this was about wanting to maintain a certain lifestyle such as adequate time with family.

- **Certainty:** The signal needs to be unambiguous. A proposed change in regulations is an ambiguous signal and as such, does not enable change. Interview data revealed that this type of signal often prevented change on-farm. For example, Farmer R in Canterbury and K and I on the West Coast:

  R feels that a strong positive regulatory signal drove him to take action [legal signal]. *However, now there are uncertainties about future regulations* [political signal] *e.g., HWEN, has slowed down his decision making. R feels that uncertainty about sequestration* [political signal] *prevents him from making decisions about planting riparian margins and increase native planting on-farm. This is because it has an impact on investment – if you don't know how big the planting needs to be (wide enough or m^2) then this hampers investment in trees. Also, the time to do it all can feel too much* [human capital signal].

  Up until the wintering regulations were clear, K and I felt there had been too much uncertainty about regulatory changes [legal signal]. *This had pushed out the timeframes for making a change on-farm. Their investment decision had been delayed because of this uncertainty.*

- **Consistency:** For a signal to be effective, the signal should be consistent with other signals from other sources. Consider Farmer M who was confused by signals from an unexpected source:

  M wasn't sold on the need for fencing of waterways but felt he didn't have a choice. This meant he felt negative about it at first. He felt that this was the Regional Council's job rather than Fonterra's. He felt that Fonterra had signalled urgency on the need for fencing streams, but the Regional Council had not. There was misalignment.

- **Delivery**: The delivery of a signal was also considered important. Signal brokers can be advisors or other land stewards. The advisors interviewed highlighted that land stewards generally only listened to trusted sources. Advisors indicated that successfully engaging with the farming community typically means being active members of that community. Advisors also highlighted the need for starting where land stewards are, for example advisors E and A said:

  Extension is iterative. You tailor the approach to address this [where people are at] so you can get people on the journey.

  A believes the key to successful extension is making it a two-way communication process. "Genuinely asking how you can help, and not just telling people."

Using signals in extension design and implementation

Advisors use of signals

Advisors acknowledged that understanding signals was important, with five of the six advisors interviewed indicating that signals were very or extremely important. When asked initially about their extension programme design and implementation process (i.e., with no prompts regarding signals), most (four of six) advisors mentioned at least one signal as something they considered in this process.

However, it appears that although most advisors do consider signals, they tend to focus on one or two critical signals (almost all only mentioned one to two signals). The full range of signals was not explored, in contrast to farmers themselves who mentioned more.

It is possible that advisors are not able to accurately gauge the range of signals a farmer responds to. In other words, while advisors can take a guess at signals influencing the farmers they worked with, they cannot understand the true complexity of factors influencing them. However, more data is needed to understand this better, and this is an area for further enquiry.

Advisors tend to learn about/train others about extension in an informal way (typically through experience, on-the-job training, shadowing, etc) and are unlikely to regularly break down their processes in a structured or comprehensive manner. As such, it may be that advisors do consider many signals, but they do so instinctively, and therefore do not mention everything they consider within an interview. This suggests that some form of guide to support advisors to learn about, train others and work with signals could be helpful.

Opportunity for further work

Considering the way in which advisors work, learn and train others, less experienced advisors could benefit from signals resources. Firstly, because understanding signals is useful, and secondly because resources that support structured learning may help make advisor training more effective.

We believe this is worth exploring further, as increasing the rate at which advisors become more experienced would help make less experienced advisors more valuable to land stewards and the businesses they work for (in terms of billable hours). This has been identified within other research as one barrier to taking on new advisors (MPI, 2021).

However, it is not clear whether experienced advisors interviewed consider signals more frequently, or more actively than their less experienced counterparts. Amongst those interviewed, some less experienced advisors felt they did already consider the influence of signals. It is possible that they overestimated their consideration of signals as one does not know what they do not know. This is an area for further research.

When asked whether less experienced advisors thought about signals during design and implementation of extension, most advisor interviewees felt that they did not, suggesting an opportunity to train advisors more in this space.

Use of signals resources

None of the interviewees were aware of any resources that could help advisors consider the signals influencing farmers when designing or implementing extension programmes.

Advisors commented that such a signals resource should consider:

- The farm and land steward (i.e., intrinsic drivers) first, and then practice/technology (i.e., what is currently used, compared to what could be used. This means assessing relative advantage, availability, complexity, compatibility, trialability and observability. There are tools available for this.
- The relationship between source, signal, land steward and technology/practice.
    - These layers interact with one another to determine how a farmer will respond to a signal. For example, a trusted advisor who takes the land steward and

technology/practice into account and tailors their advice and message for this person, can help communicate signals in a constructive way. A resource should show this interaction and encourage tailoring.

- Which signals are relevant now and which ones will be in future (thereby using the resources both proactively and reactively).

Advisors noted that any resources designed for extension experts should be:

- Flexible
  - Each advisor will use the guidelines in different ways, for example, they may use it at a different point in their design and implementation process, or with a different level of detail.
- Used iteratively
  - There is no distinct design and implementation phase for advisors, with the process instead being circular and continuous. As such, any resource must enable and encourage iteration.
- Used as an addition to on-the-job training
  - On-the-ground experience appears to be the primary way of working, learning and training others in the advisory system. A resource could never replace this and needs to be designed to work as part of this process.
- Kept simple
  - Some advisors found the resources very overwhelming at first glance. Simplifying the resource so that the need to understand signals is balanced with the extra time required to consider these.

However, caution needs to be taken in creating a signals resource. While the signals lens is useful, this does not ensure that a resource would be. While the literature review revealed that there is little information on how advisors can leverage/mitigate signals, there is extensive – and in fact sometimes overwhelming – findings on how to design and implement effective interventions and these do not appear to be widely used by advisors.

There are a range of possible reasons for this which have not been directly explored in this project. These may include that:

- There is a plethora of information on design and implementation – which either does not provide a starting point for advisors (through prioritisation), or is not delivered in a suitable way for them.
- Advisors tend to use on-the-job learning, mentoring and / or shadowing rather than having a structured training path.

Remaining questions to consider then include:

- Can signals resources be designed in a way that aligns with how advisors work, learn and train, so as to safeguard the value that the signals lens adds, from the additional burden the resources create?

- At what point in their work could an advisor access such a resource? (e.g., perhaps moments that are unproductive / unbillable, such as during driving, 10 minutes waiting for farmer to arrive to house, during debrief time).
- What format could signal resources take that would best align with the way advisors work, learn and train? (Print, website, a gamified phone app, AI?).
- Could this make junior advisors 'billable' sooner?

Beyond this project, there appears to be opportunity to not necessarily better understand farmer decision making, but also to better understand the advisors themselves. Current research in this space tends to be focused on rural advisor in the developing world or based around extension agent competency and training in the USA. A limited amount of research has been done in Australia and New Zealand. One example of this is Gray et al. (2016) who explored how novice farm management consultants in dairying best gain the expertise of experienced consultants and how learning from expert farm management consultants in dairying could assist less experienced consultants.

Possible future amendments to the framework

It is important to note that these suggestions are built on qualitative, exploratory data, collected from various sources including project team expertise, literature and interviews. As such, future research could consolidate this framework further, by:

- Refining the list of signals, particular to determine how on-farm signals differ from intrinsic drivers, or determining under what circumstances the distinction is important.
- Conducting research that refines the critical attributes of signals.
- Determining whether an exercise to quantify the importance of different signals for different farms, land stewards and wider contexts would provide useful information.
- Exploring the possibility of formally documenting the way in which signals are used by experienced advisors with a dynamic tool, e.g., through an app.

The vision for the app/dynamic tool is that decision makers could input things like the type of signal, the perceived clarity of the message, the amount of trust in the information broker, and the relevance to the farm, and be presented with relevant suggestions as an output. This way land stewards would have a readily available, easily digestible way to access expert wisdom around signals.

One intended audience for the guide to signals is junior advisors, as senior advisors are likely already capable of confidently identifying influential signals. This raises other questions, beyond the scope of this project, around whether such tools (dynamic tools that aim to capture the wisdom gained by advisors through years of experience) could support an aging advisory sector at risk of knowledge loss, where change is constant.

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Appendix

Interviewee details

Seventeen interviews were undertaken with a range of farmers and advisors. A summary of these is provided in Table 3.

Table 3: Overview of interviewees for the Signals for Land Stewards project

Interviewee	Farmer/advisor	Location
M	Farmer	Northland
P and A	Farmers	Northland
D	Farmer	West Coast
K and I	Farmers	West Coast
M	Farmer	West Coast
P	Farmer	West Coast
S	Farmer	West Coast
T	Farmer	West Coast
W	Farmer	Canterbury
R	Farmer	Canterbury
G	Advisor	Northland
L	Advisor	Northland
Ea	Advisor	Canterbury
A	Advisor	Canterbury
Eb	Advisor	Canterbury
M	Advisor	Canterbury
O	Researcher	Wellington

Case studies

Three case studies were developed based on the data from Farmers M, K and I and W.

Case study 1 - Northland farmer

A target farmer in the E350 extension programme.

Stage 1 - signals reach farmer

- Farmer's milk supplier starts talking about fencing waterways becoming a condition of supply.
- Farmer learns about mauri (life) in the water from the Regional Council rep at an E350 group day.
- Farmer completes a Farm Environment Plan (FEP) with someone trusted from the milk supply company which personalises priorities for environmental action on farm.

Stage 2 - signals trigger farmer's thinking

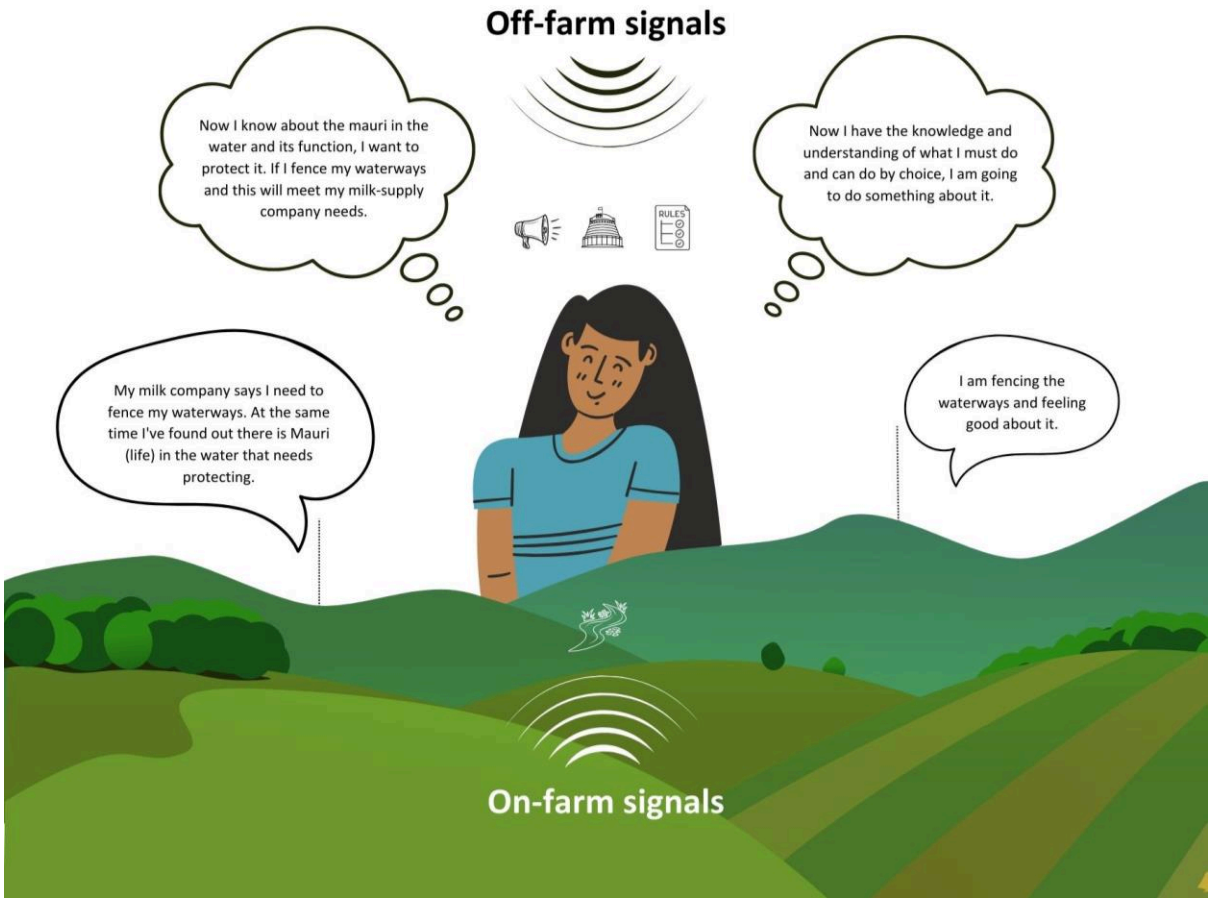
- Farmer is annoyed that they must fence waterways because it seems to be just a condition of supply, and the farmer is time poor and has a tight budget. However, the farmer likes to be compliant do the right thing.
- After being told about the life in the water, the farmer begins to observe it on farm and this resonates with the farmer's values.

Stage 3 - signals change farmer's mindset

- Farmer decides to prioritise fencing the waterways to be compliant and finds out about subsidies along the way.
- The trusted person who completed the FEP explains the why which changes the farmers mindset to committing to fencing waterways.

Stage 4 - signals follow-up and change support

- With the support of the Regional Council, farmer mentors (through E350) and the trusted farm supply rep, the farmer fences the waterways.



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Case study 2 - Canterbury farmer

A farmer who moved to Canterbury and participated in Environment Canterbury's Shed Talks Extension Programme.

Stage 1 - signals reach farmer

- Moving to a new area the farmer wanted to gain a Canterbury perspective and hear how other farmers do things
- Farmer attended a Shed Talk where it was rewarding to hear from other farmers and learn about the region.

Stage 2 - signals trigger farmer's thinking

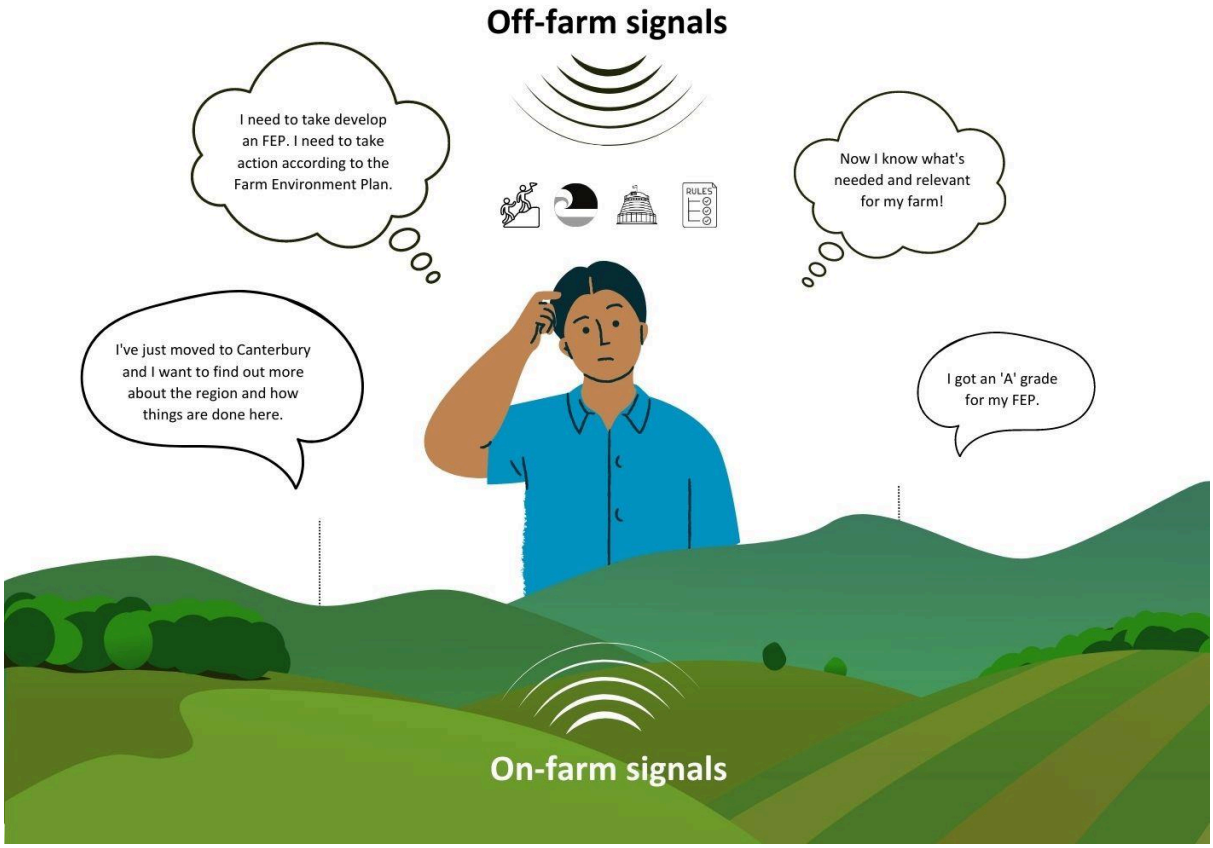
- The Shed Talk event further triggered this farmer's values which, as a community leader, include to lead by doing and to do "the right thing" in the context they are in.
- A Farm Environment Plan (FEP) was developed with some recommended actions
- The Shed Talk talks helped the farmer understand the why.

Stage 3 - signals change farmer's mindset

- The farmer accessed catchment-specific information that demonstrated how others do things in the region which meant they were able to develop their FEP to a high standard.

Stage 4 - signals follow-up and change support

- The farmer achieved an A Grade FEP and gold elite status.



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Case study 3 - West Coast farmers

A couple adapting to the new wintering regulations on the West Coast.

Stage 1 - signals reach farmer

- Heard from their community about spikes in measurements from the Lake that demonstrated water quality was deteriorating
- Became aware that their effluent storage on-farm wasn't sufficient for the new wintering regulations

Stage 2 - signals trigger farmer's thinking

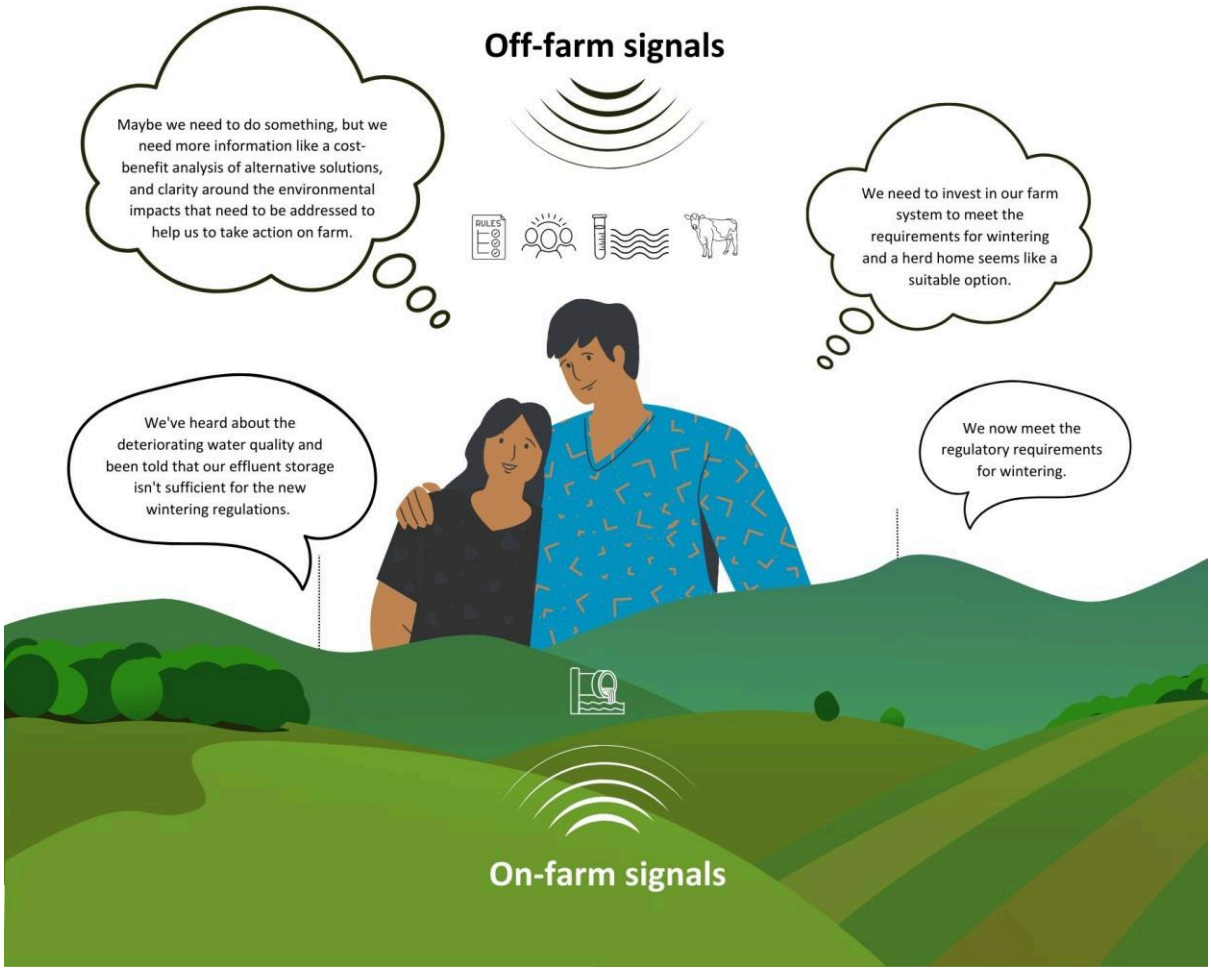
- Hearing that the water quality was deteriorating prompted some thinking about what changes might be needed on-farm(stand-off pad and an uncovered effluent pond)
- They considered that if they were to make changes they would need to invest - they were debt free at the time

Stage 3 - signals change farmer's mindset

- They decided to invest in a herd home which could shelter their cows and allow them to put in a new effluent system at the same time. The new effluent system was underneath the herd home which had the additional benefit of being covered.

Stage 4 - signals follow-up and change support

- Working together with experts, a herd home is built on farm and wintering requirements met.



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