OUR LAND AND WATER | Toitū te Whenua, Toiora te Wai

National SCIENCE Challenges

Guide

Understanding signals

March 2023

Overview

How to use this guide

This guide is intended to help advisors to use the signals framework as a tool in their toolkit for influencing constructive practice change in farming. It is organised by:

- Overview of signals
- Identifying signals (and intrinsic drivers / noise)
- The signals framework
- Moving from signals to change
- Case studies
- Attributes of signals
- Other resources

What are signals?

Signals are information from on- or off-farm that could enable or prevent a farmer from moving along a constructive change process. Information can come from the farming system or the operating environment.

Signals can come from *on-farm* (e.g. next generation, animal behaviour, plant condition, soil erosion…) or *off-farm* (e.g. regulations, market prices, climatic conditions, opinions of community including other farmers, rural professionals such as advisors, bankers, accountants, scientists).

Why are signals important?

More than ever farmers and their stakeholders want to drive change on-farm to achieve social, environmental, and business outcomes. As such, many people and organisations are providing farmers 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. Our research suggests that understanding signals means advisors are able to deliver more relevant and effective information to farmers, in order to influence action on-farm.

Our Land and Water

This work is funded by the Our Land and Water (OLW) National Science Challenge, which has the vision of enhancing 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 guide specifically relates to the Signals for Land Stewards project, which focuses on identifying the signals that influence farmers and growers when implementing environmental practice change. More information can be found here.

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

Technological

Off-farm signals coming from new technologies

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

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.

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

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

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
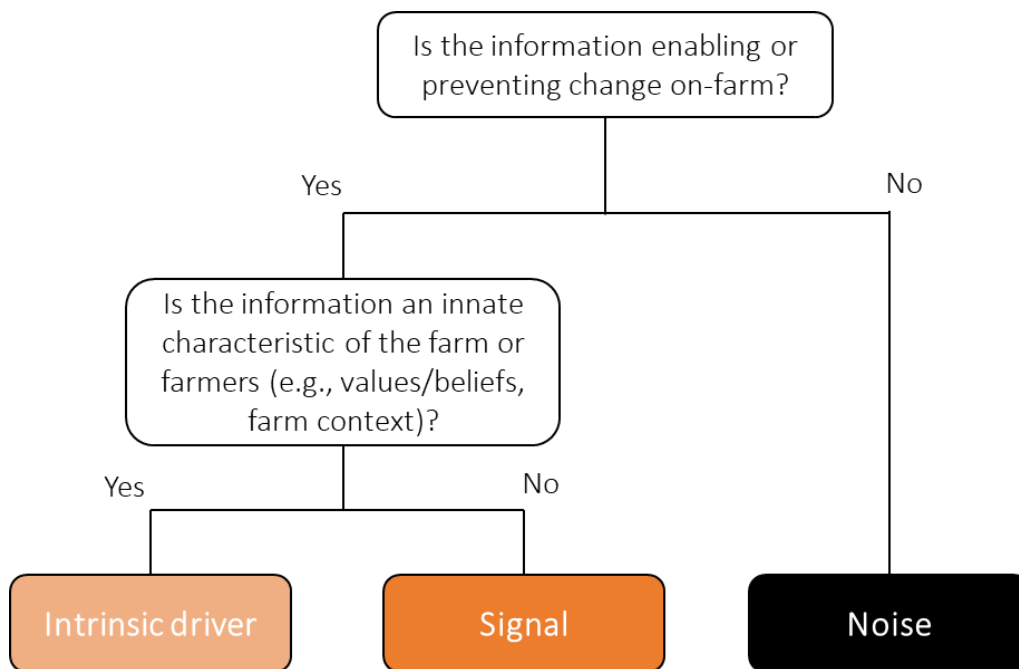
On-farm signals from farm management

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

Identifying signals

Off-farm signals
Political, environmental, social, technological, legal, economic

I found out about...

On-farm signals
Natural, physical, human, financial, social, political and cultural capitals

Noise

A key property of signals is that they are from the external environment, as opposed to something innate about the farmer or their farm, such as age, gender, beliefs, farm location, climate etc. These things are all characteristics of the adopter and as such are called *intrinsic drivers*.

Similarly, it is important to note that not all information reaching a farmer enables or prevents them from taking action on-farm. Information that does not influence change because it is considered irrelevant or unimportant is known as *noise*.

The following flowchart shows how to differentiate signals, intrinsic drivers and noise:

```
              ┌──────────────────────────────┐
              │  Is the information enabling or  │
              │  preventing change on-farm?     │
              └──────────────────────────────┘
         Yes                              No

    ┌──────────────────────────┐
    │  Is the information an innate  │
    │  characteristic of the farm or │
    │  farmers (e.g., values/beliefs,│
    │  farm context)?               │
    └──────────────────────────┘
      Yes                  No

  ┌──────────────┐   ┌──────────┐    ┌──────────┐
  │ Intrinsic driver │   │  Signal   │    │  Noise    │
  └──────────────┘   └──────────┘    └──────────┘
```

Signals framework for identifying signals

Based on existing literature on external factors in farming, we have also developed the following framework for categorising the kinds of signals that a farmer might receive from both on-farm and off-farm sources.

Off-farm signals

Type of signal	Examples of these signals
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
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 • Inflation • Interest rates
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.	• Trusted sources of information (e.g., via an extension programme, peers or advisor) • Consumer preferences • Benchmarking data • Social norms
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. These 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) • Other monitoring data • Weather forecasting • 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-	• New and current regulations/rules from Regional Council

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

Type of signal	Examples of these signals
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.	• Life in the water (e.g., the bugs in the waterway) • State of soils
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.	• Farm team • On-farm labour
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.	• Skills and experience of farm team/labour • Staff wellbeing • Relationships within farm team
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.	• Debt levels/available cash • Costs • Productivity/profitability • Other farm management data
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.	• State of feed (e.g., pasture, crops, bought in feed) • Current infrastructure • Production levels • Stock health • Stock shelter • On-farm observations • Other farm management data
Cultural capital signals are defined as information about traditions and language, which influences what voices are heard.	• Leading by example
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	• Perspectives and connections of farm team

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.

Off-farm signals

Political, environmental, social, technological, legal, economic

I found out...

I understand I might need to...

I need to change...

Please help me to...

On-farm signals

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

Case studies

When analysing signals, we found it useful to look at the signals in light of the four different stages above. The following illustrate some real-world examples of how signals have influenced change on-farm and are drawn from interviews with farmers who had interacted with an extension programme with an environmental focus.

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.

Off-farm signals

> Now I know about the mauri in the water and its function, I want to protect it. If I fence my waterways and this will meet my milk-supply company needs.

> Now I have the knowledge and understanding of what I must do and can do by choice, I am going to do something about it.

> My milk company says I need to fence my waterways. At the same time I've found out there is Mauri (life) in the water that needs protecting.

> I am fencing the waterways and feeling good about it.

On-farm signals

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.

Off-farm signals

I need to take develop an FEP. I need to take action according to the Farm Environment Plan.

Now I know what's needed and relevant for my farm!

I've just moved to Canterbury and I want to find out more about the region and how things are done here.

I got an 'A' grade for my FEP.

On-farm signals

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.

Off-farm signals

Maybe we need to do something, but we need more information like a cost-benefit analysis of alternative solutions, and clarity around the environmental impacts that need to be addressed to help us to take action on farm.

We need to invest in our farm system to meet the requirements for wintering and a herd home seems like a suitable option.

We've heard about the deteriorating water quality and been told that our effluent storage isn't sufficient for the new wintering regulations.

We now meet the regulatory requirements for wintering.

On-farm signals

Attributes of signals

We have also discovered some key attributes of signals which can influence the likelihood that a given signal influences constructive practice change. These are:

- **Relevance:** The signal needs to be considered relevant to the farm, farmer and wider context. It also needs to be compatible or complement the intrinsic drivers of the farmer receiving the signals.

- **Certainty:** The signal needs to be unambiguous. A proposed change in regulations is an ambiguous signal and as such, does not enable change.

- **Consistency:** For a signal to be effective, the signal should be consistent with other signals from other sources.

- **Delivery**: The delivery of a signal was also considered important. Signal brokers can be trusted advisors or other farmers.

Using signals in extension programme design and implementation

There are a range of ways to use an understanding of signals in extension programme design and/or implementation. The following table has some suggestions, based on the attributes of signals.

	Enables or prevents change on-farm	Certain or uncertain whether it will happen	Understood or misunderstood / little understood by farmer(s)
What should I do in my extension programme?	If the signal is driving change on-farm: • Leverage it (e.g., offer incentives) • Use the lead in time to raise awareness and highlight the information and support available • Ensure the farmer receives consistent messages from their sources	If the signal is considered certain: • Consider incorporating into awareness raising activities • Ensure the farmer receives consistent messages from their sources • Prioritise trusted information sources to start with highest risk areas first	If the signal is understood well by the farmer(s): • Focus on developing skills, confidence, practice change • Highlight/promote farmer stories outlining their (positive) experiences
	If the signal is preventing change on-farm: • Mitigate it or at least acknowledge it • Demonstrate how the desired practice change aligns with their goals • Focus on the unexpected outcomes / benefits they will get (e.g., songbirds) • Provide trusted advisor and strong support network • Recognise those who are acting – rewards don't have to be monetary	If the signal is uncertain: • Provide trusted advisor and strong support network • Build a logic framework to break it into steps • Use seed techniques • Link to other farmers (real life examples, material that isn't just the science) with practical demonstrations, peer to peer events, field trips • Start with the smaller, first steps (the practicalities) • Things that still make sense (when uncertain) e.g., still do an FEP	If the signal is not understood well or if misunderstood by the farmer(s): • Undertake myth busting • Find farmers who do understand, or have the first steps in place and support them to talk about it • Ensure there are two-way conversations • Ensure the farmer receives consistent messages from their sources • Provide trusted advisor and strong support network, e.g., experts who may have data/information to help • Ensure enough time to build trust

 Enables or prevents change on-farm	 Certain or uncertain whether it will happen	Understood or misunderstood / little understood by farmer(s)
	• Providing confidence that investments / changes will make sense • Create holistic approach which shows how doing this now will help in future • Ensure the farmer receives consistent messages from their sources • Use real, farm context relevant data wherever possible	

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Other resources

For design and implementation of extension programmes

- Over the Fence

- Keys to success in extension – a checklist

- Comparisons of extension methods

- Good extension starts with the audience and their needs

Further reading on Our Land and Water and the Signals for Land Stewards project

- About Us - Our Land & Water

- Signals for Land Stewards - Our Land & Water