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Harvest of a workshop held at the Royal Society of New Zealand on 27 April 2018.

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# 1. The Programme

This report refers to an MBIE funded programme **Soil health and resilience: *Oneone Ora, Tangata Ora*** that included the Māori research stream, **Māori perspectives and Mātauranga for Soil Health**. Programme leaders are Bryan Stevenson and Garth Harmsworth of Manaaki Whenua – Landcare Research.

## Towards a Framework

The programmes are developing a path toward a shared vision of long-term soil health in New Zealand that will include crafting an ‘Integrated Framework’ for Soil Health and Resilience.

## Towards a Field of People

Electra Kalaugher (Manaaki Whenua) leads a strand of work on engaging stakeholders. She presented findings from a nationwide stakeholder survey ‘A range of needs and perspectives’. An invitation was extended to over 150 people who contributed to the survey. An expanding field of people have expressed interest in staying engaged. On 27 April 2018 over 60 people met at the Royal Society in Wellington, to workshop common ground and future steps on ‘Soil Health and Resilience’.

## The Workshop

The workshop invitation was extended to ‘soil practitioners’ from across many fields and many parts of New Zealand. The three aims of the workshop were to: 1) communicate the aims and approach of the project, and seek input on future interactions with stakeholders; 2) understand the needs and aims of different sectors and end users at different levels, and how these might be reflected in an integrated framework; 3) develop a path toward a shared vision of long-term soil health in New Zealand.

## The harvest of perspectives – this report

This report is based on the spoken and written words of participants. We welcome your response and continuing participation, and also welcome widening interest.

Bryan Stevenson introduced the research *Soil health and resilience programme: Oneone Ora, Tangata Ora*. Garth Harmsworth gave an overview of the research stream on Māori perspectives and Mātauranga for soil health, and Electra Kalaugher reported on the nationwide stakeholder survey findings that included the different definitions people have of soil health and what people are monitoring and measuring for. These presentations and future reports will be shared with you and posted on a soil health and resilience web portal when established.

## Cultivating the Field: next step – where from here?

As well as the content of sessions, the workshop process sought to reveal, connect, and cultivate a diverse community of practice with a commitment to the kaupapa of soil health and resilience. The design was to enable participant agency and ownership, and seeking new parts of the active field in this sector.

There are many strengths to work with that were present and many aligned aspirations with diverse perspectives. There was clear evidence of commitment, and shared concern about the need to work in more connected and supportive ways. There are suggested tools that could be developed. There are ways in which we may need to turn our thinking (and perhaps practice) on its head. The innovative strengths of New Zealanders could perhaps help us turn our care for soil into more healthy directions.

An immediate next step is the sharing of this report with participants and the wider interested group, inviting responses and further contributions.

## 2. The Workshop

The workshop convened at 9:30 am with a welcome from the convening team, and mihi whakatau and karakia tīmatanga from Garth Harmsworth.

*In the session 'Towards a nationwide picture of current practice and future aspiration',* Electra Kalaugher reported on the nationwide stakeholder survey findings. Following this were five short presentations from soil practitioners from a range of sectoral perspectives. A summary of each of these talks is in Annex 3.

These short talks sparked many powerful questions from participants. These were all harvested, and illustrate the range of curiosity and commitment, as shown in the report below.

Before lunch we made a start towards the continuing project of building a nationwide picture of current practice (including, for example, land management, education/extension, policy, science and research, market driven concerns) through table-based conversations about what work people were involved in that might be of value to others and that they might not know about.

After lunch, in the session *'Towards a more coordinated approach to Healthy and Resilient Soil'*, in a 'world café' format, each participant contributed a written and (in groups) spoken contribution to three questions that will help us build towards a framework:

*Question 1:* What are the strengths in this field (of soils expertise and practice) that we could tap into more?

*Question 2:* What would enable you (or your sector) to achieve your goals for soil health? And,

*Question 3:* What could healthier soils contribute to NZ within 10 years? (or longer).

The rich responses to each of these questions have been collated and analysed in the contents below. As each of you engages with this material, you can become part of us – seeing what needs to be part of a more comprehensive framework to move Aotearoa/New Zealand towards healthy and resilient soils.

The second afternoon session allowed time to examine six 'Focused Themes' chaired by leading peers. The components we explored in this session were:

- Why do we want to measure Soil Health,
- Bridging 'knowledge' and people on the ground: reaching farmers failed by the education system,
- How do we know we have long-term resilience and what do we monitor,
- A Soil Carbon theme,
- Integrating monitoring across scales, and;
- Human well-being and soil health.

For a summary of each theme and what that future work could like, see Annex 1.

*The Closing Session* was a table conversation with peers that discussed 'What would you like to see come out of this – and in what ways do you see that already emerging?' Each participant offered a closing reflection, which is presented in the Word Cloud on page 15.

This report presents the results of these participatory sessions.

Where might we be in ten years from now? And, together, how could we best get there?

### 3. Visions and Values of Soil

*A key question of the afternoon sought to tease out the potential importance of attention and work on soils and what values are generated through strategic work and good practice. The question asked was **what could healthier soils contribute to NZ within 10 years** (or any longer time period you choose).*

*This question provoked a range of comments on the future for this country provided by healthier soils. Many links were noted between health, climate and environment, resilience, economic value, productivity, national identity, leadership, etc. As many of these values were mentioned multiple times, they have been aggregated. These are annotated, e.g. "x5 = mentioned five times. Some were written as a vision to be aimed for.*

*Some of these identified values are cause, while others could be seen as the effect of other actions. Some are not fully achievable without others, and some are simultaneous or go hand in hand.*

#### **Aspirational Positive Visions:**

"NZ could be a carbon negative country producing the world's most nutrient-dense food."

"New Zealand producing high-value healthy foods in demand from consumers wanting meat and vegetable diet (not synthetic meat)."

"In ten years, drinkable water in all upper catchments."

"Carbon sequestration that is capable of mitigating all New Zealand."

"Ability to sell only products that have a great story around soil regeneration, greenhouse gas footprint, wellbeing of the animals and social impacts (benefits) of the farming."

For the longer term: "growing profitable healthy food supporting healthier communities."

"Right thing, right place, right time."

#### **Soil and Environmental Values**

- » Better water quality x12
- » Improved water and nutrient use efficiency x4
  
- » Reduced weed infestation x2
- » Healthier fisheries
  
- » Reduced greenhouse gas emissions x5
- » Carbon sequestration x4
- » Lower Nitrous Oxide N<sub>2</sub>O emissions
  
- » Greater effective soil resource
- » Reduced erosion x3
- » For arable soils, address organic matter and structure for soil resilience x2
- » For pastoral soils address compaction for increased pasture growth for same or lesser inputs x2
- » Greater macropores
  
- » "Lower P in streams (through lower Olsen P values – Lower sediment through lower compaction – Less run-off through better macropores – less compaction through lime"

***Legislative Values***

- » Achieve environmental legislative goals
- » Widespread policy on awareness of the need to change fertiliser and plant cover practices

***People, Health and Life Values***

- » Healthier, better quality and nutrient dense food x5
- » Better human health through nutrition or lesser use of harmful inputs x4
- » Better soil means better farms, which means better communities x2
- » Increased appreciation and respect for farmers and producers; to lead us to improved mental health and happier land managers x6
- » Restored pride in New Zealand's land and a more desirable landscape
- » Land use that is appropriate to the soil and mātauranga; that shows balance and respect between humans and environment x4
- » Healthier plants and animals

***Agricultural and Economic Values***

- » The marketing edge – Better 'claim or say' and brand in international markets x11
- » Including greater market access and increased produce value and in global markets.

- » Higher primary productivity and greater output x9
- » Through less inputs – increased farm and value profitability x7

## ***Resilience Values***

- » “Resilience: in land and environment, people, and community.”
- » Resilience to climate change including greater buffer against events and minimised environmental impacts x4
- » Increased flood protection/attenuation through storage capacity x5
- » Reduced ‘drying out’ x2
- » Future-proofing generation.
- » More integrated and multi-function farming systems

## 4. Strategic Enablers

*A further key question of the afternoon sought to elicit potential high-value pathways that would enable greater effectiveness towards soil health and resilience right across the field of diverse people and organisations. The question posed was **what would enable you (or your sector) to achieve your goals for soil health?***

*A range of themes emerged from participants for what would most enable their sector's goals to be achieved. This has highlighted some strategically important avenues for groups to explore together and act on. Thematically, these included ideas for Infrastructure and Systemic Shifts, Strategic and Policy directions, Commercial and Ag-Sector initiatives, Research and Innovation focusses, and Educational and Communication needs. While these suggestions from participants are written in brief, there is opportunity to think who would need to be involved and what steps might be needed to move the idea ahead.*

### **Infrastructure and Systemic Shifts**

- » Economic factors and local infrastructure facilities for the farming sector to be more self-sufficient and diversified. Facilities such as local slaughter and processing facilities, breaking the monopolistic practices and being able to move outside of the 'mass' market model to enable value-add marketing; and branding taking advantage of their soil health.
- » Enhance and support the social networks that support/encourage/give confidence to land managers to improve practise.
- » Ability to recognise achievements and capability for soil health – an economic return on soil health.
- » Seeing soil health as integral to human well-being, water quality, etc.

### **Strategic and Policy directions**

- » Link Best Management Practice for GHGs, water and soil. Identify where we get best bang for buck, e.g. stand-off pads.
- » Agricultural policies that alter/ increase/ decrease/ the following:
  - Carbon sequestration
  - Nutrient attenuation
  - Soil Ecosystem Services (managing and enhancing)
  - Soil Physical degradation – soil erosion – compaction
  - Sediment loss reduction
- » A common and agreed framework and indicators for Soil Health Monitoring.
- » Having consistent methodologies for assessing soil health/  
Meaningful definition of what “soil health” is - what are we aiming for?
  - Structure
  - Porosity
  - Carbon level
  - Is C being sequestered?
- » Local farmer group definition of what healthy soil is. Extension
- » What are the proven steps to get there?
- » What is the economic value of soil health?
- » More attention to urban soils and their use.

### **Commercial and Ag-Sector initiatives**

- » Better buy-in *between* sectors.
- » Monitoring/ collating soil data in an integrated industry database with meta-data.



- » Indicators for the farming system rather than the soil type.
- 1. An understanding of Why you are measuring soil health
- 2. What are the indicators/ measures we should use?
- 3. What do these indicators mean? – interpretation?
- 4. Then what practices are required to change the indicators if that is what is required – implementation

#### *Strategic Enablers continued*

- » Peer-to-Peer – learning and support. (Learn with your mates and from your mates)
- » Demonstration farms where a group of farmers can define a standard for healthy soil.
- » Branding – that enable premiums for carbon farming.
- » Identify the greatest limit to soil resilience – lime? – soil C – shelter – trees for erosion control...
- » Have farmers back away from water soluble superphosphate and urea fertiliser applications.

#### **Research and Innovation focusses**

- » Need-based research that is applied to land managers' user needs.
- » Complex information into simple English.
- » Integration of knowledge across disciplines.
- » Personal tools more widely accepted and adopted e.g. Visual Soil Assessment also brix measurements and others.
- » Local and Community tools adopted by enabling groups, e.g. peer support groups, extension workers in soil resilience.

- » Have national monitoring or central body to extend monitoring to 8-km grid based on LUCAS.
- » Archive leftover soil after analysis.
- » Quantify economic, environmental, cultural value of soil health.
- » Clearly established relationships of indicators to function.
- » To understand the key attribute of soil health indicators.
- » Regional Benchmarking
  - » → Enabled to be able to monitor
  - » → pools of farmers like catchment groups to define soil health.
- » Farm environment plans → will provide a big chunk of data into regional councils. And, information shows positive as well as negative (points for improvement).
- » Regional Council, MfE: Better data, erosion and soil health. Better information on LUS to inform policy about land use.
- » Sharing data generated by Regional Councils with researchers.
- » (Future need) more 'remote' monitoring... tech and data analysis ability, spatial and temporal.
- » Remote sensing technologies to understand properties of soil on a spatial basis. This may not only be nutrients but also other properties which may be useful in the 'soil health' area.
- » A lot of knowledge/ research doesn't find its way out of universities. We need to ensure research is moving from Universities to industry.

#### **Educational and Communication needs**

- » A standard terminology for soils that the general public can understand.
- » Talking with Pastoral Farmers whenever possible about soil management both for productivity and soil resilience

- » Increased understanding of the value of healthy soil and principles that lead to increased or decreased soil health.
- » Increased awareness of importance of soil – Capability with soil – Tell good news stories.
- » Integrated education and extension on;
- » Benchmarks – more understanding of what results mean – offering trends in data over time.
- » Urbanised people being more aware on the role of soils in critical life-services.

## 5. Possible Actions for the *Integrated Soil Health and Resilience Framework – Oneone Ora, Tangata Ora*

*In all the workshop sessions participants suggested actions and goals that related more directly what the integrated soil health framework programme could target or enable. These are wide ranging, from focused scientific steps to more systemic initiatives that would involve bringing together diverse others. These ideas were given throughout the day and aggregated. Valuable courses of action suggested here also relate strongly to the wider scope of ideas that came from the Strategic Enablers section above. As a preface to what any of us in this field might critically ask before settling on a particular course of action, the powerful question was asked **Do we know yet why it isn't happening?***

### Action Ideas

- This group, or a subset, could do a robust assessment of where we sit with the current soil health indicators, and *put together a white paper* that could be critiqued.  
“Put it out there, let’s have a discussion around it and let’s see if we can’t get it on the national agenda. I think there clearly is enough passion around this and I don’t think we are pushing a strong enough agenda.” – Mike Beare
- Need to see if there are there any other indicators that could be better or might add additional information we aren’t currently capturing.
- ‘To see a framework, to see the measures, so that we can collectively work on calibrating and interpreting them, and being able to use that with farmers, growers and whoever else is working the land.’

- ‘Could a sampling protocol come out of this programme? For instance, Regional Councils only sample to 10 cm, but 60 cm would be better.’
- What’s needed for Carbon accounting at various scales of management and reporting?
- 
- Carbon stocks – needs a national statistically designed system – then others could add sampling using the same approach.
- Need a policy context/ baseline in order to assist interpretation of what data means. As data complexity increase systems need to respond.
- How can we show data across property and region boundaries? Suggestion: Heat map method – Remove fear of the unknown or possible penalty for sharing data. Publicly report integrated data.
- Create a ‘lessons learned’ review out of the experience of the existing soil quality monitoring framework – captured by the experts who contributed to its development.
- To create a good soil quality indicator for nitrate losses.
- Create a diverse vast far-reaching group of knowledge and ability to interact with many different fields.
- Join and be part of a Global soils partnership

- Widespread policy on awareness of the need to change fertiliser and plant cover practices.
- Bridging the expertise in development of development of statistical and measurement frameworks at government level with on the ground performance/management metrics.
- Better utilise potential in natural trials that are being undertaken on different properties operating under different management regimes. Use these, no need to create artificial experimental plots at great expense.

## 6. Participant's (Powerful) Questions

*Following the morning's speaker session where participants heard from a range of perspectives (see Annex 3 for speaker notes) on how soil health relates to different sectors, participants were asked to write and have a discussion based on the following question: What is the question you're most left with? It might be something that hasn't been spoken, it might be something that you would have given to one of those speakers, or an emerging or meta question?*

*The following groups all questions written or spoken on the day, in their own words. These are grouped under four broad headings:*

- 1) Commitment and Paradigms*
- 2) Institutions, Policy and Markets*
- 3) Relationships, Communication and Social factors*
- 4) Science and Research*

### ***Commitment and Paradigm questions***

- » Identify different groups to sell 'WHY' of soil health – what are the value propositions?  
To: Political, policy (central/ local), sector, region, community, farmers, consumers, ag business...
- » What core farming paradigms and practices need to change to move agriculture toward 'soil health'/resilience? (A lot of talk about mapping and measuring and definitions – what about practices to shift soil dynamics?)
- » We need to focus back on right land use. Restore connection. Put right land use on right soil for healthy food. Environment as part of LUC.
- » Why have we made so little progress on this so far when primary industry is so important to our economy?

- » Is there an end vision, i.e. a societal end vision? What is the mission statement? What is it that can universally enroll the participants – all of us – farmers, service providers, research facilitators, marketers, food processes, et cetera, et cetera. Once universally enrolled we can all get involved in the mechanics.
- » Are we all working towards the same goal? Is this a generic goal and the specifics differ markedly between different sectors/groups?
- » We need to do better and build our soils, and enhance our local, regional, National environmental health. Connect this to human health outcomes.
- » Who are soil health indicators for?
- » How to incorporate non-soil factors, e.g. landscape, climates, in assessing soil health?
- » How do we escalate the importance of soil health alongside water and greenhouse gas?
- » Carbon neutral is one aspiration for many sectors. However, what does this really mean? What about moving beyond neutrality? Neutral means maintaining a status quo.

### ***Institutional, Policy and Market questions***

- » Why is there no coherence nationally around soil health?
- » What is the role of stats NZ chief data steward for all data in NZ – and as agency whose bread and butter is development of measurement frameworks and 'gold standard' indicators?

- » What to measure and highlight in next land national state of environment reporting? Our Land 2021.
- » Definition of health needs to be expanded to include all of the services (benefits) we (humans) obtain from our landscapes.
- » How does soil resilience get defined – is it just another way of saying how much burden can the soil take, i.e. how long will it 'endure' poor management decisions?
- » Soil science in New Zealand strategy? Funding – funders – providers. Needs – Capability, Promoters, Knowledge transfer and Decision support tools.
- » National policy for soils?
- » Different farming groups are all raising the need for soil quality, will they look to draw together a common framework and how will it link to existing soil quality work?  
E.g. Fonterra, Beef and Lamb, FAR.
- » What do these organisations want for future soils?
- » How do we integrate all of our soil health data?
- » Monitoring happens in regional councils, not in sectors, how can we unlock the potential of that area?
- » Reasons we should monitor soil health: evaluate the effectiveness of plans and other regulatory documents. Provide early warning of emerging issues.
- » How might an Aotearoa/NZ space strategy evolve if we include the measurement of soils?
- » Support for farmers – changing behaviour and practices. Connecting policy, science and farming communities.
- » Farmer capacity – how could we best support that – what do they need?
- » How will a land manager know whether they have 'healthy' soil?
- » How do they determine if things are moving in the right direction?
- » Connect science to farms, empower farms and land uses to success. Ensure healthy feedback loop.
- » How to repackage/integrate the vast amount of info that is already collected? How can we utilise this on farm?
- » Hundreds of soil tests but what do all those numbers mean? And, how to make it relevant to the tenant/occupier?
- » How do we assist farmers in valuing the changes to improve soil health?  
Especially, whole plant/soil/microbe relationships, in particular the pathways of carbon and water.
- » Do we know where the biggest barriers are to enabling action to achieve goals of healthy soils?
- » Steps required to develop a bicultural approach to resource management (incl. soil health)?
- » How can we better collaborate between different entities, e.g. regional councils/universities/CRIs?
- » How best to combine resources of all interested parties to get useful information? – More cost benefit – synergies.
- » How to establish (physical, social, economic) balance between sustainable production and environmental protection? – What do we need to know to achieve this?

***Relationships, Communication & Social questions***

## ***Science and research questions***

### ***Sector-wide questions***

- » A standard set of rules to display big data?
- » Why is the drop in organic matter production never investigated?
- » N2 use is always glossed over and accepted. Where is the monitoring of the negative effects on soils?
- » Pastoral sector soil needs physiographic units!

### ***Core Definition questions***

- » What do we mean by resilience? Important to define resilience to/from what? E.g. pressure from specific uses, pressure imposed by climate change?
- » What is a healthy soil? E.g. some soil types are naturally degraded. Do we really know enough about soils?
- » We can readily define when the soil is degraded. But how can we define, from a soil quality perspective, when a soil is back to 'health'.
- » Why do we want to measure soil health?
  1. *Why do people care*
  2. *What are the key areas*
  3. *What are some key linkages*
  4. *What do we know*
- » What are the critical soil functions and objectives that different stakeholders need (farmers, regional councils, etc.) to support that define our soil as healthy?

## ***Stocktake and Monitoring questions***

- » Need to assess what is working well farm by farm, catchment approach.
- » What is the starting point or baseline to measure against if we want to show we have made a difference?
- » Long-term monitoring is needed to detect the components of temporal change and extricate the eggs effects of multiple pressures.
- » Hill country – sediment sources/erosion losses – where is sediment coming from?
- » What currently employed farming practices can be used to improve soil quality?
- » Do we know what we have got?  
Do we know what optimum levels are going to give long-term resilience?

### ***Indicator questions***

- » What are the optimal levels/ranges for our soil indicators?
- » All the speakers said soil health/quality was important to their vision/strategies, which begs the questions:
  - 1) What are soil health measures? Quantitative, qualitative and Māori measures?
  - 2) How do we know what they mean?
  - 3) How do we interpret/change if necessary?
- » Soil indicator development/refinement.
  - 1) What is the measurement indicating?
  - 2) What is the critical value with respect to soil function/ service.

- 3) What is the farmer/land use educational value? Feedback loop!  
(From regional council or industry state of environment monitoring.)
- 4) incentives for building soil health
- » Can we use nutrient density (ND) in food as an indicator of soil health? (How can we measure and improve ND through from practices?
- » What are the key soil health indicators for different soil threat or ecosystem service? Develop soil threat or ecosystem service specific soil health indicators.
- » Connecting soil quality indicator targets with changes in the soil function or process.
- » How do we know the right optimum is in the soils for all the indicators we have?
- » There is currently no really good measure to assess P loading in the soil. Is it time to move away from the Olsen P to a more modern test like the Mehlich where aluminium and iron are measured to SSP saturation levels?

### ***Food quality and health questions***

- » Need to link soil health to human well-being.
- » Effects of agri-chemicals on micro communities to connect to soil and food qualities.
- » Limited number of links between' soil health and human well-being (includes environment).

### ***Soil Chemistry questions***

- » What is the realisation of the impacts of high soluble nitrogen and phosphorus in relation to soil ecosystem services? I.e. the disruption

to soil biota that support soil structure, sequestration of carbon and nutrient holding capacity and efficient utilisation.

- » The importance of soil carbon for soil functioning?
- » Soil N: Nitrogen mineralisation – the capacity of the soil to supply plant available N – value of this is to improve forecasting of N fertiliser requirement and reduced risk of oversupply/ N losses.
- » Soil C: Soil Carbon saturation deficit – methods to define the capacity of soils to store more C (stabilise more C). The difference between the C stabilisation capacity and the soil current C stop defines it saturation deficit.
- » Soil compaction: What are the best/most practical methods to measure soil compaction that allow comparison across space (soils) and time? How does land use affect soil compaction? What are critical thresholds for compaction that offset production and environmental outcomes (e.g. greenhouse gas emissions)?

### ***Sequestration and climate questions***

- » How could we get carbon back into the soil?
- » Sequestering enough carbon to offset NZ GHG emissions while building high-quality soils.
- » (Pastoral farming or cropping)
- » to be carbon positive not just carbon neutral, e.g. beef and lamb New Zealand goals.
- » Carbon plus/carbon neutrality.
- » How much do cropping agricultural systems need to change to be carbon neutral or carbon plus. Can we do this under the current paradigms – or is it a paradigm shift required?



### ***Commercial and Economic Questions***

- » Every land management decision has a trade-off – how can research quantify these trade-offs (including economics).
- » What is the financial benefit of building soil carbon in an arable system?
- » A farmer said to me ' we understand the value of returning straw to the soil, but selling it means we can buy shoes for the kids'. How do we value soil carbon?
- » The measure is profitability. What else could be used to indicate soil improvements?
- » Cost-effective ways to mitigate?

### ***Management regime and Land-use questions***

- » Links between soil fertiliser programmes and pasture quality to nitrate leachate from dairy cows?
- » How to fertilise to improve soil humus levels and vitamin and mineral content of the food produced. (TDS/ Brix)?
- » How to build a healthy soil while improving pasture production and complying with Council environmental guidelines/requirements?
- » What are the limitations for land use?
- » Qualification of ecosystem services from soils?
- » What role can land use suitability and soil optimisation have on the resilience of pastoral farming?

### ***Technology question***

- » Can we use Earth observation from remote sensing to visualise soil health?



*In closing,*  
 workshop participants were invited to share a  
 “one word or sentence” reflection on  
 what they would like to see happen and  
 that they could already see signs of happening.

*This Wordle is built from the words they shared.*  
 It is available in three formats for participants to use and  
 share.

## 8. Annex 1: Working Groups Focus Session

*The final working session of the afternoon involved participants taking themselves to focus sessions based on themes and questions that had emerged on the day; these were refined with caucusing over the lunch break. There was great candour and vigour in the conversations, with several continuing into the break time. Commitment to seeing progress to the issues discussed was evident and the following material can be seen as a potential prototype of action to be further iterated upon.*

*This section offers a summary of the primary question and conclusions reached that were written down from the six groups.*

Exercise: What components should we explore in relation to a framework?

Prompts;

- *Why do people care?*
- *What are the key areas?*
- *What are some key linkages?*
- *What do we know?*

Group 1: *How do we know we have long-term resilience and what do we monitor?*

Group 2: *Soil Carbon theme*

Group 3: *Human well-being and soil health*

Group 4: *Why do we want to measure Soil Health?*

Group 5: *Integrating monitoring across scales.*

Group 6: *Bridging between 'knowledge' and people on the ground: Reaching farmers failed by the education system.*

### (Group 1) "How do we know we have long-term resilience and what do we monitor?"

Facilitated by Mike Beare and six more participants.

*This group came together and discussed through what they mean by Resilience and explored what it would mean to achieve that in the long-term. Their conclusions as follows:*

Resilience – The ability to rebound from disturbance/ pressure.

Resistance – The ability to resist change under pressure/ change.

This can be defined by:

- 1) Inherent properties – soil classification (e.g. texture, drainage, class)
- 2) Dynamic soil organic matter (SOM) – modify outcomes within inherent boundaries

How we might measure Resistance – may be reflected in the rate or extent of change in soil functions as a product of a defined change (e.g. climate change, LUC, etc.)

How we might measure Resilience – time under restorative management to its benchmark condition. Or, the amount of "bought capital" (e.g. water, nutrients, etc.) input that is needed to recover to its benchmark condition.



## **(Group 2) “Soil Carbon theme”**

Led by Louis Schipper, with eight participants.

*This group worked on the questions: Why do we care about soil carbon? What are the benefits of soil carbon?*

*They also explored the need to have a good discussion at a national scale about what people actually think is happening to Carbon stocks under different land uses and practices, because there is a difference between reality and perception. Also, where do we go from here and how do we manage that?*

### **What do people think about soil carbon; what are the benefits and why do people care?**

It's Functionality through soil structure/ porosity/aeration – Ability to filter water and remove contaminants – Biodiversity – Retention and attenuation of water – Resilience to climate events, animals – Decreases annual variability in yield.

### **Evidence for these beliefs?**

Anecdotal/ generalisations/ conversations/ farmer claims – Trials show change but is that causality? – Marta Camp's paper increased organic matter = increased resilience – More carbon equals more microbes

The group observes that what is happening to soil carbon in NZ agricultural systems is on average annually variable but still declining over time. Though in pastoral systems, particularly under biological farming approaches Carbon is increasing.

Different soil types behave differently. High input NPK decreases Carbon in soils.

### **What data are available?**

Much data are collected but need to be published or shared more.

A lot of sector knowledge for example in FAR (foundation for arable research)

In fertiliser companies that hold information, but farmers are interested.

Perceived wisdom in trusted sources

### **Observations:**

Quality issues with sampling for consistent analysis.

Regional Councils only sample to 10 cm, but 60 cm better.

Will sampling protocol come out of this programme?

Lots of work happening at farm level but not enough measurements. Not enough NZ data.

What's the trade-off between more samples vs deeper samples. What's needed for Carbon accounting at various scales?

Carbon stocks – needs a national statistically designed system – then others could add sampling using the same approach.

In particular, more funding to test management practice differences in Carbon stocks on split farms.



### **(Group 3) “Human wellbeing and soil health”**

Led by Phyllis Tichinin and Annie Perkins, with four participants.

*This group looked at science and factors for developing a case on how soil health benefits in nutrition and human health.*

*“We all know healthy soils, healthy plants, health animals, healthy people – that’s meant to be the linkage. We seldom acknowledge that we can measure and affect the nutrient density, i.e. the concentration of the vitamin and mineral content based on our agricultural practices, that this is not a genetics issue, it is a nutrition issue. So how does that move on to how do we actually produce food that heals people from healthy soil.” – Phyllis Tichinin*

#### ***Why do people care?***

- » People are becoming more health conscious
- » Nutrient dense food preventing disease.
- » Perception that the problem is growing, cancer, inflammation, etc.
- » Perception people care about their own health – it affects quality of life.
- » Healthy soil enables diverse ecosystems.
- » Reducing environmental degradation for an improved environment, which also sustains us.

#### ***What do we know?***

We cannot get nutrient dense food from mineral deficient plants and animals. Massey nutrient course does not focus on healthy soil and healthy food. There are financial and physical constraints. Banks controlling expenditure for fertiliser and requiring ‘approved’ nutrient recommendations. Soil Carbon is important.

#### ***What are the key issues?***

Chemical contamination in food and water – Land use choices are removing productive soils under property development.

#### ***Possible responses***

Educating farmers in how to deliver a healthier food – Demonstrating to farmers how the farming systems make a difference in nutrient density for healthy food.

### **(Group 4) Why do we want to measure Soil Health?**

Facilitated by Samuel Lang with four participants.

*This group approached this question by asking – For a range of different actors, what value can soil health and resilience add to them? What is their Why? Therefore, why do they want to measure? The stakeholder types chosen were Consumer, Farmer, Marketer, Māori, Government/Policy, and Community.*

#### ***For Consumers:***

Product quality, nutrition and non-toxicity – Environmental Ethics – Cost (differentiation) – New values (lower sediment loss, Carbon sequestration, water health etc.)

#### ***For Farmers:***

Productivity – Regulatory compliance – Stewardship ethos – Weather and market resilience – Animal health and plant health – Increased income from increased consumer value – Secure social licence – Decrease inputs – Decrease erosion – Increased water infiltration and drainage – Reduce pest pressure – Increased feed value – Access to finance (sound business model) – Increased understanding of farm system and function, incl. soil and water, etc.

#### ***For Marketers:***

A better story that is verified/quantified – Consistent and increased product quality – Perceived as responsible – More margin to capture – Increased productivity/volume of supply chain and consistency (capital utilisation)

#### ***For Māori/ tangata whenua;***

‘Mountains to the sea’ (integrated and connected approach) – Respecting Mana, founded on health of land/water/people (Mauri) – Being also the farmer, consumer, community, marketer, those apply too.

#### ***For Government/ Policy;***

Communicate expectations of stewardship better – Better informed land use suitability – Better informed land management advice and instruments in general – Better targeted research policy – on the cause not the symptom – Identify co-

benefit opportunities – Links to Carbon, Community, Water (N), profit/wealth, biodiversity, mental health, tax and other policy areas.

**For Community:**

Water health – Amenity (decreased erosion) – Balanced ‘healthy’ landscape – Decreased risk of natural disaster impact – Positive feedback to land managers with: Improved relationships, more connected community, feel good factors (FGF) – Health of community: food, environments, wealth, relationships and spiritual well-being, secure livelihoods, increased ability for community to support more people – Mutually reinforcing relationships farmers/community – Multigenerational stewardship.



**(Group 5) “Integrating monitoring across scales”**

Led by Garth Harmsworth and Ross Abercrombie and seven participants.

*This group discussed reconciling different needs and measures across the variety of scale that had been a part of the day’s sessions.*

*This included extracting and identifying some of the indicators and metrics that come at those different scales, for what purposes and who is best to be doing it.*

*“Just think of national monitoring, we are not fulfilling end user needs, or industry groups or even client preferences from overseas. We might think we have got it right with the indicator set now... in future I think we really have to start to think at these different levels right down to paddock at what data we are collecting, for what purpose and how we are interpreting it, and who will be doing that measurement.” – Garth Harmsworth*

*“Water quality is facing the same challenge, upscaling (data) from paddock to farm to catchment as well.” – Ross Abercrombie*

**Examples of data sharing:**

- » Kopeopeo Canal, dioxins, on BoPRC website
- » Water quality in swimming areas. LAWA.

**A Māori perspective:**

Enhancing Mauri – by giving back. Carbon as a potential indicator for management practices.

**Data sharing issues:**

Commercial sensitivity – Data collected for specific purposes, rather than multiple purposes – Lack of coordination leads to duplication – Demonstrable benefits of sharing? – New technology opportunities – Clever data collection. The ‘hook’ could be that it is cost effective to share data overall.

Need a policy context/ baseline to help interpret what data mean. As data complexity increases systems need to respond.

Bring land use suitability into the equation. Benchmarking. Evolve to a transparent system where info is available.

### ***How can we show data across property and region boundaries?***

Heat map method – Remove fear of the unknown or possible penalty for sharing data. Publicly report integrated data.

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## **(Group 6) “Bridging between ‘knowledge’ and people on the ground... Reaching farmers failed by the education system”**

Facilitated by Electra Kalaugher and Jacqui Hahn with five participants.

*This group examined the question in an engaged dialogue and made insights on many aspects of knowledge and training gaps between people on the ground and various sectors.*

*“The knowledge between people on the ground and everyone else, if we don’t fix that, it (the soils) won’t be fixable.” – Jacqui Hahn*

### ***Finding the right language***

“Numbers from Soil tests is not the right language.”

Need for really good, skilled liaison people who can translate between different groups and knowledge. If you don’t have the education, you don’t know how to interpret.

Change the narrative from ‘marginal land’ to appreciating what it is valuable for – valuable to a farm and ecological system, important at particular times of the year – telling a catchment story.

### ***Supporting Learning***

- » Start from where farmers are – what they are worried about. Otherwise most people have disengaged from the process and are engaged when forced.

- » Individual/ farm scale goals first. People have to make the connections for themselves.
- » Soil tests should be done as you go, not at the end.
- » Making things more tactile – VSA is very powerful.
- » In our new science and new knowledge development we need to involve everyone. Engage and involve in rich way (Doing).
- » How to reach less academically inclined people? With, demonstrations, and demo farms. Telling the story – whatever scale, inventory of the good stuff – linking back to farms. What’s great (create pride), vision – steps to take, GAP analysis, actions prioritise/ resourcing.
- » Individual learning style – independent thinkers.

### ***Building the right relationship***

Te Tumu Paeroa treat the people they work with as Kaitiaki. People on the ground make the changes and the need is to acknowledge them.

Not everyone sees success the same way – work at goals first!

Connecting more producers and consumers, telling stories.

### ***Acknowledging experience-based practice and knowledge***

Can stocktake of what we’ve got – farmers have expert knowledge – need to capture and legitimise local knowledge and people’s stories.

### ***Looking after people***

Farming can be really hard sometimes, with great uncertainties. This is an important social issue of resilience and how to create it.

Champion catchments and communities rather than community champions.

### ***Supporting practical measurement and feedback***

From the farmers’ perspective – what are easy and incremental KPIs? How do you know you are making a difference? What could be fitness tests for soils?

If people don’t know their soil, they might not recognise the productive opportunity. More than LUC is carrying capacity, site index, whole landscape approach – collective approach to new industries?

## **9. Annex 2: What are the Strengths in this Field (of soils expertise and practice) that we could Tap into More?**

A further question of the afternoon working sessions identified the assets for future work and progress that the participants across the whole field.

*By considering each of these as a recommendation we might see the strategic path that is being pointed to. What would it look like if each recommendation below was utilised and who would need to be brought together to do it?*

### **Places of Commitment and Vision**

- » Everyone has the same vision – healthy soil.
- » Policy and consumers wanting evidence for good environmental stewardship. Impetus for improving and quantifying.
- » Willingness of all these actors to engage with each other. This is unique to the soil community.
- » Diversity/ vast far-reaching group of knowledge and ability to interact with many different fields.

### **Documented resources**

- » Environmental Reporting Act 2015.
- » 'Our Land' MfE State of the Environment Report 2018.
- » A 60–80-year history and storehouse of science, data, information, and knowledge about soils and soil function.
- » The proposed National Policy Statement on Soils/ Environmental Reporting Act and NPS for versatile soils.
- » Montréal Process Framework. This indicator framework is for 'sustainable forest management'. 12 countries report against this set of indicators, they use different data types and thresholds as they can never get standardised data at such a national/ international scale. Canada report for Montréal protocol for the best way to communicate.

- » Our Land and Water (National Science Challenge) White Paper “co-innovation for high impact indicators”.
- » Liquid carbon pathway work of Dr Christine Jones about soil carbon. Papers available at [www.amazingcarbon.com](http://www.amazingcarbon.com)
- » Role of and nurture of mycorrhizal fungi. Aberdeen Mycorrhiza Research Group

### **Our People Resource**

- » The people who can speak both the soil science language and the language of farmers and planners.
- » Passionate, interdisciplinary people who work in 'soils' with a willingness to co-operate.
- » Tap into farmer knowledge. There is a huge wealth of practical, pragmatic, hands-on knowledge out there that we are not adequately tapping into by any means.
- » Farmer feedback on policy. “Acid test” pun intended.
- » Experience of the existing soil quality monitoring framework – captured in the experts who contributed to its development – we need a 'lessons learned' review.
- » Innovative champions, early adopters of change – farmer willingness to innovate.
- » Citizen Science.
- » Soil mapping and farmer knowledge – Tap into farmer knowledge to capture it and map.
- » Collective observations: Successes and Failures.



## ***Sector Groups***

- » Sectors appear willing to understand how they are managing soil, as a means of connection to custody values.
- » Forestry Sector Environmental committee.
- » FAR – ‘We have scientifically verified information about soil management practices for cropping farmers, e.g. cultivation’.
  
- » Data availability. Farmers, fertiliser companies, and numerous agencies with different IP and organisational constraints. How do we link/integrate and tap into it?
- » Diversity of sectors with different needs but with the common goal of needing information on soil health. This needs coordinating with existing soil health/ quality programmes.
  
- » Regional Council Environmental Reporting including Soil Quality monitoring programmes.
- » Regional Council Land Monitoring Forum and RC Land Managers Group
- » Regional Councils working better together to take ‘standard approach’ and share knowledge and experience.
- » Regional Council collaborative approach with landholders.
  
- » Bridging the expertise in development of development of statistical and measurement frameworks at government level with on the ground performance/management metrics.

## ***Knowledge and Experience Assets***

- » An understanding that soils and their function are a complex interaction of chemistry, biology, physics, climate, and human activity.
- » Understanding of soil chemistry via soil tests. And, (the impact of ) stocking rates on physical soil properties.
- » We need far more informing of questions from an applied perspective rather than from a theoretical perspective.

- » Connecting with the groups working on the ground i.e. connecting new findings with observations (How to get knowledge into the real world).

## ***Ecological and Comparative Advantages***

- » ‘Well exactly that, they are in the paddock!’
- » The ‘naturalness’ that is possible in our farming. We can work with nature a bit easier than some places in the world.
- » Unused potential in terms of natural trials that are being undertaken on different properties operating under different management regimes. Use these, no need to create artificial experimental plots at great expense.

## 10. Annex 3: Guest Speakers, 5 short presentations on soil health and resilience from different sectoral perspectives.

### Jacqui Hahn:

- Jacqui began by talking about the breadth of her and her families' farming businesses in the Waikato across Dairy, Sheep and Beef, farm forestry and feed cropping; and what this means to her as an intergenerational farm. Until recently, she has been leading in the positions of Waikato Dairy Section chair, Vice President of Waikato, and National Dairy Sector Junior Vice Chair in Federated Farmers.
- Jacqui focussed on the kinds of mind-set shifts and challenges between her and her parent's generations, she sees different ideas about how to work with the stock, taking into account lessening impacts on the soil.
- She noted that Federated Farmers and the sector don't have an apparent label or policy of 'soil and health resilience'. But, that the 'sector aims to protect soil, and to optimise its ability to grow plants, and minimise environmental damage'. Current sector focusses are on water, climate change, and biodiversity. And 'science-led solutions that are pragmatic'.
- Jacqui then spoke of how other sectors can better reach farmers and the communication challenges in doing so. 'It's a pity that soil is going to be the last officially off the rank. Most of the things we do on farms to protect water, is about soil.'
- 'We would've had more buy-in from farmers at the outset (about water), had we begun with soil.' Most farm leaders are very supportive of property-focused but non-prescriptive Farm Environment Plans, the key being defying gravity preventing damage to soil structure and keeping as much of the soil on the property as possible.
- The drivers for action are controlled by the (current) 'generation and the level of education of the older and uneducated in the farming sector. For example, on our farm, we employ six people. Five of those are kids who've been expelled or felt compelled to leave early'. 'There needs to be a way to

teach farmers damaged or failed by the education system. It's not just the older generation; it's an expelled generation, too.'

- 'The other factor is controlled by profitability. So, examples of drivers: we have cross-bred cows, rather than lighter Jerseys. And that's because they have more profitable offspring, and we don't have to milk so many cows -- which means more money, and less time.'
- Jacqui illustrated the dynamic factors in the choices of which feed species between profitability, impacts on soil, less need for herbicide and maintaining cover"
- 'Lately I am hearing that because dairy and irrigation grow soil, arable farmers in the South are interested in buying struggling dairy farms for arable purposes.'
- 'And in terms of gaps, we don't know enough about biomass under our feet.'
- 'We grassland farmers do have a problem. We grow four tons of grass dry-matter per year less than we used to. Who knows exactly why? I have observed light soils when not grazed or held in place by deep roots, quickly becoming lighter and more erodible.'
- 'A large chunk of New Zealand's most productive land is sitting under buildings, and this continues unabated.'
- 'Lack of a bigger-picture thinking: Good policy must be driven by science and field-proofed, not perceptions-based.'
- 'I am infamous for my part in talking about cadmium, an overlooked issue.... the policy to manage cadmium on farms was rubbish. It focused primarily on soil concentrations, rather than what animal or plant accumulation causes are. Which had no correlation to soil concentration.'
- 'So please listen to the farmers' voices. They are a large part of the solution, farmers want to protect their future which lies in looking after the soil.'
- 'And I know you want to save the world today; but from my interaction with the Rural Support Trust, the burden of action is falling on a shrinking proportion, rapidly increasing numbers of farmers are not coping with the stress. Will there be more than one solution? Like the play on words about the "road works" sign, I certainly hope so!'

### **Diana Mathers:**

- Diana is a research manager for farm systems for FAR (Foundation for Arable Research). When young, her parents moved her family from Bristol, England to Hawke's Bay. And a major factor in their choice to settle was because of the Hastings silt loam soils.
- She noted the difference of mind-sets 'When we got here, (Dad) was appalled to discover that New Zealanders referred to soil as 'dirt'. "Dirt", he said, "is what is behind small boys' ears! And don't they realise that all of life depends on the soil?" So for Dad, his morning started with an hour's digging in the garden, or on his nursery soil, and our recreation was to go out and get compost -- and what he called leaf mould -- so that he could add it to the soil. And then he would scoop it up, and he would smell it. And he would say "This is what good soil smells like". And as a young child, I kind of had that ingrained into me. And I still think of that as being a good measure of soil health -- to be able to pick it up and smell it.'
- Now, 'I'm working with the arable sector. And I would have to say that Dad would probably be slightly appalled at some of the practices that go on, relating to soil.'
- She noted the Arable sector is 'A cropping sector, and we also have animals on the farm. So, there's a lot of intensity around soil workings. Planting, harvesting, rotations can come and go in a four-month cycle, and so there's a big emphasis on the soil for our farmers'.
- What do our farmers expect from their soils? They expect them to be sustaining and resilient. And that is a big ask.
- 'What do I mean by "sustaining"?' An arable farmer will expect that the crops that he plants will yield a good yield, given that he's going to manage his nutrients and his other resources in an optimal way.
- This includes 'that our crop health is going to be sustained by the soil. So, we don't want soil-borne diseases and soil-borne pests to start building up'.
- 'What do I mean by "resilient"?' We expect our soil systems to be resilient to the arable system. When we (do) work and farm environment workshops, where we have a soil management component, we talk about resilience, and

we find that farmers are pretty confident around their cultivation practices.' But sometimes, when it falls down is when the harvester comes in. Because often they don't have control over the harvesting process.' 'We expect our soils to be able to withstand that sort of mechanical intervention, and also to bounce back.'

- 'We also want our soils to be resilient to climactic effects. Not only do they have to be able to hold onto water, but they also need to be able to transport water away -- so, dealing with both ends of that spectrum... expecting the soil to do that piece of work for the system.'
- FAR is going to be starting off a bit of work on (soil erosion and sediment movement).
- 'As a sector, we've got a number of work programmes in place.' Stepping up our soil monitoring programme. 'We want some help here -- we've got some ideas about what indicators we need to collect, but perhaps more information... We need more of an idea about soil health indicators... I would like to see farmers begin to see soil monitoring on their farms, so that we can measure changes on farmed soils (as well as FAR sites).'
- 'We need more work about machinery impacts... understanding how we can manage that better for farmers.'
- 'We probably need to do some more work about nutrient supply, which is the soil's service. And... probably, around residues... in arable systems, everything is harvested, usually... and very little is going back into the soil, to maintain that organic content in the soil.'
- 'So, we have a portfolio of work. We would like to work with other sectors, because farmers are very cross-sectoral, and also with some of the regional council programmes.'

### John Drewry:

- John now works with Manaaki Whenua – Landcare Research and until recently was at Greater Wellington Regional Council. He works particularly in the area of soil quality – and a few colleagues here are also currently involved with that. John gave his talk on behalf of two regional sector groups.
- ‘One’s called the Land Monitoring Forum, which deals with the science side of soil, soil quality and monitoring, including a suite of trace elements as well. And that stems from about 18 years ago, where you may have heard of the 500 Soils programme, which was started with regional councils and Landcare Research.’
- Also ‘the Land Managers group. These are the team that go out on the farms as mentioned today, produce the Farm Environment Plans, traditionally looking at soil conservation, erosion control; but largely these days, also focusing on nutrient management, better practices, and other things that farmers are interested in, in respect to soil’.
- John spoke to the current ‘roadmap’ recently developed by these two groups together. ‘I don’t think it’s off to printer’s yet, but all the regional councils have contributed to that’.
- ‘The soil community are launching... a more integrative and holistic framework. This time, things like greenhouse gas emissions have been included, and our farmers are making decisions based on social aspects that are becoming more important, and the councils are becoming more aware of the importance of those.’
- ‘Regional councils have a number of programmes going on. One is called EMaR, which is Environmental Monitoring and Reporting; that’s trying to improve the reporting practices across the sixteen regional councils. So collectively, the regional councils are trying to become a little more holistic in their sampling and monitoring programmes, to help with the needs that the community are wanting.’
- ‘Collectively, the regional councils have produced a Science and Research Strategy, several years ago... But other things that have happened in the

meantime: MPI, with Manaaki Whenua, have produced the *Future Requirements of Soil Management in New Zealand*.’

- ‘The combined roadmap is a strategy for the Land Managers Group and the Land Monitoring Forum. [They’ve] selected a number of soil goals, increased landscape resilience. ...things like adverse weather effects – drought for example -- and how to help farmers work with those circumstances, and what it means for the soil; reducing the adverse impacts from land, ensuring healthy soil, and there is obviously the debate around that here today, in terms of what that can include.’
- ‘There’s a programme going on with Auckland University, looking at DNA and the communities of bacteria within the soils.’
- ‘We also do a suite of soil contaminants; so, we’ve heard about cadmium today but there’s a number of other ones. And these can be diffuse contaminants for various reasons, such as arsenic, lead, copper, zinc, and so on... a lot more work needs to be done in that area.’
- ‘Improving the long-term reporting... What does it mean in a national sense? Again, Stats New Zealand and MfE recently produced their report (Our Land 2018), to pull some of that together. But one of the issues is that... each council does its own thing – so there’s that dance of usability, and then integration needs some improvement... And also building capacity among staff and people out in the community, and influencing policy effectiveness - - which has been mentioned today.’
- Important are ‘the tools that are needed. So, they’re listed at the bottom [See slides]. And they’re in no particular order, these things, but one of them is to turn on and extend the suite of ecosystem services and spatial modelling in an integrated sense, can help regional councils and community make decisions. Plus, enhance SMAP. So, regional councils largely fund the mapping of SMAP throughout the country. A lot of the science that’s done is funded by MBIE, for example, but actual mapping is largely funded by regional councils. They’re also interested in land cover and erosion; [versatile] soils; the extent of urbanisation such as areas of Auckland,

Waikato, Tasman, on these versatile soils, and hence the very productive ones.'

- John gave a second short talk about the work on soil quality and some activities and issues affecting Environment Southland, on behalf of Tim Ellis, the soil and freshwater science manager.
- 'There's a number of things going on down there. One thing they had noticed is that some soils, for example -- uniform soils, well-draining -- they've noticed a lot of localised ponding of water, leaching of water... And the question for them is are these management effects, or -- you know, why are these effects happening?'
- 'Another thing they are looking at is improving the hydraulic data in SMAP. Again, regional councils have largely funded the bulk of the mapping. But there is a need, in terms of the science, to improve hydraulic properties in SMAP. And often, we'll find that the area that needs improvement is the area around saturation. So, that's water holding capacity, water content, but also the flow and infiltration characteristics around those -- around where the soil is saturated, or near-saturated. And often that's quite difficult to measure.'
- 'Fine soils are being investigated in Southland, and a number of people have been involved, including several Environment Southland staff, themselves, and also some PhD students as well. Again, [we] mentioned the saturation and field capacity where soil naturally drains after a couple of days because that area was quite [unintelligible 0:40:23-26]. But it's also important for nutrient movement characteristics, as well.'
- There are also 'a couple of PhD students' projects that I'll mention now -- Kirstin, who's in her first year... being supervised at Lincoln University. Their aim is to quantify and model the soil hydrological response under tile drainage. So, a number of soils that poorly drain in Southland... a number of questions are being asked: How is water moving through the profile? How does this effect things like Overseer? Overseer probably doesn't take into account this particularly well at the moment.'

- 'Another PhD student, in their second year, is looking at how soils affect nitrate attenuation... so there is a gap in the knowledge there. And this is looking at various ways of looking at denitrification in lab and field experiments.'

### **Richard Parkes:**

- Richard has been working in soils and land management from the beginning of his career in New South Wales, Australia. He works with a colleague, Bruce Lorimer, who would purchase and turn around poorly performing farms, mainly through improvement in their soils and management. His current role is the Environment Capability Manager with Beef & Lamb.
- Richard gave an overview of the direction in which Beef & Lamb is heading.
- 'Farms are dealing with a lot of stuff, a lot of complexity and change, and a lot of people telling them what they should or shouldn't be doing. And a lot of that's a pretty negative story, and that has a big impact on farmer pride. And I think we see how that manifests itself in a whole lot of ways; at the very least, people just withdrawing from the conversation -- you know, it's the old 'fight or fly'.'
- 'We've got an overall strategy for Beef & Lamb<sup>1</sup>... that's about thriving farming communities... it's recognising that we're dealing with people, and we're dealing with farming communities... that those farming communities are valued by all New Zealand.'
- 'This is fundamental to... building the farmer pride that we were talking about. And I think soils can play a key role in this, because it's about farmers being able to tell their story, and take pride in the resources that they have. So, we look at the French and the pride they take around Terroir... soils have a role to play, particularly in farmers developing some of their identity around who they are and where they come from, which could play quite a key role in developing that pride.'

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<sup>1</sup> B+LNZ Strategy: <https://beeflambnz.com/about-blNZ/blnz-strategy-2017-22>

- 'One of the key pillars underpinning Beef & Lamb's overall strategy is "enhancing our environmental position".' That 'farms are recognised for their commitment for the environment, while maintaining the productive capacity of the land. So, that's very much about telling their story and starting to have other people starting to tell that story for them.'
- 'Beef & Lamb's environment strategy<sup>2</sup>, the vision, is for... farmers to become world-leading stewards of the natural environment, and thriving farming communities. And that's underpinned by four pillars: which is cleaner water, towards CO2 or carbon neutral, thriving biodiversity, and healthy soils....You can see that soils are pretty front-and-central in our environment strategy and, hence, the overall Beef & Lamb strategy.'
- 'Some of these needs... in the soil space as we're moving forward, by no means the whole list... it's how can we measure the impact that they're having on soil... the impacts for the better, having better information around the soil that they do have. And a lot of my work... how we can set up a framework – both at the farm level, the catchment, and throughout farmer councils – where we can start taking a stock-take of where things are at... before we can move forward to knowing where we want to go, and having a vision for the future.'
- 'Then we can identify what we need to do to move towards that vision. And then the key to this is then being able to tell that story.'
- 'We're very interested in taking that natural capital approach (including) with ecosystem services... it's supporting the use of land use classification as a national framework. Bringing into the conversation things like – diversity and resilience in the landscape, attenuation capacity along flow pathways. And again, how do we get this to translate into some meaningful action on the ground – because that's really what's going to improve the situation.'

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<sup>2</sup> At the time of the workshop the Environment Strategy had not yet been formally launched. The updated Environment Strategy can be accessed at: <https://beeflambnz.com/environment-strategy>