



# Future requirements for soil management in New Zealand – a summary

## **Publisher**

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# Introduction

Soil is fundamental to life on Earth – it underpins food, feed, fibre and fuel production. Soil also supports clean water, nutrient cycling and carbon storage, and hosts more than one-quarter of the world's biodiversity.

Soil is formed through the complex interaction of factors such as climate, underlying geological material, vegetation, animals, humans, topography, and time. It can take thousands of years to form – meaning soil resources are non-renewable in a human lifetime.



# Project background

With agriculture accounting for close to two-thirds of our merchandise exports, New Zealand is highly dependent on the availability and condition of our soil resource to support our primary industries. To determine the state of soil management in New Zealand, the Ministry for Primary Industries (MPI) commissioned a three-phased project to address the following questions:

**Phase 1: Looking back** – What are the current and emerging pressures to New Zealand's soil resource? Do we have the required knowledge and capability to meet these pressures?

**Phase 2: Looking out** – What are we doing in regard to soil management? Is it enough, and can we learn anything from international case studies?

**Phase 3: Looking forward** – What do we want from New Zealand soils? What policy, practice, science and institutional shifts can we make to get there?

These three phases of work should help inform future policy formulation in government, planning and regulation in regional councils, as well as practice principles and sector strategies for landowners, business and industry.

To test the project findings, a steering group was established. The steering group was comprised of representatives from MPI, the Ministry for the Environment, regional councils, the Foundation for Arable Research and Federated Farmers of New Zealand. The project findings were also tested with key stakeholder groups and individuals through one-on-one interviews, workshops and forums.

The resulting three reports commissioned by MPI and led by the National Land Resource and its collaborators, included input from Crown research institutes (CRIs), the University of Waikato, regional councils and the primary sector.

## A need for action

New Zealand ranks third out of OECD countries for land per capita, however, there is considerable pressure on the availability of land, particularly soils classified as “versatile” (soils that are capable of growing a wide range of crops).

Approximately half the country's 26 million hectares is used by primary industries. Another one-third of

New Zealand's land is legally protected for conservation purposes. Of specific concern is that a disproportionate amount of the soil being used for urban development is on our most versatile soils, which is limited to 5.5 percent of New Zealand's total land area (1.389 million hectares).

## Versatile soils

“Versatile” or “high-class soils” are suited to a wide range of uses – including cultivation and cropping which are very demanding on soil. National analysis of our most versatile soils shows the area is limited to about 5.5 percent of the area of New Zealand. (*Survey of New Zealand Soil Orders* by Allan Hewitt, Landcare Research, 2013)

## Today's operating landscape

Over the past 25 years, productivity in the primary sectors has rapidly grown. Since 2011, the value of agriculture, fisheries and forestry exports has grown from \$31.9 billion to an estimated \$35.2 billion for the year ended 30 June 2015 and is forecast to grow to \$41.3 billion in 2019 (MPI 2015).

Significant growth will be required to meet the Government's aims of doubling export value by 2025 as set out in its Business Growth Agenda. To stay competitive, New Zealand will also need to shift to high-value food and beverage products. Matching opportunity with our finite natural resources to maximise the value to the New Zealand economy will require a more co-ordinated approach than what was required in the past.

Practicing excellent land and soil management underpins product integrity and is crucial to New Zealand's brand and supporting premium prices in global markets.

This direction is supported by the independent Māori Economic Development Panel, which has set out a plan for Māori economic development to 2040. Central to this plan, is raising the productivity of Māori-owned land assets in a sustainable way (in line with principles of kaitiakitanga and whanaungatanga) and using this as part of Brand Māori and Brand New Zealand.

## Planning for the future

As our soil and land resources come under increasing pressure, hard choices need to be made on optimum and sustained use. Decisions made today will affect the prosperity and well-being of future generations.

Critical to better decision-making by officials, businesses, landowners and the general public is clarity on the existing and emergent pressures, threats, opportunities and impacts on our soil and associated natural resources. This is recognised globally and

reflected in the establishment of the United Nations Global Soil Partnership in 2011 and the Intergovernmental Technical Panel on Soils in 2013. The aims are to support sharing science and technical advice, and move towards better governance of soil assets.



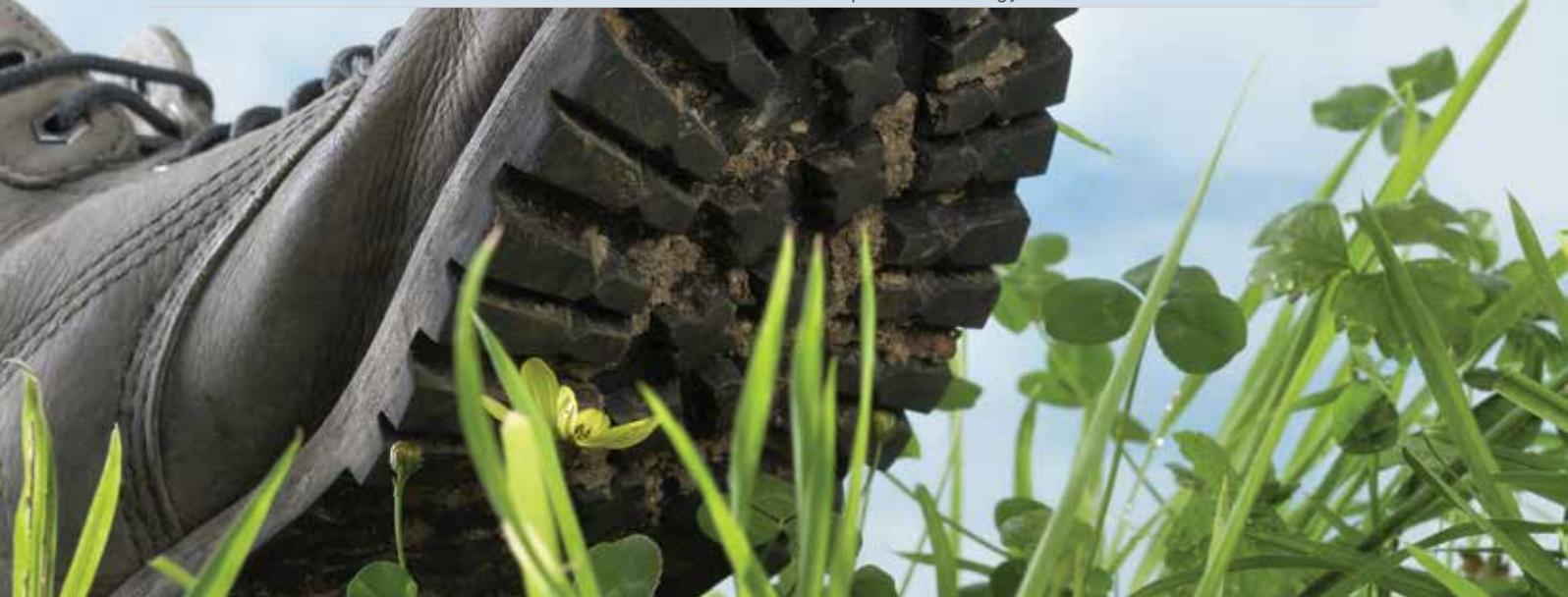
# Phase 1 – Looking back

The first step in Phase 1 was to consider the pressures on New Zealand's soil resource, and then identify the drivers of those pressures and the resulting impacts.

Social, economic and cultural drivers underpin the tradition we have in land development and land-based industries. These drivers create pressures, as well as opportunities as noted in the table below.

Table 1. Drivers, how they link to pressures, and potential trends and opportunities

Driver	Link to pressures	Trend and opportunity
Social and societal	Has built the productive capacity of much of the national soil resource for a diversity of land uses. Ongoing pressures (for example, risk of erosion) has the potential to limit function.	Important determining factors in the choices that are made about land use and associated practices and can influence other pressures. Increasing societal pressure for change (social license to operate) will likely shift the deeply embedded views on the use of our land.
Economic	Ongoing and increasing pressure to produce more from the land can result in a variety of threats.	These pressures are likely to grow (for example, with the price of land and current industry strategies), but it could be moderated by focusing more on "value-add" products and global markets.
Policy and practice	Technologies have focused on overcoming limitations in provision of services, while policy has been retrospective, which has led to enabling instead of preventing many of the pressures.	The challenge will be to regain lost ground in policy and practices. There may be opportunities in emerging approaches, such as a greater focus on natural capital and clearer recognition of the link between land and water.
Cultural values	There is significant potential economic value of large areas of Māori-owned land that has yet to be realised.	The opportunity exists within the principles of kaitiakitanga and whanaungatanga to realise the potential economic opportunity from Māori land holdings, as well as to apply these concepts more generally. This approach aligns with a large number of Treaty settlements and the Māori Economic Development Strategy.



There are many factors contributing to the attitudes and behaviours surrounding land and its use within the primary sector. At a regional and national level this can range from the characteristics of farming to the configuration of the primary sector. At the farm level factors can include farm type, farm size, level of income and debt on-farm, current level of intensification, whether a successor has been identified (suggesting a long-term commitment), diversity of the farming operations, and local availability of specialist services.

Collectively, drivers generate four overarching pressures:

- **Intensification:** Agricultural intensification, which is defined as a production increase per unit land area. Intensification is achieved through greater use of inputs (such as feed, fertiliser or labour), lifting system efficiencies (such as improved technology, management or genetics), or system modifications (such as irrigation or land clearance).
- **Land-use change:** Competition for land use is reflected in urban expansion, to large-scale conversion from dry-land sheep to intensive irrigated dairy farming, through to poor land-use choices on sloping or highly erodible land.
- **Climatic pressures:** Climate change has the potential to increase erosion rates through hotter, drier conditions that make soils more susceptible to wind erosion, as well as intense rainfall events that can trigger erosion and shallow landslides. Sea-level rise is also likely to cause changes particularly in coastal areas, while the changes in carbon dioxide will alter biogeochemical cycling and microbial processes within soil resources.
- **Legacy effects:** Agriculture in New Zealand is the largest sector of the tradable economy. Our biologically dependent economy has resulted in significant modification of land and soils through activities such as forest clearance and land development, fertiliser application and cultivation.

Together, these pressures can impact on the quality and integrity of soil resources. Because soil resources also provide a number of regulating services, such as filtering, water and greenhouse gas regulation, these pressures also affect the quality and integrity of other natural resources, such as water and air.

Experts identified six specific pressures as significant to New Zealand soils. These include:

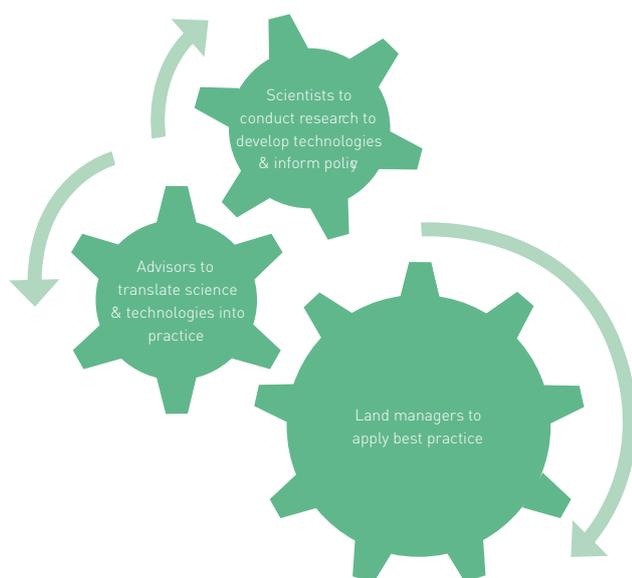
- **Irrigation (intensification):** This is a pressure because of the rapid expansion on soils with little natural capital (such as stony soils or hilly terrain) and because very little is known about the long-term implications of irrigation on soil function in New Zealand.
- **Addition of chemicals (intensification):** This is a pressure because it poses a threat to freshwater quality. It is also becoming socially less acceptable and may affect social licence to operate.
- **Inadequate vegetation cover (land-use change):** This pressure results in erosion and sediment transfer to freshwater, particularly in erodible hill country and on fragile lowland soils under cultivation. An estimated 1.14 million hectares of hill country is classified as erosion prone in New Zealand, with erosion estimated to cost \$100 to \$150 million each year in loss of nutrients and production, along with damage to infrastructure and aquatic habitat (MfE, 2007).
- **Fragmentation of land and spill-over from urban expansion reducing the availability of versatile soils (land-use change):** This pressure is based on the rate of urban expansion (estimated at five percent each year) and the irreversible nature of the impact, as well as the flow-on effect of triggering intensification elsewhere.
- **Poor matching of land use to inherent capability (land-use change):** This issue is becoming more widespread and causes pressure when the land-use activity (for example, production forestry on steep, highly erodible land or putting in crops on fragile or sloping land). An estimated 65 percent of soils have a physical limitation to pastoral agriculture and 95 percent are unsuitable for horticulture and yet the pressure to develop these soils is increasing.
- **Past deforestation (legacy effects and climatic pressures):** This pressure has an ongoing impact. The cost of erosion together with likelihood of increased erosion with climate change suggests this as one of the highest priority pressures.

Pests and diseases pose pressure to New Zealand soils. At present, this pressure is managed well by the sectors, but with changes in climate there is the potential impact of new control methods and treatments on soils.

## Considering our current capabilities

Capability to respond to identified pressures requires a well-functioning capability system that has the necessary knowledge and includes scientists, advisors, and land managers.

Figure 1. Capability system requirements



Source: Landcare Research.

Below we consider each part of the capability system.

**Scientists** – Crown research institutes account for a significant proportion of New Zealand’s overall research effort. According to Ministry of Business, Innovation and Employment estimates, the number of agricultural and horticultural scientists (which includes soil scientists) rose by about eight percent between 2010 and 2012, however, there are still too few scientists to fill available vacancies. Scientist roles in specialist areas, such as soil science, are particularly challenging to fill. That may increase in coming years as tertiary organisations that offer degrees in soil science note that enrolment remains low compared to other degrees.

**Advisors** – Advisory roles range from general advisors through to highly specialised experts. Up until the 1980s, much of this expertise sat in the Advisory Services Division of the former Ministry of Agriculture and Forestry (now part of MPI). When this division was disbanded, some advisory services were picked up by large agricultural service companies, regional councils, sector groups and consultants, but advisory coverage is more ad hoc under this framework. The MPI-commissioned *Future capability needs for primary industries* (April 2014) notes that there is a critical need for “more accredited rural professionals/providers to transfer new techniques and knowledge”.

**Land managers** – Future capability needs for primary industries forecasts that across the primary industries there will be a need to have a workforce that has been upskilled in what are traditional primary industry occupations, and a growing demand for professional skills such as engineering, science and management. To address this issue, MPI is working with the industry and other government agencies to undertake actions to attract, train and retain talented people in the sector.

## State of soil and land information

Resource information provides the critical evidence required to assess, use and monitor our soils and lands. (The Environmental Domain Plan led by Statistics New Zealand in 2013 explored this issue).

Key soil information sources include (the below list is not exhaustive):

- S-map (a digital soil spatial information system);
- Soil Quality Database;
- Land Use Capability System based on the New Zealand Land Resource Inventory;
- Land Cover DataBase;
- New Zealand’s Land Use Map (as part of the Land Use and Carbon Analysis System); and
- Land Information New Zealand (LINZ) topographic data.

The Department of Conservation, regional councils, Ngā Whenua Rāhui, the Queen Elizabeth II National Trust and other organisations also hold resource information and maps for a variety of purposes.

As the list above suggests, land-use information in New Zealand is fragmented, at various scales and, in many cases, difficult to access. Most information sources are incomplete and lack of secure funding means that many are not maintained to the level required for quality data. Currently, most land-use related projects must use a patchwork approach of pulling together information from several sources to ascertain the condition and trend of land, land use and soils.

There is a need and opportunity to create a single point of entry into the available research and resources, data and experts. While the National Land Resource Centre has made some progress in this area, as have LINZ and the Geospatial Office, there is a need for a more co-ordinated national strategy and suitable resourcing.

## Soil science funding

There are a number of government funding sources (such as Ministry of Business, Innovation and Employment contestable funds, National Science Challenges, Sustainable Farming Fund and Contaminated Sites Remediation Fund), along with regional economic development and industry initiatives that support various soil science work.

Without clear national research priorities, however, it is difficult to ascertain the amount of investment dedicated to soil priorities, and to evaluate the impact of this funding. The National Science Challenges are an opportunity to address part of this issue as they are designed to take a more strategic approach to the Government's science investment. Most relevant to addressing pressures and impacts on the soil is the Our Land and Water National Science Challenge.

## Opportunities to increase readiness

Based on the findings of Phase 1, a number of opportunities to increase readiness were identified. These include:

- stable investment to upgrade and enhance nationally agreed resource information;
- secure a number of long-term soils trials or experiments;
- develop foresight projects that are based on tractable problems to identify possible trends and solutions;
- initiate research projects that are highly relevant to New Zealand, consider long-term implications of emerging pressures and actions, and are outside of traditional research areas (such as implications of intensification on fragile land).

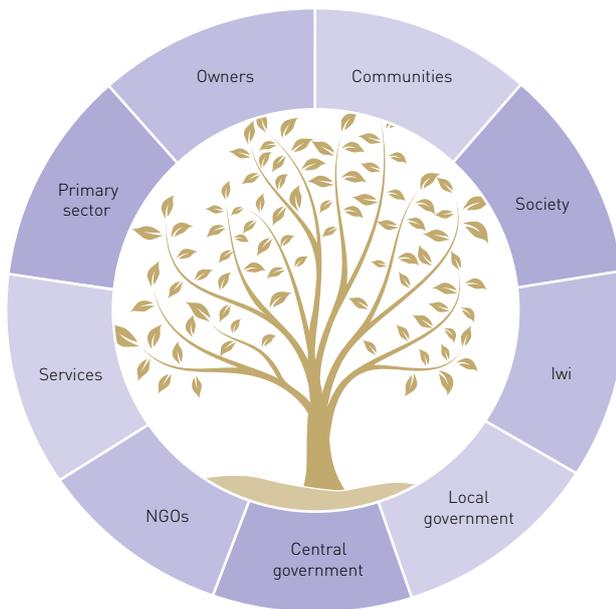


## Phase 2 – Looking out

Phase 2 of this project looks at the state of soil management in New Zealand, how to optimise the use of our land resources, and the readiness of soils knowledge and capability to develop policy and support stewardship.

Because of its close link with land and its ownership, the governance of soil in New Zealand is complex and involves a range of organisations, sectors and individuals as noted in Figure 2. Complexities include property rights (private and public), competing resource use (production within environmental limits), governance (ownership, use and guardianship) and the demands and variety of stakeholders for the finite services the land provides.

Figure 2. Main stakeholders with an interest in soil and land in New Zealand



Source: Landcare Research.

Because stakeholders do not operate in isolation, building partnerships and achieving good alignment between the main stakeholders is critical to ensure progressive stewardship of soils.

The Land & Water Forum brings together 62 organisations across industry groups, electricity generators, environmental and recreational non-governmental organisations, iwi, scientists, and central and local government, to develop a common direction for freshwater management in New Zealand (currently this does not include land). The forum demonstrates the potential for bringing key stakeholders together to

collaborate on nationally agreed outcomes.

A similar effort on soil management has considerable merit.

### On the ground

Collectively, the primary industries play a significant role in the stewardship of New Zealand's soil resources and land. This is a diverse group, however, with a broad spectrum of industry groups that represent production sectors, co-operatively owned companies, along with individual producers and growers. In addition, individual sectors have different soil needs and varying impacts on soil resources.

To determine the current state of soil management, for Phase 2 the project team tested information with key individuals or groups within each sector to determine:

- pressures and relative priorities;
- initiatives used in response to these pressures;
- relative uptake and adoption of initiatives, as well as their effectiveness;
- drivers of adoption.

The analysis suggests individual sectors perceive a similar set of pressures as identified in Phase 1.

The relative importance of pressures, however, varies by sector, reflecting both the type of land and soil managed by the sector and the pressures generated by the practices employed.

Most sectors are actively managing threats, particularly those that affect their productivity and profitability. There are a number of sector-specific initiatives used to manage soils, as well as practices that are common among the sectors, including codes of practice and management guidelines, farm-management approaches, nutrient budgeting tools, and smart or precision agriculture.

Partnerships between the primary sector and the service sector (such as Irrigation New Zealand and the Foundation for Arable Research) are successful and provide crucial education and extension services.

Uptake and adoption of soil management practices varies according to a range of factors, including access to investment, education, maturity of the sector, and the strength of the service sector partnerships. A major gap across all sectors is lack of monitoring and evaluation of the use of and uptake of soil management measures.

## Policy and planning framework

New Zealand has a range of regulatory and non-regulatory measures to support economic growth within environmental limits. Limitations of the current framework, however, include that soils are not recognised as a finite resource and that there is a need to protect soil functions against current and future pressures on soils. Another area of weakness, is that the framework does not match land use to soil capability.

### Regulatory

At the national level there are a range of regulatory instruments that provide some direct or indirect protection to soil resources. These policies tend towards regulating activities rather than ensuring outcomes, and often do not recognise the finite nature of soils.

At the regional level, rules and regulations are in place to address pressures on soils, but these vary from region to region. Intensification pressures are most recognised, with climatic pressures least well identified or addressed.

To address the pressures identified through this process, the overall framework needs to better anticipate and address emergent land uses, such as access to irrigation water and new technologies, by defining the underlying soil quality boundaries for sustained function.

### Non-regulatory

There are a number of initiatives and approaches, including schemes, education programmes and partnerships. To date, most non-regulatory efforts have focused on addressing pressures of intensification, land-use change and climate as they relate to erodible hill country.

Collectively, non-regulatory efforts have had the effect of taking fragile land out of agricultural use and into exotic or indigenous forestry, but uptake is susceptible to market forces.

### Is it enough?

Sectors are both aware and have initiatives in place to address pressures on our soil resources, but the research team looked at whether these current initiatives are enough to reduce these pressures. The top six pressures identified in Phase 1 were considered by the researchers as noted in Table 2.

### Measuring up

As part of Phase 2, a benchmarking framework was established to compare New Zealand's performance with our international peers, including the United States, Canada, Australia, England and Wales, Scotland and Denmark. That review suggests that there are five key areas for safeguarding soil resources:

1. increasing awareness about soils;
2. quality data and closing knowledge gaps;
3. integrating soil management into policy and planning;
4. developing specific legislation for soil management;
5. managing soil pressures.

While New Zealand is not behind its peers, there are opportunities to learn from several of these countries to improve the stewardship of our soil resources.

As a small, biologically based country, New Zealand has the ability to develop an integrated framework that could realise enduring economic, environmental and social benefits, as well as provide an exemplar for other countries.

Table 2. Pressure, initiatives in place and assessment of impact of those initiatives.

Pressure	Initiatives in place	Is it enough?
Irrigation (intensification)	Management of this pressure by the sectors is driven by likely gains in product yield and quality, profitability, improvements in water-use efficiency and cost savings. Freshwater reforms require better irrigation practices, but are targeted at protecting against impacts on water quality and allocation, not specifically soil function.	Despite the range of good practices there are still significant opportunities to increase water use efficiency through wider adoption, better irrigation management practices, and in some cases investment in technology. Animal management on irrigated soils requires adherence to good management practices.
Addition of chemicals (intensification)	Affected sectors are actively managing this pressure, driven by a combination of conditions of supply, market access and regulations through the freshwater reforms.	Existing limits on nutrient losses are defined on the basis of freshwater quality, with no specific limits on nutrients or contaminants in soils.
Inadequate vegetation cover (land-use change)	Affected sectors have developed strong partnerships to manage this pressure, particularly in erodible hill country.	An emerging risk is the increased use of annual crops, short rotation pastures and forage crops, increasing the risk of soil loss during periods when soils are bare.
Fragmentation of land and spill-over from urban expansion reducing the availability of versatile soils (land-use change)	While there is awareness of the pressure, there is limited ability to manage or reduce this pressure when land prices and market forces encourage fragmentation and there is little regulatory control.	Overall, analysis suggests not enough is being done to manage this issue. Currently, the area is small but it may grow over time.
Poor matching of land use to inherent capability (land-use change)	The scale and speed of some land-use change is an issue, for example the rapid expansion of dairying onto shallow soils in Canterbury. While the New Zealand Land Use Capability Classification System helps define use of land, it is not always the primary determinant of how land is actually used or managed. This is due to the complexities of land ownership, governance, and day-to-day decision-making.	As a consequence of this complexity and without clear leadership beyond the sectors, not enough is being done to manage this increasingly critical pressure.
Past deforestation (legacy effects and climatic pressures)	In some areas, past deforestation has not been mitigated and still impacts on erodibility of land.	The cost of erosion together with likelihood of increased erosion with climate change suggests this remains as a significant pressure.
Pests and diseases (climatic changes)	Currently well managed by the sectors.	While this pressure is characterised as under control, it is important to remain mindful of the potential impact of new control methods and treatments on soils.

# Phase 3 – Looking forward

Using the findings from Phases 1 and 2, Phase 3 outlines actions to optimise the sustainable use of soil and land resources.

A guiding vision for New Zealand soils was developed as part of Phase 3:

To recognise and explicitly manage our fragile, finite and precious soils to ensure productive and protective functions for all society.

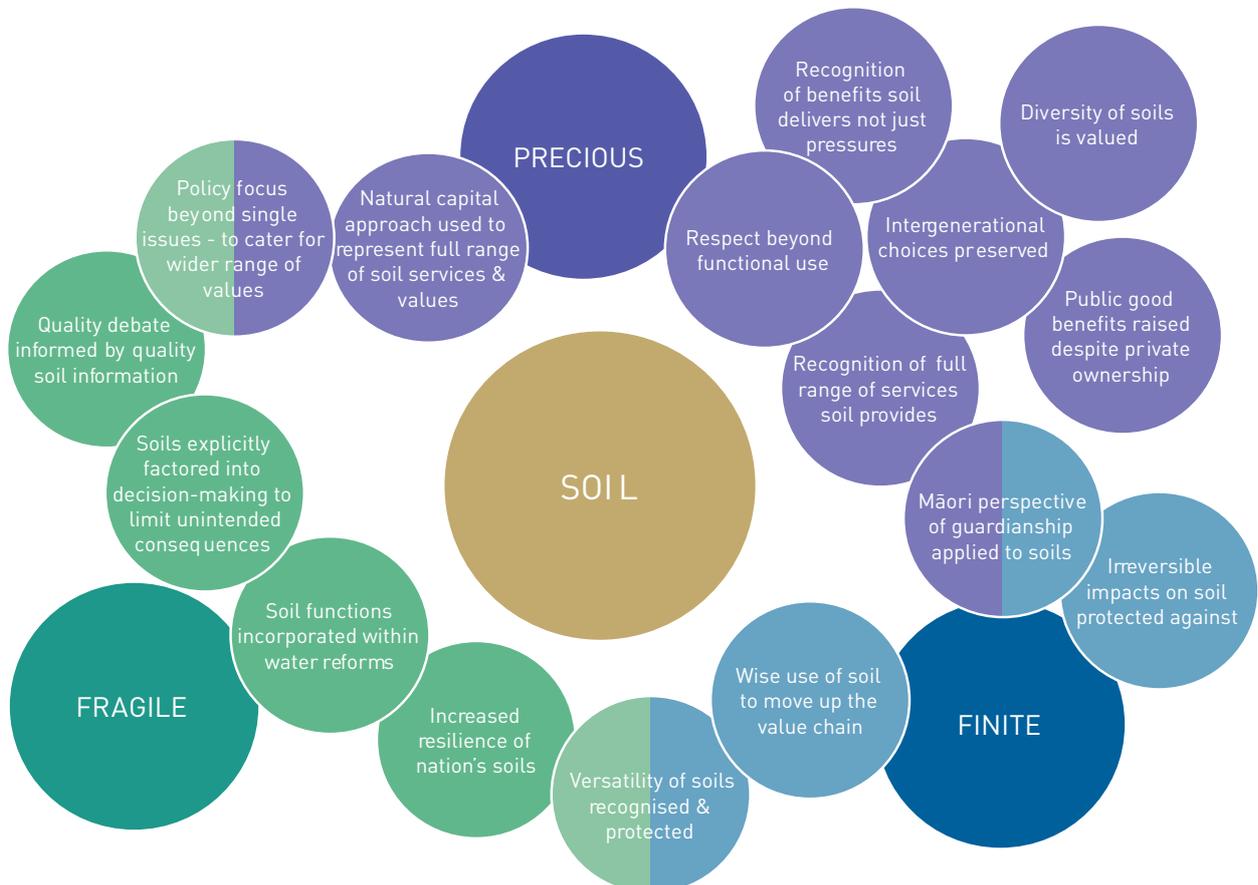
The project findings suggest there are gaps in the understanding of information on soil resources as illustrated in Figure 3. As part of this, there is a lack of understanding of the interconnections between people, soils, plants, and animals. As a consequence, society is poorly informed on the importance of soils and wise soil management.

## Could we manage our soil resources better as a country?

Based on the findings in Phase 2, it is apparent that there are significant opportunities for better soil management to address current and future pressures. Greater monitoring and evaluation of soil management initiatives is also needed to better understand levels of uptake and effectiveness.

The use of our versatile soils and land to subdivision has been identified as an important issue. In recent years, New Zealand's population has grown at one of the fastest rates in the OECD (New Zealand Productivity Commission 2015). Most of this growth has been concentrated in cities, especially Auckland. Growing populations need more housing, yet New Zealand cities have struggled to provide enough land to meet this demand, turning towards rezoning and bringing rural land to the housing market.

Figure 3. Aspirations for New Zealand soils, recognising they are fragile, finite and precious



In addition, soil management needs have not been nationally prioritised. This has resulted in gaps in understanding, particularly about the long-term implications of emerging pressures. Compounding this lack of nationally agreed direction is a fragmented approach to soil resource information. To ensure good soil management, we need a well-connected and functioning knowledge infrastructure that includes scientists to conduct research to develop technologies and inform policy, advisors to translate and pass on science and technologies, and land managers to apply best practice.

There has been a concerted effort to move NZ Inc towards exporting high-value, premium products that command top prices, but parts of the primary sector continue to intensify to serve a high-volume commodities market. In key areas New Zealand has not yet committed to moving up the value chain through premium products and robust environmental credentials.

In the coming years it will be crucial to avoid making decisions on land use that can have long-lasting or irreversible impacts on the ability of soils to provide services. Such a shift in approach could result in a reduction in key pressures and better realise the full potential of New Zealand's soils.



# Conclusions

Figure 4. Proposed New Zealand Soil Framework for resilience and growth



Source: Landcare Research.

## Leadership and partnership

A common theme emerged through all three phases that to do things differently society needs to view soil differently, with greater leadership and collaboration required. The wide range of instruments and mechanisms that the Government can use for managing natural resources (such as national policy statements and national environmental standards under the Resource Management Act 1991 (RMA)) can serve as a framework for building these partnerships and providing nationally agreed direction.

## Actions proposed

1. Establish a National Soil Management Group to:
  - a. develop a national soil strategy;
  - b. provide leadership;
  - c. inform and advise policy and practice;
  - d. provide a national perspective on research;
  - e. promote and monitor a capability growth strategy;
  - f. act as an advocate for soils.
2. Develop a national soil management plan to set direction on the use, policies capabilities, and research on soils. This plan should be underpinned by:
  - a. partnership across government, sectors and science;

- b. driven by the principles of kaitiakitanga and whanaungatanga;
- c. recognise the role and value of soils in land productivity and the integrity of natural resources (including freshwater).

## Recognition and readiness

Soil and its life-supporting provisioning and regulating services are poorly understood. To increase awareness there is a need to quantify both the actual and potential realisable economic value derived from our soils and the services they provide. Using globally recognised approaches, including an ecosystems services quantification framework or a system of environmental-economic accounting, would increase the visibility of soil resources and support sustainable management practices.

Beyond awareness, there is a need to shift from “owning” soils to “stewarding” soils for future generations. This is consistent with the Māori view of natural resources and kaitiakitanga.

## Actions proposed

3. Profile the importance of land and soil resources to the New Zealand economy and society by quantifying the actual and total potentially realisable economic value of our soils.
4. Undertake a foresight exercise to explore risks and opportunities to the future economy and environment by examining how soils are used now and might be used into the future.

To respond to pressures and trends, and realise opportunities, requires clarity on priorities for research and what data sets are required. Currently, investment in soil-related research occurs through a number of investment mechanisms and investors. A more comprehensive and co-ordinated approach would support a comprehensive and nationally prioritised knowledge infrastructure. As part of this, there is a need for a more nationally unified approach to gathering soil resource information. Once agreed, effort will be needed to establish priorities and stable funding secured.

There is also a need for a unified capability-building strategy to raise general soil literacy, as well as a nationally led effort to optimise the supply of scientists, advisors and land managers with soil knowledge.

### Actions proposed

5. Undertake a national prioritisation of soil research to support the National Science Challenges, land-based sectors, and government agencies, as well as guide investment in research and development.
6. Agree on the national suite of underpinning soil and land resource information required to inform policy and decision-making on soil management. Determine priorities and secure stable funding.
7. Create an inventory of the current and projected skills and capability in central and regional government and industry, including current and projected graduate numbers. Identify a plan to optimise the capability system for soils, including improving competencies for extension and adoption.

### Measures and management

Many of the pressures affecting New Zealand soils can be addressed within sector practice, and the policy and planning frameworks. Analysis in Phase 2, however, identified that there is very little information either in the sectors or in regional government on the uptake and effectiveness of soil management initiatives and measures. It will be critical to improve the evidential basis on which soil policy, planning and land management decisions are made.

### Action proposed

8. Develop an evaluation and monitoring framework to determine the effectiveness of soil management practices, non-regulatory approaches and policies in achieving soil management goals.

### Integrated policy framework

The RMA creates room for soil protection to be incorporated into planning and policy, but there are still gaps in providing adequate regulatory tools for key pressures, or using non-regulatory approaches for a wide range of pressures. The development of a “toolbox” of measures for both regulatory and non-regulatory approaches would help to reduce current pressures and support addressing emerging pressures.

### Action proposed

9. Investigate the form of an integrated regulatory and non-regulatory framework, which explicitly recognises and protects soil functions against current and future pressures and gains the highest value from soils.



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