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Building agricultural resilience to natural hazard-induced disasters: New Zealand case study

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Note by the Secretariat

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This case study was prepared by Francesca Casalini, Morvarid Bagherzadeh and Emily Gray, based on information obtained through a questionnaire provided to countries, interviews with stakeholders, field visits and desktop research.

This revised document incorporates comments received at the *ad hoc* meeting of the APM in October 2020, as well as feedback and comments received from a wider group of government experts, stakeholders and academia during a policy seminar organised on 10 December 2020.

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Key messages

What is the issue and why is it important

- New Zealand is exposed to many natural hazards. Floods are a particularly costly hazard for farmers, and flood risk is increasing due to climate change.
- New Zealand's agricultural sector receives minimal support from the government, which encourages farmers to take responsibility for managing natural hazard risk. But given the probability of more frequent and intense floods, a key question concerns the appropriate role for the government in strengthening the resilience of farmers to natural hazard risk.

What did we learn?

- New Zealand's cross-sectoral and agriculture-specific disaster risk management frameworks consistently encourage communities and individuals – including farmers – to take responsibility for disaster risk reduction and preparedness, while identifying a more direct role for government in responding to crises and supporting recovery. *Ex post* disaster assistance to agriculture is disciplined *ex ante* by the Primary Sector Recovery Policy, which increases farmers' incentives to manage natural hazard risk.
- In this context, industry groups, such as Beef + Lamb NZ and Dairy NZ, play a key role in disaster risk management for New Zealand's agricultural sector, supporting farmers with information and programmes that improve their capacities to plan, prepare for, respond to, and recover from, a range of risks.
- The government has recently re-entered the extension services space. By investing in farmers' capacities to adapt to the long-term challenges that they face, this contributes to the sector's resilience without undermining private incentives to manage risk.
- Disaster recovery emphasises mental wellbeing following a crisis. In particular, the Rural Support Trusts, with support from the Ministry for Primary Industries (MPI), provide psychosocial support and advice for farmers in dealing with the impacts of a shock.

Key recommendations

- New Zealand encourages communities and individuals to take responsibility for managing natural hazard risk, and the policy environment increasingly focuses on readiness and resilience building. However, there is an opportunity for public and private stakeholders to strengthen the enabling environment that supports actors' efforts to increase resilience. In particular:
    - Improve data collection, including on impacts from previous events, and risk scanning across the country. This would help decision-makers – including farmers and local authorities – to identify vulnerabilities and make targeted and cost-effective investments in risk prevention and mitigation.
    - Collaborate to develop effective solutions for mitigating the risks and impacts of natural hazards on farm, and to ensure their diffusion in the sector, including by drawing on the renewed engagement on extension services.
- To improve disaster response and recovery in rural areas there is a need to strengthen mechanisms and networks for rural stakeholders, such as MPI, Regional Civil Defence Emergency and Management Groups, and industry groups, to collaborate and build preparedness capacities and relationships before crises occur.

1. Introduction

1. New Zealand's geography and climate expose the country to a variety of natural hazard risks. Earthquakes, volcanic eruptions, and weather-related events such as drought and heavy rain, and unseasonal or heavy snow falls, are common in the country, and can have severe economic impacts on agriculture as a result of on-farm loss of assets and damages to agricultural productive capacity. Natural disasters that affect agriculture can also have significant flow-on effects, in terms of the public costs of disaster assistance, indirect losses from supply chain disruptions and impacts on the wellbeing of rural communities.

2. This case study examines how governance arrangements and policy measures help to build the resilience of farmers and the agricultural sector to natural hazard-induced disasters (NHID) in New Zealand.[1] It is one of seven case studies prepared for the joint OECD-FAO project on *Building agricultural resilience to natural disasters*.[2] The project examines Disaster Risk Management (DRM) frameworks in selected OECD and developing countries to identify what governments and agricultural sector stakeholders can do to build resilience to natural hazard-induced disasters – defined here as the ability of farmers to prepare and plan for, absorb, respond, recover from, and more successfully adapt and transform in response to natural hazards (OECD, 2020[1]). The project identifies good practices for building resilience at each stage of the DRM cycle – risk identification, assessment and awareness; prevention and mitigation; preparedness; response and crisis management; and recovery and reconstruction – where good practices are identified according to four principles for effective disaster risk management for resilience (Box 1).

3. Each of the country case studies in this project focuses on a particular type of natural hazard in order to explore how different policy measures, governance arrangements, on-farm strategies and other initiatives contribute to building agricultural resilience. In New Zealand, flooding caused by heavy rain events is the most frequent and most costly type of natural hazard for primary producers. Moreover, heavy rainfall events are projected to increase in frequency and intensity due to climate change, threatening large areas of agricultural land across the country. Therefore, against the background of an agricultural sector that receives only limited support from the government, a key policy question relates to what is an appropriate role for the government in strengthening the resilience of primary producers to flood risk. This includes identifying whether the current policy approach, which is based on individuals and local authorities taking primary responsibility for managing risk, may leave gaps in resilience levels both among primary producers, as well as more systematically in the sector.

[1] Resilience as a notion is context-specific and it is a deliberate choice of this project to focus on the resilience of farms and primary producers, notwithstanding that this also has effects on the wider food system.

[2] The seven case study countries are Chile, Italy, Japan, Namibia, New Zealand, Turkey and the United States.

Box 1. Principles for effective disaster risk management for resilience

In 2017, G7 Agriculture Ministers in Bergamo recognised the effects of natural hazards on farmers' lives, agro-food systems, agricultural production and productivity in regions all over the world, and that climate change is projected to amplify many of these impacts. Ministers also noted the importance of strengthening the resilience of farmers to natural hazard (G7 Agriculture Ministers, 2017[2]).

- Responding to this imperative, the joint OECD-FAO project on *Building agricultural resilience to natural disasters* identifies good practices for building agricultural resilience at each stage of the DRM cycle. Good practices in the case study countries are identified according to principles and recommendations from key international frameworks for managing the risks posed by disasters and other critical shocks, including OECD recommendations and the Sendai Framework.[1] Based on these frameworks, each case study assesses their country-specific situation according to the following four *Principles for Effective DRM for Resilience*:

1. An inclusive, holistic and all-hazards approach to natural disaster risk governance for resilience.
2. A shared understanding of natural disaster risk based on the identification, assessment and communication of risk, vulnerability and resilience capacities.
3. An ex ante approach to natural disaster risk management.
4. An approach emphasising preparedness and planning for effective crisis management, disaster response, and to "build back better"[2] to increase resilience to future natural hazards.

Good practices encompass policy measures and governance arrangements that encourage public and private stakeholders to address gaps in their resilience levels. This can be done by helping stakeholders understand the risks that they face from natural hazards and their responsibilities for managing the risks they pose to their assets. For example, while rarer catastrophic risks such as NHID may require public intervention, on-farm strategies and the individual farmer's overall capacity to manage risk also play a critical role in reducing risk exposure to catastrophic events, particularly over the long term (OECD, 2009[3]; OECD, 2020[1]). Specifically, good practices that build agricultural resilience to natural hazards are policies and governance arrangements that:

- Encourage public and private actors to consider the risk landscape over the long term, including to take into account the potential future effects of climate change on the agricultural sector, and to place a greater emphasis on what can be done *ex ante* to reduce risk exposure and increase preparedness.
- Provide incentives and support the capacity of farmers to prevent, mitigate, prepare and plan for, absorb, respond, recover from, and more successfully adapt and transform in response to natural hazards.
- Consider a wide range of future scenarios, including expected environmental, economic and social structural change, and contribute to agricultural productivity and sustainability, even in the absence of a shock or stress.
- Take into account the trade-offs inherent in natural disaster risk management, including between measures to build the capacities of the sector to absorb, adapt,

or transform in response to natural disaster risk, and between investing in risk prevention and mitigation *ex ante* and providing *ex post* disaster assistance.

- Are developed with the participation of a wide range of actors, to ensure that all relevant stakeholders are equally involved in the design, planning, implementation, monitoring and evaluation of interventions; and share a common understanding of the risk landscape and their respective responsibilities for managing natural disaster risk.

Note: 1. OECD's Approach to Risk Management for Resilience (OECD, 2009[3]; OECD, 2011[4]; OECD, 2020[1]); the Sendai Framework for Disaster Risk Reduction (UNISDR, 2015[5]); the OECD Recommendation on the Governance of Critical Risks (OECD, 2014[6]); and the Joint Framework for Strengthening resilience for food security and nutrition of the Rome-based Agencies (FAO, IFAD and WFP, 2019[7]).
2. Building back better is defined as using the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalisation of livelihoods, economies and the environment (UNISDR, 2015[8]).

2. Country context

4. New Zealand is a relatively small, advanced and open economy, strongly market-oriented and with a focus on exports. Primary production accounts for 7% of GDP and 6% of employment. Agro-food products account for over 60% of New Zealand's total exports (OECD, 2020[9]). With little arable land, grass-fed livestock products and derivatives represent the backbone of the agricultural sector – livestock accounted for 76% of total agricultural output on average in 2016-18. The horticulture sector also contributes significantly to the country's overall agricultural production and exports (OECD, 2020[9]).

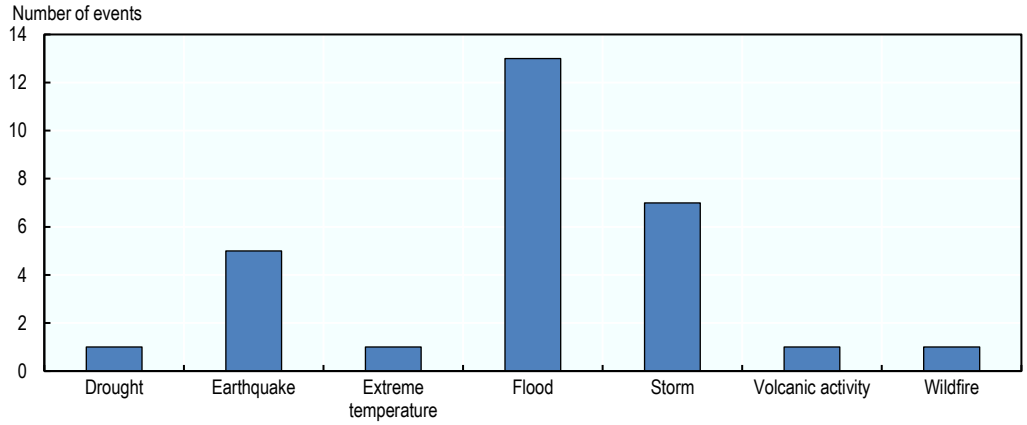
5. Following a wave of economic liberalisation in the 1980s, support to the agricultural sector has been the lowest among OECD countries for almost three decades,[3] and mainly goes towards biosecurity-related measures, knowledge and innovation systems, and payments in the event of natural disasters (OECD, 2020[9]). At the same time, there is significant co-operative activity in the form of industry groups that undertake 'industry good' activities such as research and development, forming and developing marketing strategies, and providing business management and technical advice. Several of these industry groups represent a unique institutional arrangement among farmers themselves and between farmers and the government, as their financing is enforced by law (Melyukhina, 2011[10]).

6. New Zealand is highly exposed to a range of natural hazards, including earthquakes, volcanic eruptions, storms and floods, drought, landslides, and wildfires (OECD, 2018[11]). In modern times, earthquakes have caused the most significant damages and losses per single event for the New Zealand economy as a whole (Figure 1), and have shaped the emergency sector in the country at large. Nevertheless, weather-related risks represent the most significant threat to agriculture in the country (OECD, 2016[12]). In particular, while the type of hazards experienced varies per year, storms and flooding events are the most recurrent type of natural hazard, and overall are considered to have

[3] Support to producers averaged 0.6% of gross farm receipts in 2017-19, and was below 1% in all but one of the last 20 years (OECD, 2020[9]).

caused the most damage and losses to the primary sector during the past few decades (New Zealand Now, 2019[13]; Ministry for the Environment, 2008[14]).

Figure 1. Occurrence of natural hazard-induced disasters by type in New Zealand, 2000-2020



Source: CRED, 2021, "EM-DAT Database".

7. Storms and flooding can have short- and medium-term impacts on New Zealand farms and agricultural businesses. Heavy rain events can cause significant soil erosion in hill country as well as flooding of lowlands. Losses and damage arise from tree, crop and livestock losses, unsecured fences, compromised feed supplies, access issues for milking, damaged water and power lines, debris clearing, and pasture and soil renovation expenses. The magnitude of the impact of these events varies widely depending on the severity of the event. In 2004, the Lower North Island storm event caused losses of NZD 185 million (USD 122 million) to the agricultural sector, from lost production and uninsurable rehabilitation costs (ReliefWeb, 2004[15]). In April 2017, a storm caused by ex-cyclone Debbie caused catastrophic failure of stop bank protection on the Rangitāiki River at Edgecumbe, leaving many rural communities isolated for several days. This came only a few weeks after the 'Tasman tempest' when soils were already saturated, exacerbating impacts and damage.[4] Moreover, in any given year, smaller events periodically cause damage to primary producers in different parts of the country.

8. In the long-term, flood risk is also forecast to increase on floodplains and in coastal areas due to increased rainfall and rising sea levels across New Zealand, threatening to impose higher overall economic and ecological losses, and recovery costs on the sector and the government, with attendant effects on the wellbeing of rural communities. For example, the Department of Internal Affairs (DIA) commissioned a report from the New Zealand Institute of Economic Research (NZIER) to detail the costs of natural hazard events to the government, explore future liabilities associated with natural hazard events, and identify where there are investment opportunities to reduce future government liabilities. According to this report, under projected climate change scenarios, government expenditure on storms and floods may average NZD 245 million (USD 161 million) per year from now until 2050, up from NZD 24 million (USD 16 million) per year over the past 10 years (NZIER, 2020[16]).

[4] Discussion with MPI, January 2020. No information is publicly available on damages to the agricultural sector from this event.

9. Building the agricultural sector's resilience to natural hazards requires effective short-term hazard management strategies, but also investments to improve the sector's capacity to prevent and mitigate – if not adapt to – the impacts of natural hazards in the long-run. In that vein, the NZIER report also concluded that natural hazards-related government expenditures are currently skewed towards response activities, such that there is a need to shift investments towards the reduction of known hazards for which preventive measures can materially reduce expected future costs (NZIER, 2020[16]).

10. The resilience of the agricultural sector is particularly important for New Zealand at a time when the country's borders are closed due to the COVID-19 pandemic, preventing tourism, which is traditionally a key pillar of the country's economy. At the same time, the New Zealand's policy settings and frameworks concerning adverse events must be considered in the context of the government's overall approach to the primary sector, which does not foresee specific policy measures compared to other sectors of the economy.

11. Over the last decade, the New Zealand Government and key agricultural stakeholders have implemented several changes to how they approach disaster risk management, significantly improving the capacity of the sector to plan for, cope with, and recover from flood and other adverse events. This flexibility will continue to be important to ensure the resilience of New Zealand to a shifting risk environment. The following section outlines the current state of disaster risk management as it relates to New Zealand agriculture both generally, and with a more detailed focus on floods, highlighting examples of good practices while noting ongoing challenges and opportunities for future improvement.

3. Management of natural hazard risk in agriculture

12. Resilience to natural hazards is an outcome of measures put in place before, during and after an extreme event, such as a flood. Different measures are typically instituted by different actors, with some measures more effective at managing the impacts of specific risks, while other measures contribute to building resilience to a variety of known and unknown risks more broadly (OECD, 2020[1]). In New Zealand, the resilience of the agricultural sector is shaped by the efforts of a range of public and private actors to manage natural hazard risk across society, and specifically for the sector. The following sections describe the frameworks and activities that are in place at different levels of government and society that contribute to building agricultural resilience in the country, highlighting key efforts in the areas of: risk identification and awareness; prevention and mitigation; preparedness; response and crisis management; and recovery and reconstruction. Many of these measures are applicable to a range of natural hazards, but the discussion focuses on measures of specific relevance for floods.

3.1. Governance frameworks affecting disaster risk management in agriculture

13. Strong and effective governance arrangements are crucial for building agricultural resilience to natural hazard-induced disasters. Institutions and policy frameworks influence decisions by farmers, government agencies and other stakeholders on whether or not to invest in building resilience, by defining stakeholders' roles and responsibilities for managing natural disaster risk, and by providing incentives to invest in risk prevention and mitigation, including after a disaster (OECD, 2014[17]; UNISDR, 2015[5]).

14. Compared to most OECD countries, the primary sector in New Zealand receives only limited sectoral support from the government, and key disaster risk management frameworks are whole-of-government and all-hazard. Operating through a devolved

governance model, the primary responsibility for managing natural hazard risk lies with individuals, including primary producers, and local and regional authorities. National policies focus on ensuring that individuals and local governments have the tools and ability to understand the risks that they face, and to prevent, mitigate and prepare for risk.

15. A more direct role for the central government is only envisioned during the response and recovery phases of an emergency, and this support aims to be proportional to the magnitude of the event, to ensure that incentives are aligned. As a legacy of the devastating earthquakes that hit the Christchurch and Canterbury regions in 2010, 2011, and 2016, disaster response and recovery activities in New Zealand emphasise the provision of psychosocial relief following a shock as an important enabler of resilience, with a focus on the welfare of 'rural communities' more generally, rather than specifically with respect to primary producers. In addition, the government and MPI also have dedicated initiatives for Māori communities, who receive tailored funding programmes, and whose perspectives influence consultations and partnership approaches to policy and implementation (Box 2).

Box 2. Engaging with Māori culture to strengthen agricultural resilience

Māori resilience is an important component of the resilience of the New Zealand primary sector as a whole. In 2017, it was estimated that Māori collectively own NZD 13 billion (USD 9.6 billion) in primary sector assets – approximately 10% of New Zealand's total agriculture, forestry and fishing asset base (MBIE, 2017[18]). However, Māori land is particularly susceptible to natural hazards, as it tends to be prone to erosion, exposed to flooding, and have limited access to sources of water.

From a governance perspective, challenges arise in building Māori agricultural resilience, as Māori culture approaches land management differently than western systems. For example, Māori tribal land is managed based on co-ownership, such that decision processes can be slower and more consultative. Māori also have close ties to the land (historical, cultural, or association to the prestige of the *iwi*[1]) and may not wish to sell land or relocate. In the context of these and other cultural specificities, MPI has been looking at how to better support resilience intended as the context-specific capacity of the country's entire agricultural sector to manage risk. This means both delivering programmes that take into account agribusiness and cultural issues relevant to Māori – or developing tailored solutions where appropriate – as well as taking into account Māori traditional knowledge to strengthen resilience and improve land management across the sector.

While capacity building and Māori development *per se* is in the purview of the Ministry for Māori Development, MPI has recently committed NZD 12 million (USD 7.9 million) to ensuring Māori landowners and agribusinesses have the tools, support systems (e.g. specialised advisors) and information, to use their land effectively. In particular, it has established two programmes to support Maori landowners to achieve their specific economic, environmental, social and cultural aspirations while ensuring sustainable development of primary sector assets. These programmes are the *Māori Agribusiness: Pathway to Increased Productivity* (MAPIP) programme, which operates via a one-on-one approach, and the *Māori Agribusiness Extension Programme* (MABx), which operates via a one-to-many approach.

At the same time, MPI is considering the role Māori knowledge can play alongside western knowledge systems. A framework approach is being developed to help MPI

appropriately use Māori knowledge to inform sustainable use of food and primary sector assets, for example through regenerative agriculture, and with reference to the concept of '*te taiao*'. *Te taiao* refers to a deep relationship of respect and reciprocity with the natural world, where the health and welfare of New Zealand's water, climate, land and living beings are all interconnected across each other, through generations.

Finally, Māori are also often cited as playing a key role in the social resilience of rural communities. For example, '*marae*', the Māori community meeting places, are capable of hosting many people in case of emergency, and are used for welfare support and accommodation when people are evacuated due to natural hazards in rural regions.

Note: 1. The term *iwi* refers in Māori culture to extended kinship group, tribe, nation, people, nationality, race. It often refers to a large group of people descended from a common ancestor and associated with a distinct territory (Māori Dictionary, 2021[19]).
Source: (MBIE, 2017[18]; MPI, 2019[20]).

16. More specifically, the key policy frameworks that influence natural disaster risk management in agriculture are:

- The Civil Defence and Emergency Management (CDEM) legislative framework that sets out the broad frameworks for governing risk across society. These instruments, although not specific to agriculture, result in a range of services in the fields of risk identification, prevention and response, which can also contribute to strengthening the resilience of the agricultural sector (New Zealand Legislation, 2002[21]; New Zealand Legislation, 2015[22]; Director of CDEM, 2015[23]).
- Some agriculture-specific funds and frameworks administered by the Ministry for Primary Industries (MPI), which support on-farm capacity building and provide recovery support to primary producers after an adverse event affects the rural sector (MPI, 2020[24]).

17. The vision and long-term goals of the CDEM system for society-at-large are outlined in the National Disaster Resilience Strategy (Minister of Civil Defence, 2019[25]), which is revised every ten years. The current Strategy, released in April 2019, has a focus on community wellbeing and recognises a need to ensure that risk-related messaging and activities are 'rural-appropriate'. The details of how the objectives of the Strategy are to be achieved are being defined through the development of a roadmap. In parallel, the National CDEM Plan 2015 ('the Plan') and the Guide to the National CDEM Plan 2015, which are revised every five years, contain provisions for the co-ordination and operational aspects of disaster risk management across four areas of activity known as the '4 Rs'– reduction, readiness, response and recovery. The Plan defines roles and responsibilities of the National Emergency Management Agency (NEMA), regional CDEM groups, government agencies (including MPI), and lifeline utilities, among others.[5]

18. In line with the devolved governance model, the Plan stipulates that the organisational and financial burden of risk identification, mitigation and preparedness, including for the agricultural sector, fall primarily on local and regional authorities. These functions are to be fulfilled in line with certain national frameworks, such as frameworks

[5] These instruments are currently undergoing revisions. In early 2021, a Regulatory Framework Review Programme (also known as the "Trifecta") was established to ensure these revisions are aligned in content and outcomes. (NEMA, 2021[85])

governing land and water use, and biosecurity (New Zealand Legislation, 2002[26]; New Zealand Legislation, 1991[27]; New Zealand Legislation, 1993[28]).

19. When an emergency occurs, disaster response under the CDEM system is whole-of-government, although managed on-the-ground through a system of 'lead' and 'supporting' agencies depending on the type of hazard, and always with some degree of support for co-ordination at the national level.[6] Response to geological and meteorological hazards, including storm surges and floods, and infrastructure failure, is led by regional and local authorities, and regional CDEM Groups, under the leadership of NEMA. In contrast, response to drought (when affecting the rural sector), biosecurity issues, and food safety hazards is led by MPI at both the local and national level. In addition, rural advisory groups[7] have formed in several regions to provide a platform for communication and co-ordination among public and private agricultural stakeholders at the response stage for any type of hazard that affects rural areas.

20. In terms of policies and programmes that influence agricultural resilience, New Zealand provides only limited sector-specific support to help primary producers manage risk. Nevertheless, MPI has several policies in place that can contribute to strengthening the resilience of primary producers. In particular, and in line with the understanding of natural hazard risk management as an individual and local responsibility, MPI administers a handful of programmes that aim to build farmers' capacities for managing risk, as well as grants and cost-shared programmes to encourage community- and farm-level investments in risk mitigation and adaptation. These investment incentives focus on erosion control as a strategy to reduce flooding risk. Additionally, after a few decades of absence, MPI has recently decided to re-enter the extension services space.

21. At the same time, MPI provides funding through the *Primary Sector Recovery Policy* to co-ordinate recovery and support farmers to return to production after an adverse event. The Primary Sector Recovery Policy sets out an *ex ante* framework for guiding decision-making and managing farmers' expectations in relation to *ex post* assistance available to them (MPI, 2019[29]). The threshold for triggering this assistance is independent of an emergency declaration under the CDEM system, and is broadly defined as the 'inability of a community to cope', such that social impacts are also taken into account. As further described in Section 3.6, a key way that the government supports rural areas following adverse events is through the Rural Support Trusts, a network that provides psychosocial support in rural communities. This reflects the wider focus on mental wellbeing as a key driver of recovery after a disaster, including in the agricultural sector (Box 3).

22. Finally, while some support is available from central and local governments for managing natural hazard risk, farmers are accustomed to relying primarily on private resources and industry networks for their risk management needs. The Commodities Levy Act 1990 allows industry groups to raise a levy to fund a range of activities, including for disaster readiness, risk communication, and in a limited capacity, disaster response and recovery. Industry groups include compulsory levy-funded organisations such as Beef + Lamb NZ, Dairy NZ, Horticulture New Zealand, the Foundation for Arable Research (FAR), Deer Industry New Zealand (DINZ), Pork New Zealand and United Wheat Growers. Commercial organisations such as Zespri (kiwi fruit) and Fonterra (dairy), and voluntary funded representation groups such as Federated Farmers, also act as a source of

[6] NEMA may intervene as lead agency on the ground in the event that a state of national emergency is declared, as per Section 66 of the Local Government Act 2002.

[7] These are also referred to as 'rural co-ordination groups', or 'primary sector clusters'.

support for farmers, via extension programmes, information sharing on risk readiness (or preparedness), and operational assistance following an adverse event, including via the rural advisory groups platform in recent years.

23. Overall, New Zealand frameworks and mandates clearly establish responsibility for managing flood risk, and the policy environment consistently provides incentives to farmers to take actions to manage natural hazard risk. However, some challenges arise due to the devolved governance model, in particular because of a misalignment between national, regional and local capabilities and capacities to undertake risk identification, prevention and mitigation activities on and off-farm. To address this, an inter-agency Community Resilience Groups was initiated in 2018 to strengthen the capacity of local governments to build community resilience in the face of natural hazards and the effects of climate change. In particular, an review led by the Department of Internal Affairs (DIA) into the regulation, ownership and governance of water identified capability and affordability challenges that arise in certain regions as key obstacles to effective water risk management in the country, in particular for structural interventions that require large upfront investments (DIA, 2019[30]; 2019[31]; 2020[32]). As a result, the Community Resilience Group was tasked to consider the relative roles and responsibilities of stakeholders in managing flood risk as well as the regulatory and funding settings. More broadly, and as described in more detail in the following sections, the government is incrementally reviewing and making legislative amendments to its policies to clarify or strengthen its presence where capacity constraints are a barrier to resilience.

Box 3. The Rural Support Trusts, a voluntary network for psychosocial support in rural areas

A unique feature of the New Zealand approach to disaster risk management is the emphasis placed on mental wellbeing as an enabler of resilience, and the role of the Rural Support Trusts (RSTs) in supporting rural communities from a psychosocial perspective. The first few RSTs were formed in the late 1980s when the farming community was going through a difficult period of adjustment following the deregulation of the agricultural sector. The network of RSTs has been growing, especially over the last decade, and today the RSTs cover the entire country and are highly regarded as a key resource in rural communities.

The RSTs are autonomous and not-for-profit networks that operate locally. RSTs directly assist farmers, growers and their families who experience a climatic, financial or personal adverse event to more effectively meet and overcome these challenges. The role of an RST facilitator (mostly serving on a voluntary basis) is to ‘empower’ affected parties to deal with problems rather than to provide specific advice.

RSTs receive some baseline funding from MPI but also operate thanks to donations. During or after an identified adverse event due to climatic or biosecurity reasons, RSTs in affected regions receive additional funding from MPI, which they may use to co-ordinate an initial needs assessment and the response to the event; to provide information and assistance to impacted groups; to arrange for mentors from rural backgrounds to talk over problems; and to provide stress management services and support social healing. In the case of a medium- or large-scale event, MPI actively works with the relevant RST(s) as the key on-ground resource supporting rural communities. The RSTs deliver MPI’s recovery measures to those in need, and work closely with the

relevant regional CDEM groups by assisting and supporting their activities in rural areas during and following an emergency.

The continued demand for RST services in rural communities signals the importance of providing psychosocial relief to rural communities in the medium and long-term after a shock. At the same time, the local level presence of the RSTs facilitators largely depends on the commitment and availability of volunteers. The performance of the different RSTs is said to vary geographically and over time. 'Burn-out' among these volunteer groups is an ongoing – and according to some, increasing – risk, highlighting a tension between ensuring that the RSTs remain truly locally-driven organisations, while also ensuring that they have the resources (trained people and monetary means) to operate efficiently and effectively.

Source: (RuralSupport, n.d.[33]); and stakeholder discussions with RST co-ordinators and MPI, 22 January 2020.

3.2. Risk identification, assessment, and awareness

24. A shared awareness and understanding of natural hazard risk is important for all actors to be able to make informed decisions around natural hazard risk management. This means that comprehensive and reliable risk information is essential for government, communities, and farmers to have an accurate perception of the risk environment within which they operate, in order to make optimal choices on strategies and investments to strengthen their own resilience. At the most basic level, this requires risk identification and assessment activities for producers to have knowledge of the risk environment that they face. At the same time, more detailed data on the risk environment – including on damage and losses from previous events – is also extremely important to inform investment strategies and facilitate decision-making at later stages of the risk management cycle by public and private actors alike. Looking beyond the current risk environment, activities such as modelling, horizon-scanning or data collection efforts focused on climate change indicators are also key to improve risk identification and assess how the risk environment will likely evolve over the medium- and long-term. In turn, to support improved disaster risk management, these activities must increase stakeholders' awareness of risks (OECD, 2020[1]).

25. Given the public good nature of activities related to natural hazard risk identification, these are usually carried out by public sector actors. Accordingly, private partnerships or knowledge dissemination activities in conjunction with risk assessment are crucial to maximise their effectiveness in helping to manage risk. In New Zealand, risk assessments activities, which fall within the National CDEM Plan definition of risk reduction, are part of the regular activities of government agencies, regional and local authorities, and research institutions. While some of these activities include considerations of, or are particularly relevant for the agricultural sector, none of them focuses on agriculture specifically. Risk communication strategies are also mostly tailored to the wider public, with agricultural industry groups playing a critical role in improving farmers' awareness and understanding of the local risk environment.

26. At the national level, natural hazard risk identification and assessment is structured according to the type of hazard, with agencies having responsibility for assessing the hazards for which they have 'lead' competence during response. For example, MPI devotes resources to assessing the risk of biosecurity threats to agriculture and with respect to potential and emerging food safety risks, both domestically and trade-induced international risks (MPI, 2020[34]). On the other hand, regional governments, local authorities and

regional CDEM groups are responsible for responding to floods. They also undertake flood risk assessments, develop risk management plans for their territory, and make that information public online.

27. While some regions make information and resources on flood risks publicly available, which allows some communities to develop risk reduction and readiness plans, there are significant differences in the financial capacity and organisational capability of local governments to conduct these assessments. In addition, research on risk appears to be constrained by the absence of a systematic process for collecting information on hazard impacts and damages. This information would help to identify vulnerability to floods and gaps in capacities for coping with floods both in specific regions and in the agricultural sector, in turn enabling more targeted and informed investment decisions for disaster risk management.

28. To address gaps arising from the fragmented way in which risk assessments are conducted at the regional and local level, the inter-agency Community Resilience Group aims to advance a jointly developed and resourced work programme with local governments to progress across various work streams, one of which aims to enhance the use of data in risk assessments (DIA, 2019[31]). To improve datasets and ensure interoperability of national and subnational data, guidelines on risk assessments for regional CDEM Groups are to be released soon. In their draft version, the guidelines detail a comprehensive framework which could represent a first major effort in capacity building for developing datasets to support risk assessments, including elements that are relevant for risk identification in agriculture – for example, collecting data on risks to soil and water quality, livestock and infrastructure (LGNZ, 2019[35]).

29. Also at the national level, the first National Climate Change Risk Assessment was released by the Ministry for the Environment in 2020, which will inform the development of the National Adaptation Plan. Work underway in the Community Resilience Group is also feeding into the National Adaptation Plan (Ministry for the Environment, 2020[36]). The National Climate Change Risk Assessment considers all risks presented by a changing climate with a horizon of six years.[8] The Framework on which the Assessment is based stressed the importance of considering the distribution of climate change effects across society, with a particular focus on vulnerable groups or sectors, such as agriculture. The Framework is consistent with internationally applied risk assessment elements, but places particular emphasis on community engagement, such as through 'risk workshops' and other outreach activities, including to ensure that the Māori perspective is represented (Ministry for the Environment, 2019[37]). Nevertheless, the Climate Change Risk Assessment addresses issues for the agricultural sector only generally. The time horizon of six years may also be suitable to motivate immediate action among farmers and other actors, but may not be sufficient to support industry-level discussions on adaptation and transformation needs in the long-term.

30. Similarly, the Ministry of Business Innovation and Employment (MBIE) funds ten-year academic research projects on emerging risks via the National Science Challenges. In particular, rural communities and the primary sector are key stakeholders in the Deep South Challenge (which aims to improve understanding of the role of the Antarctic and Southern Oceans for New Zealand's climate and future environment) and the Resilience to Nature Challenge (a project for fostering participatory and interdisciplinary approaches to resilience building in New Zealand). A research segment of the Resilience to Nature Challenge focuses on agro-food value chains specifically, including using future scenarios

[8] According to the Climate Change Response (Zero Carbon) Amendment Act, subsequent risk assessments will be undertaken by the Climate Change Commission every six years.

to identify effective interventions for resilience. However, although the current model for the National Science Challenges has successfully fostered collaboration through multi-disciplinary teams, the collaboration occurs within the constraint of a given challenge's mission and scope, and none of the challenges currently has an objective, or funding, to deliver the broad science needed for the sector to assess and adapt to natural hazard risk in the long-term (Climate Change Adaptation Technical Working Group, 2018[38]).

31. Finally, New Zealand has a number of scientific institutions that conduct research on natural hazards. The New Zealand Institute of Economic Research, for example, regularly produces reports and analysis of key economic challenges for the New Zealand economy. In September 2020, it released a report assessing the costs to government of adverse natural hazard events since 2010; liabilities that the government can expect to face from adverse natural hazard events up to 2050; and the best options for investments to reduce future government liabilities (NZIER, 2020[16]). Although not specific to agriculture, the report makes an important contribution to stimulate long-term thinking about natural hazard risk and related costs, while drawing attention to the difficulties of obtaining good quality data about past events and damages that could inform future investments and mitigation strategies.

32. Publicly owned Crown Research Institutes also carry out modelling, mapping and forecasting activities on natural hazard risk. For example, the National Institute of Water and Atmospheric Research (NIWA) and the Institute of Geological & Nuclear Sciences (GNS) jointly run Riskscape, a modelling programme for natural hazard impacts and losses, with modules that can be "mixed-and-matched" to estimate supply chain effects for all sectors (Riskscape, 2020[39]). However, missing information about farm buildings and assets, as well as on losses from previous adverse events, reportedly poses a challenge for modelling efforts in relation to the agricultural sector, again suggesting room for improvement in systematic data collection about how natural hazards affect rural areas. In September 2020, NIWA obtained over NZD 15 million to conduct a national flood risk assessment over the next five years, with a key output being nationally consistent flood (fluvial and pluvial) inundation maps (MBIE, 2020[40]). This will likely represent a significant step forward for future efforts to assess flood exposure, and quantify the potential social and economic consequences of flooding on New Zealand's agricultural sector.

33. Together with risk identification and assessment activities, communication and dissemination of risk-related information is also crucial, especially for an agricultural sector that is encouraged to make production decisions and invest in risk management strategies autonomously, with little financial support from the government. In general, New Zealand farmers are considered to have good levels of awareness of the risks they face from natural hazards, in part because of the limited availability of public support and relatively frequent exposure to natural hazards.

34. In addition, industry groups, and more recently MPI, have extension programmes to disseminate information and enhance risk awareness among producers. In particular, Beef + Lamb NZ's Land and Environment Plans encourage farmers to consider the impact of extreme weather events on whole farm systems, and to develop a plan for managing them (Box 4). The organisation estimates that up to 49% of sheep and beef farmers have a plan in place (Beef + Lamb NZ, 2020[41]). Notably, Land and Environment Plans have become a regulatory requirement in some regions, as part of an effort to improve the environmental sustainability of agriculture.

Box 4. Beef + Lamb NZ programme for farm-level Land and Environment Plans

Since 2011, a major priority for Beef + Lamb NZ (B+LNZ) has been supporting farmers to develop a Land and Environment Plan (LEP). An LEP is a tool that helps farmers to manage regulatory requirements around water quality and other environmental concerns, while leveraging the opportunities that these offer to improve farm profitability. B+LNZ has produced workbooks and hosts facilitated workshops to guide farmers while developing their plan, which has been a key factor in improving uptake. Participation in workshops is encouraged not only for farm owners, but for all staff working on the farm.

In practice, an LEP guides farmers through a recorded assessment of their farm's natural capital assets to understand their vulnerabilities and the opportunities that these hold. In sequence, it envisions a stock-take of land, soil and water resources; an assessment of production opportunities and environmental risks; the development of a written plan showing what actions need to be undertaken to manage said risks, and a timeline to implement them. The key environmental issues actively identified and managed through LEPs include contaminants that can flow overland to be discharged to surface waterbodies, as well as identifying areas of the farm that may be susceptible to erosion and nitrogen losses.

During the workshops, farmers create a detailed map of their farm, identifying all its natural and added features, as well as areas where problems such as erosion, fencing streams, bush and scrub areas, wetlands and forestry blocks may exist. Farmers are then guided through a process of risk assessment, including by stimulating a discussion on what different risks look like, and some thinking about what reparation strategies would work best for each scenario, considering costs and time required.

The programme has been successful in introducing farmers to the concepts and value of farm-level risk assessments and environmental planning. Some regional councils now require an LEP plan as a way to facilitate regulatory compliance.

Source: Beef + Lamb NZ (2020[41]).

35. Nevertheless, while the public sector is demonstrating increasing awareness of the changing risk environment, awareness among farmers of the long-term challenges facing the sector – and how that will change their own exposure to 'known' risks – remains mixed. A 2019 survey conducted as part of the MPI-funded Sustainable Land Management and Climate Change (SLMACC) research programme investigated, among other things, New Zealand farmers' risk awareness in relation to climate change. The results highlighted that climate change awareness is low overall, with horticulture, viticulture, and dairy having the most awareness (MPI, 2019[42]).[9]

36. More broadly, anecdotal feedback has highlighted a desire among farmers for more science-based information that is consistent across government agencies and industry groups, and that contains clear guidance on practices that are proven to be effective to build resilience to adverse events. As the government undertakes risk assessments through a variety of agencies and lenses to understand the risks to agriculture, challenges may arise

[9] The research programme report looked at attitudes across several different items including climate change. Based on the response from a sample of 707 farmers, it appears that awareness is varied with at least 50% agreeing that climate change will have an impact on their farm and business.

from the fragmentation of information sources. This underscores the importance of also investing in channels for streamlined, consistent and targeted messaging on natural hazard and climate change risks specifically for agriculture, to raise awareness and support action on farms (see Box 5 for a specific case study of factors influencing the adoption of technological innovation on the farm).

Box 5. Factors influencing adoption of technology innovation by the farming sector

Agricultural innovations, including digital innovations, have been developed at a fast pace in recent years, and can support improvements in on-farm productivity while often enhancing both sustainability and resilience to natural hazards. However, adoption among New Zealand farmers has been slow.

In particular, Landcare Research's 2017 Survey of Rural Decision Makers highlighted that the low uptake of precision agriculture and automation and robotics was due to a variety of factors, including:

- Owner/operators tend to rely on their peers rather than experts as a key source of information when making change.
- New ways of doing things can introduce risk (even if it is just perceived risk) into the system (especially when it comes to food safety).
- There are difficulties accessing relevant independent advice or capital to adopt innovations.
- Many farmers already have significant amounts of capital tied up, reducing their appetite or ability for further investment.
- The skills required to implement significant change are quite different to those required for traditional food production.
- There are skills shortages overall in the food and fibre sector.
- There is uncertainty about whether change will actually deliver benefits, or will instead create stranded assets in the face of other requirements (this is a particular issue when considering efforts to deal with water quality and climate change mitigation).
- Some rural infrastructure limitations (such as Wi-Fi) hinder uptake.
- Some technologies are not being developed with the needs and abilities of the end user in mind - if the value proposition is not clear, then uptake will be limited.

Source: MBIE (2020[43]).

3.3. Risk prevention and mitigation

37. *Ex ante* investments in measures that prevent or mitigate natural disaster risks and impacts can be a cost-effective strategy in reducing future losses and damages, including in agriculture. In many cases, addressing underlying vulnerabilities means reducing exposure to risk and reducing the potential impacts and related costs of disaster response and recovery. To this end, public and private stakeholders should aim to reduce their vulnerability to a range of present, future, and unknown risks, and invest in their capacities to prevent and mitigate the impacts of natural hazards through structural and non-structural

measures. In particular, this can be achieved through policies and programmes that encourage stakeholders to identify disaster risks to their own assets and provide them with access to the skills and technologies they need to address those gaps in their resilience levels (see Box 1 and (OECD, 2020[1])).

38. In New Zealand, public sector activities to prevent and mitigate flood risks include measures to improve water infrastructure performance, and non-structural measures to avoid unnecessary exposure to risk. Increasingly, in the context of the agricultural sector's exposure to natural hazard risk, capacity building measures support farmers in adapting and transforming to a changing risk landscape. With regard to structural measures, primary responsibility for making decisions and bearing the costs of flood risk prevention and mitigation lies with local governments for water infrastructure; with public- and community- owned companies for power and telecommunication networks; and with individual farmers for private farmland. Accordingly, to reduce the impacts from potential floods, communities may need to invest in stop banks, weirs, and other river management and flood control schemes. However, at the local level, there is no clear process for prioritising and funding prevention and mitigation investments in situations where a risk has been identified. Because local authorities raise the funds for interventions through a system of levies, financial capacity to invest can also vary greatly among regions. Due to relatively low populations in many rural regions, local councils in rural areas can struggle to have the available rating base to address shortfalls.

39. Indeed, the Three Waters Review – a cross-government initiative that reviewed how to improve the regulation of and supply arrangements for drinking water, wastewater and storm water – confirmed that there is a need to better align planning and national requirements on flood protection, water quality and wastewater, and acknowledged that local governments might not have sufficient capacity and resources to address water infrastructure maintenance and improvements without some form of centralised funding – echoing findings from previous reviews of disaster risk management arrangements in the country (DIA, 2020[32]; IFRC, 2014[44]; Ministry for the Environment, 2008[14]).

40. Recognising the importance of investing in risk reduction to minimise long-run costs, the national government is continuing its work programme to address this issue. It has committed to working with local governments to develop a revised funding model for flood protection, while ensuring that these schemes utilise natural infrastructure such as vegetation, ecosystems, permeable surfaces and water storage, where possible (DIA, 2020[45]). In June 2020, the government also allocated up to NZD 100 million (USD 66 million) for waterway fencing, riparian planting and stock water reticulation, and NZD 60 million (USD 39 million) for road and rail investments, including maintenance such as culvert cleaning and drainage improvements, as part of a package of measures to boost employment post-COVID-19 (Beehive, 2020[46]).[10] In a system where over the last few decades nearly half of government spending on natural hazards has been on response and recovery, and only less than a quarter on reduction and readiness (NZIER, 2020[16]),[11] this may be a welcome step towards increasing *ex ante* investments that can reduce public costs in the future.

41. Non-structural measures are also key to prevent and mitigate natural hazard risk, and include measures focused on reducing exposure and vulnerability, through longer-term

[10] The funding is repurposed Provincial Growth Fund (PGF) money and unallocated funding from the Regional Investment Opportunities Contingency. The PGF, established in 2018, is administered by the Provincial Development Unit, part of the Ministry of Business, Innovation, and Employment.

[11] The remaining 27% was spent on other unspecified civil defence activity (NZIER, 2020[16]).

planning and adaptation to natural hazard patterns and threats (OECD, 2014[6]). Such measures may include land use plans, the implementation of nature-based solutions to mitigate natural hazard impacts, and adaptation strategies in response to a changing risk environment.

42. New Zealand has some key policy frameworks in place to reduce exposure to risk across society, including in the agricultural sector. Building standards and land use regulations are established in national laws and enforced by local and regional authorities. For example, agricultural structures must meet specific standards and not be located on land subject to natural hazard risk. However, no national policy statement on flood management exists, for example, defining levels of acceptable exposure to risk, which may represent a key tool for consistency in the application of land use regulations across the country. Nevertheless, local and regional authorities can refer to the New Zealand Standard 9401:2008 on Managing Flood Risk[12] for guidance in fulfilling their risk reduction roles. This provides an agreed best practice for private and public actors to ensure that proper consideration is given to all aspects of flood risk when making decisions.

43. Importantly, MPI and industry groups in New Zealand are increasing their efforts to build capacity for mitigating risks to agriculture at the local and farm business level. MPI provides grants to restore the natural functions of ecosystems, which may in turn buffer the impacts of extreme hazards. In particular, they can reduce erosion that can have negative economic impacts on farms, infrastructure and high-quality land on floodplains, and cause downstream flooding in the event of storms. The purpose of the MPI grants is to raise awareness and stimulate investment in measures to reduce erosion in the upper areas of catchments, under the rationale that it may cost less than repairing damages after a flood event, or less than investing in flood-control structures in downstream areas. Other funds support regional and local authorities to deliver catchment initiatives and sustainable land management projects with a focus on land erosion control, through spaced planting of trees (i.e. far enough apart that pasture can grow between them), and reversion to native vegetative cover (MPI, 2021[47]). The *Action for Healthy Waterways* package of policy decisions to restore and protect the health of New Zealand waterways, which took effect in September 2020, similarly intends to halt loss or degradation of wetlands and streams, by mapping existing wetlands and encouraging their restoration, all of which can contribute to enhanced reduction of flood risk (Ministry for the Environment, 2020[48]).

44. Industry groups in New Zealand also play a key role in stimulating farmers' adoption of prevention and mitigation strategies on-farm, such as irrigation systems enhancement and feed management. For producers that experience flooding as a regular seasonal event, industry groups provide recommendations such as strategic planting of willows or poplars, or ensuring that pumps on the farm are above flood levels (Beef + Lamb NZ, 2017[49]). In addition, industry-led initiatives to improve the environmental sustainability of production have sometimes led to practices that contribute to reducing natural hazard risk as well. For example, the 2013 *Sustainable Dairying: Water Accord* is a national, industry-led voluntary programme that establishes a set of good management practices to improve environmental performance on dairy farms, including practices that

[12] The standard can be accessed at: https://shop.standards.govt.nz/catalog/9401:2008(NZS)/scope.

significantly contribute to preventing and mitigating the impacts of floods, such as riparian planting and fencing dairy cattle off from waterways.[13]

45. While the measures described above can help to prevent and mitigate flood-induced disasters, stakeholders increasingly recognise an urgency to also proactively invest in adaptation strategies, shifting the focus from protection, to avoidance or accommodation of natural hazard risk. Regarding adaptation to floods, most local authorities appear to understand the importance of action, including through strategies like managed retreat,[14] but approaches differ. Again, challenges have arisen due to different capacities, capabilities and funding in relation to managed retreat in different local councils, which can send mixed signals to farmers, result in litigation, and in some cases translate into limited community buy-in (Climate Change Adaptation Technical Working Group, 2018[38]).

46. In parallel, initiatives to encourage farm-level adaptation have been developed under the Sustainable Land Management and Climate Change (SLMACC) research programme established by MPI in 2007. SLMACC aims to support researchers and farmers to experiment with on-farm adaptation strategies. MPI engages in roadshows that provide information about these funding opportunities and help interested candidates prepare their applications (MPI, 2021[50]). Nevertheless, research so far has focused on the theoretical study of the impacts of climate change, with comparatively fewer projects focused on actions and farm-level strategies for adaptation, and stakeholders have noted that the knowledge produced from these research grants could benefit from better two-way communication with farmers (MPI, 2018[51]).

47. Overall, in terms of adaptation on-farm, changes remain largely incremental, although some sectors are more responsive than others. For example, some farmers are buying plots of land in different climatic areas to hedge production risk, or experimenting with varieties that are better suited for new climatic scenarios. Certain industries, such as the wine industry, are also leading the way with efforts to adjust in the long-term to changing climate conditions, including in relation to how to re-position the industry in international markets (Cradock-Henry and Fountain, 2019[52]).

48. The government also recognises the need to develop the human capital of the agricultural sector to improve the capacity of farmers to adopt innovations, including resilience-enhancing innovations. In 2019, a package of policy programmes – the *Productive and Sustainable Land Use* package – was introduced to promote land-use practices that deliver more value and improved environmental outcomes in an integrated manner.[15] In particular, in a notable shift in policy approach, the package re-introduced

[13] In 2019, 92% of farmers report having made changes to their farm in the past five years specifically to be more environmentally sustainable for the future – a significant increase from the 78% doing so in 2009. These changes are mostly in line with sector regulations and include fencing of waterways and riparian planting (MPI, 2019[42]).

[14] Managed retreat has been defined in a coastal setting as 'the application of coastal zone management and mitigation tools designed to move existing and planned development out of the path of eroding coastlines and coastal hazards' (quoted in (Hino, Field and Mach, 2017[84])).

[15] The Productive and Sustainable Land Use package has six key parts to help farmers and growers make informed decisions: i) Extension services, providing on the ground support to farmers to improve their land-use practices; ii) Primary industry advisors, supporting the development of a training and qualification framework for professional farm advisors; iii) Māori Agribusiness**,** supporting Māori landowners and agribusinesses to realise greater value from their land in a way that works for them; iv) Monitoring and benchmarking, improving on-farm emission data and monitoring, and increasing the number of primary sectors covered; v) Decision support tools, improving and developing decision-support tools for farmers to help them manage their business and their impacts on the

public extension and farm advisory services and training, after leaving that space to the private sector following liberalisation in the 1980s (MPI, 2019[53]).[16] The extension services programme aims to remain largely farmer-led – that is, MPI aims to operate via a 'social approach' that values continued presence among farming communities to build trust, and that fosters co-innovation processes and peer-to-peer networks to accelerate knowledge transfer. This also includes a Māori Agribusiness Extension (MABx) Programme which focuses on exploring sustainable system changes and providing shared, group-learning opportunities for Māori landowners (MPI, 2019[20]).

49. Finally, various financial tools are also available for farmers to mitigate the impacts of natural hazards on their income.[17] In New Zealand, farmers make wide use of an income equalisation tax benefit scheme that allows farmers, fishers, growers and foresters to smooth fluctuations in their income, by spreading their gross income between years (Inland Revenue, 2021[54]). Communication has been a key factor to the success of the programme, and rural accountants have played a fundamental role in stimulating uptake and participation in the financial scheme.

50. In contrast to many other countries, agricultural insurance in New Zealand does not receive any form of government support. While there is generally a high take up of insurance by farmers for buildings and vehicles, the uptake of crop and livestock insurance is considered to be low and uneven across regions, although no official numbers exist. Two exceptional cases are the United Wheatgrowers scheme, whereby growers pay a compulsory levy for disaster relief insurance that insures wheat production from harvesting to transport, including against flood, and the Zespri Pool Hail Insurance Cover that is mandatory for kiwifruit producers affiliated with Zespri, the major exporter in the country.

51. Several reasons may explain the low uptake of livestock and crop insurance among New Zealand farmers. First is the high costs of insurance policies for crops and livestock, especially against floods, which in turn may be due to the high concentration of risk in the country. Second, culturally it is part of the New Zealand farmers' ethos to self-manage yield variability as an integral part of the farming business activity. On the other hand, many farmers hold significant debt, which may become a market driver for insurance as lenders begin requiring more financial preparedness to risk on behalf of borrowers. Indeed, many stakeholders consider that the expected impact of climate change on certain parts of the country will make it necessary to further leverage risk transfer tools in the future. Finally, low demand for financial risk management tools may be because farmers employ alternative risk management strategies. In particular, given the strong co-operative sector in agriculture, some stakeholders note that co-operatives may already be providing an effective alternative network for managing financial contingencies in case of natural hazards, especially via contracting in input and output markets, and forms of vertical integration (Melyukhina, 2011[10]).

3.4. Risk preparedness

52. Preparedness to manage natural hazards is crucial for effective crisis management and recovery. Ensuring that the agricultural sector is prepared for risks involves a wide

environment; vi) Market access and export system, to protect high-value food exports and update New Zealand's official assurance systems (MPI, 2019[53]).

[16] The extension programme has a budget of NZD 35 million (USD 23 million) over four years from July 2019 to support up to 2 200 producers across targeted catchments and regions.

[17] For a more in-depth discussion of the range of agricultural tax policies in New Zealand, see (OECD, 2020[82]).

range of activities, including investments in risk-monitoring systems, response planning (for example through simulation exercises such as drills and table-top exercises), and risk education and communication. Critically, strengthening preparedness requires actions on the part of institutional responders as well as farmers, but also relies on their capacity to work together and be able to activate in a co-ordinated manner when a shock occurs (see Box 1 and OECD (2020[1])).

53. In New Zealand, the National CDEM Plan defines statutory responsibilities for the monitoring, identification and analysis of geological and meteorological hazards and threats, and subsequent issuing of information in relation to specific hazards. In particular, GNS Science provides ongoing monitoring of geological hazards, and in conjunction with the Earthquake Commission (EQC), delivers GeoNet, an app and online alert and early warning system for earthquakes, landslides, volcanic activity and tsunamis. MetService provides weather forecasting and hazard analysis services, and issues weather warnings to the public. NIWA also provides public information on climatic and seasonal risk, such as drought.[18] Regional councils and some territorial authorities are responsible for monitoring rainfall, lake and river levels, and volumetric flows that are used for predicting and managing floods. These agencies may also have hazard- or stakeholder- specific early warning systems. For example, NIWA and MPI support a publicly available drought index that keeps track of emerging drought conditions nationally and at the district level. Similarly, regional councils, with support from meteorological and hydrological agencies such as MetService and NIWA, provide a real-time 4-8 hours inundation forecasts. Nevertheless, poor digital connectivity in rural areas can hinder the effective delivery of early warning systems for farmers.

54. Preparedness for responding to natural hazards is also achieved through pre-arranged risk management and response plans, where all actors are well-informed of their roles within these plans. Public-sector preparedness for emergencies in New Zealand is organised across whole-of-government field exercises and training. Under the National CDEM Plan, a key pillar to achieve readiness relates to the agencies' capability development, through the recruitment, selection, teaching, support and performance management of people involved in the emergency system, within a strategy that aims to establish a clear professional development pathway for emergency management.

55. In addition, NEMA and CDEM Groups offer training (including Coordinated Incident Management System trainings) to all those involved in disaster response, to harmonise language among emergency responders from different organisations and initiatives, and in turn enable the exchange of staff between them. Exercises and tests of arrangements, and interagency sharing of lessons learned, are mandated by the National CDEM Plan for each agency with roles and responsibilities under it. A CDEM drill exercise takes place once a year at the national level, and there is a four-year cycle for local and regional exercises (National Emergency Management Agency, n.d.[55]). Lifeline utilities are also required to continue operating during and following emergencies. For example, the New Zealand Transport Agency (NZTA) develops disaster response scenarios to understand how to ensure the delivery of energy in case of road disruptions (NZTA, 2020[56]). An annual interagency National Exercise Programme (NEP) was established in 2013 to help ensure that New Zealand is prepared to effectively respond to national security (all-hazard) events, building on lessons identified at previous events and exercises, while providing a platform for relationship-building between agencies (DPMC, 2013[57]).

56. At the same time, the regional adverse events teams of MPI also work throughout the year to build their capacity to respond to adverse events that affect rural areas,

[18] Enhancements to the drought index are being made with SLMACC funding.

strengthening their contextual understanding of risk, and engaging in building relationships with potential partners. Readiness activities are geared towards ensuring that primary sector stakeholders respond coherently and cohesively in emergencies, including through the platform of the rural advisory groups. Going forward, the MPI teams and the Groups will also have an opportunity to use their experience in disaster response to develop extension services and strengthen preparedness on-farm.

57. Indeed, notwithstanding preparedness support and activities at the government level, most frameworks and policies emphasise the need for individuals and businesses to plan for their own risks (Getthru.govt.nz, 2021[58]), and accordingly, many efforts exist to support on-farm preparedness, by providing education around risk preparedness. In particular, MPI encourages local sharing of information among farmers – through community events, workshops, and one-on-one farmer support and referral. In addition, MPI has a page on its website that collects information and resources for farmers on how to prepare for adverse events generally, and also in relation to specific natural hazards, mostly linking to material developed by industry groups (MPI, 2021[59]).

58. Indeed, industry groups are an important source of information on farm preparedness for natural hazards. For example, industry groups such as Beef + Lamb NZ, Dairy NZ and Federated Farmers have developed information and guidance for on-farm preparedness and emergency planning for floods. They recommend that farmers integrate preventative measures and recovery costs into regular farm budgets, and encourage farmers to develop recovery plans for managing milking, ensuring stock and orchard health, and maintaining water systems integrity after a flood. They also provide guidance on developing feed plans for stock, including relocation or reduction of stock if needed. Dairy NZ provides a Crisis Priority Checklist that producers are encouraged to print out 'now' to be easily accessible in case of crisis (Dairy NZ, 2020[60]).

59. Information is also available to guide farmers through on-farm crisis management. For example, factsheets on dealing with flood conditions provide guidance on personal safety, animal welfare,[19] and operational contingency management.[20] Brochures provide farmers with guidance on how to make business decisions in case of storms and floods, encouraging farmers to work out an action plan in case they are unable to operationalise a pre-existing one, to prioritise tasks and itemise jobs for work sharing. They encourage farmers to check their insurance policies for the possibility of recovering damages, in which case, they provide suggestions on how to report damages. They also remind farmers to update their National Animal Identification and Tracing (NAIT) scheme records if stock are moved during a flood (MPI, 2020[61]). Dairy NZ has also developed a decision tree for flood-damaged farms that guides farmers in decision-making during the first few days after a flood, including precise instructions on when and how to start rehabilitating flooded land (Dairy NZ, 2019[62]). In addition, all adverse events guidelines place a heavy emphasis on both assisting and seeking support from neighbours.

60. Nevertheless, stakeholders note that despite the availability of information to support individual farmers in preparing for adverse events, this is not always supported by

[19] Under the Guide to the National CDEM Plan, MPI has key responsibilities for animal welfare. Accordingly, the MPI website provides guidance about animal welfare risk reduction, response, and recovery in relation to different types of hazards, which it developed in collaboration with Federated Farmers, veterinary associations and other stakeholders.

[20] Actions encouraged by these resources in case of flooding include ensuring access to means of communication (possibly through a corded phone not requiring power), hiring a generator, moving stock to higher ground and into secure paddocks, ensuring drains are clear, gathering supplementary feed (including requesting supplies via the Federated Farmer's feedline), and in case of need, seeking extra volunteer labour (Beef + Lamb NZ, 2017[49]).

the necessary extension activity to change behaviour and drive uptake of such preparedness practices. Federated Farmers worked with the Resilience to Nature Challenge (see Section 3.2.) to enhance the extension of risk preparedness information to farms by prototyping fridge magnets and torchlights carrying information on what to do in case of an emergency, and a checklist for farmers to self-assess their preparedness and identify scope for improvement. The information aimed to provide guidance to farmers on how to manage their own farm when faced with any type of hazard, helping them to identify key resources and relationships for better coping with unexpected events from an economic and welfare perspective. Indeed, reviews have highlighted that farmers' lack of preparedness continues to be an obstacle to effective response and recovery after an adverse event (Rangitāiki River Scheme Review Panel, 2017[63]). In addition, while these resources appear to be available for the dairy and livestock sectors (Whakatāne District Local Recovery Manager, 2017[64]), less information is available for the horticultural and other important, albeit smaller, sectors, possibly due to lower capacity of smaller industry groups to produce similar preparedness resources.

61. Overall, this highlights the importance of risk education, for ensuring farmers are prepared for risk. In fact, risk preparedness is crucial to crisis management and needs to be continuously reinforced, as natural hazard experience can be forgotten and an individual farm may be impacted by a significant natural hazard only once in several years. Indeed, while public sector actors are making strides in improving preparedness through monitoring and planning, the level of on-farm preparedness for single adverse events is uneven. In particular, stakeholders note that older farmers who have experienced flooding in the past tend to manage crises better. For example, they are more likely to move their stock to higher ground when a flood is expected, based on previous experience of similar events. Older farmers also tend to be more economically and socially resilient, having more savings and more trusted relationships with retailers, who have also kept open during weekends and public holidays after certain adverse events in order to facilitate business continuity for farmers. Conversely, younger farmers can be less prepared for contingencies and more vulnerable to the impacts of natural hazards, including from a psychosocial perspective. This may be due to factors such as higher debt and a lack of financial reserves, but could also be due to a lack of experience. This underscores the importance of proactively strengthening personal and industry networks, including through scenario planning and simulations, to identify and avoid gaps in crisis management capacity across the sector.

3.5. Disaster response and crisis management

62. The capacity to manage crises depends on a number of factors, including planning for co-ordination of resources across government and broader networks to support timely decision-making, and preparedness and expertise on-farm on what actions to take during an emergency. Effective crisis management and response hinge on all actors knowing their responsibilities and communicating effectively, with the public sector taking a leadership role when the private sector is unable to cope (see Box 1 and OECD (2009[3]; 2020[1])). In crisis situations in New Zealand, public sector actors play an active role – from providing information about imminent hazards through to co-ordinating the disaster response. In the case of agriculture, industry groups also play key role, including by ensuring that the specific needs of primary producers are addressed.

63. In terms of early warnings, NEMA and regional CDEM Groups are responsible for alerts on potential or actual threats to people, property, areas, and social or economic activities arising from natural hazards. Under the National CDEM Plan, NEMA is responsible for issuing national warnings and advisories, and providing information to

national agencies, regional CDEM Groups and the media.[21] Regional CDEM Groups are then responsible for disseminating warnings to local communities, although, since 2017, CDEM Groups, and emergency services, have utilised a broadcasting system to directly alert the public, including in specific areas. An appointed person from each CDEM Group has authorisation to declare a state of local emergency for its area.

64. In instances of extreme events, NEMA is the central authority for the CDEM response, supporting and co-ordinating the work of regional CDEM Groups and local authorities, the work of communities, central government departments and agencies, emergency services, welfare agencies, lifeline utilities, researchers, international agencies, and non-government organisations. Support for local crisis management is provided via an "all-of-government" response that is co-ordinated through the National Crisis Management Centre in Wellington, which facilitates information gathering and sharing, and strategic-level oversight. All actors involved in the response refer to New Zealand's Coordinated Incident Management System (CIMS) to ensure consistent principles, processes and terminology during response and the transition to recovery efforts.

65. The objectives of the National CDEM Plan for responding to an emergency include: the preservation of live, protection of assets, the protection of natural and physical resources, the provision of animal welfare, and the continuation or restoration of economic activity. For each type of hazard, a lead agency manages the response at the localised level with co-ordination support from NEMA at the national level. As reported in Section 3.1, the lead response entity differs for each type of hazard, with local councils and regional CDEM Groups leading the response for flood events. Nevertheless, the 2015 revision of the national CDEM Plan established that MPI would also take on some specific roles during the response to floods in rural areas, recognising that the agency is best placed to raise awareness and understanding levels among regional CDEM Groups about the specific needs of the primary sector.

66. Notably, the 2015 changes also prompted the creation of rural advisory groups in almost every region to support emergency response to any type of hazard in rural areas. Led by a partnership between MPI regional staff, the relevant regional CDEM Group, local councils and Rural Support Trust, the rural advisory groups provide a platform to facilitate collaboration among all agricultural stakeholders in a given area during a crisis, including Rural Women New Zealand,[22] veterinary associations, and industry groups and farmers' associations (such as Beef + Lamb NZ, Dairy NZ, Federated Farmers, and Fonterra). In case of an adverse event, these organisations hold a conference call to pool their knowledge about what is happening, compose a comprehensive picture of issues and vulnerabilities in the affected territory, and formulate a well-informed needs assessment for CDEM responders, in addition to defining their own response actions to avoid duplication of efforts.

67. The rural advisory groups have improved oversight and co-ordination to better cater to rural needs, however, research and stakeholders' feedback suggests that emergency response from regional CDEM Groups can still be less effective in rural areas than in urban areas. Stakeholders have also noted that there is a tendency to channel available funding

[21] The National CDEM Plan stipulates that national warnings and advisories do not cover long-term or slowly evolving threats. This is the case, for example, of drought, for which MPI and NIWA are primarily responsible for disseminating information.

[22] Rural Women New Zealand is a rural organisation that promotes and advocates on health services, education, environment and social issues in the rural sector.

and recovery capabilities in support of urban centres rather than rural communities.[23] In particular, although the CDEM system is pursuing more co-ordinated and formal response structures, many stakeholders report that response efforts can largely depend on personal relationships in rural areas, with little predictability for farmers. This creates specific difficulties for rural people who may not have the ability to ask for assistance if needed, due to a lack of phone connection, (both cell phone and land line), limited road access and no electricity. For example, following the Hurunui-Kaikōura earthquakes, stakeholders had reported that civil defence did not proactively check on people in rural areas for the first few days.

68. In addition, stakeholders have suggested that more could be done in terms of temporary derogations on regulatory requirements and standards for agricultural production to support business continuity. For example, strict environmental standards may have the unintended consequence of exacerbating impacts and hindering business continuity if they are upheld in the event of flooding. Similarly, it has been noted that during adverse events crises, MPI could relax animal welfare standards enforcement, and instead focus on ensuring immediate minimum animal health status.[24]

69. For their part, farmers are generally aware of their responsibilities for managing crises on-farm, and do well at basic practices, such as moving stock or helping CDEM responders with storm water pumping during floods. As noted in Section 3.4, support between farmers is also very common – for example, providing assistance in the form of labour, food, water, and animal husbandry needs – and it is widely encouraged by the government and industry groups.

70. In addition, many industry groups have teams and processes in place to work with and support producers during crises, including through the rural advisory groups. In line with their interests representation function, industry networks provide significant on-farm support with a view to ensuring business continuity and minimising the impacts of adverse events such as floods. For example, Fonterra will pay producers for milk that cannot be collected when the tanker cannot reach the farm gate because of transport disruptions caused by floods.[25] Similarly, Federated Farmers has run adverse events charity support programmes, and previously ran a 'Feedline' programme to support farmers who need extra feed or grazing for their animals during adverse events, and can provide assistance with staff management and employment issues. In the case of the 2020 drought, which affected several regions amidst the COVID-19 crisis, MPI partnered with industry groups to offer remote feed planning support to farmers and livestock owners (MPI, 2020[65]). Different industries within the agricultural sector also provide each other with support – for example, Fonterra may lend milk trucks to transport wine during crises.

3.6. Recovery and reconstruction

71. Measures that support recovery can be crucial to enabling the agricultural sector to cope with natural-hazard induced disasters by supporting farmers to return to their business

[23] Stakeholder interviews, in particular, regional CDEM Groups, NIWA, and National Science Challenges, January 2020.

[24] Discussions with Dairy NZ, Federated Farmers, RSTs representatives, January 2020.

[25] More specifically, Fonterra pays farmers for milk that is not collected, in situations where their milk tanker is unable to reach the letterbox (i.e. road cut off). If the tanker can reach the letterbox, but the tanker track is unpassable, that cost would usually fall on the farmer.

quickly. Moreover, recovery and reconstruction efforts offer an opportunity for public and private stakeholders to "build back better"[26] by addressing underlying gaps in resilience, and building the capacities needed to manage natural hazards in the future (FAO, IFAD and WFP, 2019[7]). This requires all stakeholders – including producers – to learn from natural disasters in order to adjust disaster risk management frameworks, policy measures and on-farm strategies with a view towards long-term resilience (see Box 1 and OECD (2020[1])).

72. New Zealand defines recovery as the set of efforts and processes to bring about the immediate, medium-term and long-term regeneration, restoration and enhancement of a community, including its wellbeing and livelihoods. The CDEM system in New Zealand attributes strategic significance to the transition from disaster response to the recovery stage. The National CDEM Plan stipulates that "recovery measures should be planned for and implemented (with necessary modifications) from the first day of the response (or as soon as practicable) and should be co-ordinated and integrated with response actions" (Section 114.4). Amendments to the CDEM Act in 2016 also strengthened recovery provisions, including by introducing a detailed definition of recovery activities that includes reference to needs assessments, community participation, and the notion of 'enhancement' – that is, local authorities should take practicable opportunities during recovery to reduce the affected community's future exposure to hazards and associated risks. The amendments also establish a statutory position for Recovery Managers with powers and functions during the transition period.

73. In case of an emergency, damages are to be primarily recovered via insurance policies, although provisions in most insurance contracts do not provide for betterment, meaning that insurers would not contribute to the relocation or re-construction on a safer site. Nevertheless, in contrast to the limited involvement in the preceding phases of risk management, the central government provides financial support though relief payments for individuals affected by an emergency under the CDEM system (Work and Income, 2020[66]). Subject to Cabinet approval, the central government may also fund 60% of eligible costs, above an indexed threshold, with local authorities paying the remainder,[27] to rebuild or repair damaged essential infrastructure, river management systems and community assets, which may be vital for the recovery of the agricultural sector. Essential infrastructure assets include sewerage, water supply, storm water, electrical and gas facilities and other structures such as retaining walls and tunnels that support the delivery of essential services, as well as river management systems and their drainage schemes where there is major community disruption or continuing risk to life, all of which can be key for recovery in the agricultural sector. However, while there is a special policy for financial support during recovery that allows infrastructure to be upgraded during repair and rebuild projects, the specified, default position is that central government support to local authorities does not imply an obligation to restore assets to a better state than existed before the emergency.

[26] Building back better is defined as using the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalisation of livelihoods, economies and the environment (UNISDR, 2015[8]).

[27] Thresholds are as follows: 0.0075% of the net capital value of the city council, district council or unitary authority involved; 0.002% of the net capital value of unitary authorities where the assets in question are of a type that ordinarily are managed by regional councils; 0.002% of net capital value in the case of regional councils. See Section 33 of the CDEM Plan Guide (Director of CDEM, 2015[23]).

74. Disaster recovery in the agricultural sector is based on the understanding that farming is a business like others. To this effect, farmers are able to access funding that is available under the CDEM system to support society-wide recovery. In parallel, MPI has responsibility for recovery activities for rural communities, and it is in this context that it provides the most direct form of support to primary producers and their families. Specifically, MPI administers the Primary Sector Recovery Policy – the framework that guides government decisions on recovery assistance following adverse climatic events and biosecurity incursions that affect farms (Box 6) – to provide support specifically for farmers and growers, farm workers, and their families. There is also an MPI Adverse Events Contingency Fund that can be accessed for medium and large-scale adverse events.[28]

75. In terms of specific disaster assistance measures for agriculture, the government decides on the measures to be made available under the Primary Sector Recovery Policy in response to each event, and the assistance package is tailored to the specific needs that arise from a menu of pre-defined options. In the case of localised events, regional governments, through the regional CDEM Groups, may provide support measures in accordance with their own plans and using their own funds, and are not bound by the Primary Sector Recovery Policy. Inland Revenue can also provide support in the form of tax relief (essentially around the timing of tax payments rather than the quantum of tax due) and the Ministry for Social Development can provide general social support, such as special needs grants and jobseeker benefit support. In case of medium and large-scale events, MPI may provide additional assistance in the form of grants for technology transfer assistance, or for the appointment of a rural recovery facilitator to co-ordinate the use of support resources in rural communities. However, most support tends to be directed towards funding the Rural Support Trusts to provide psychosocial support, and co-ordination and information services in affected communities (Box 3).

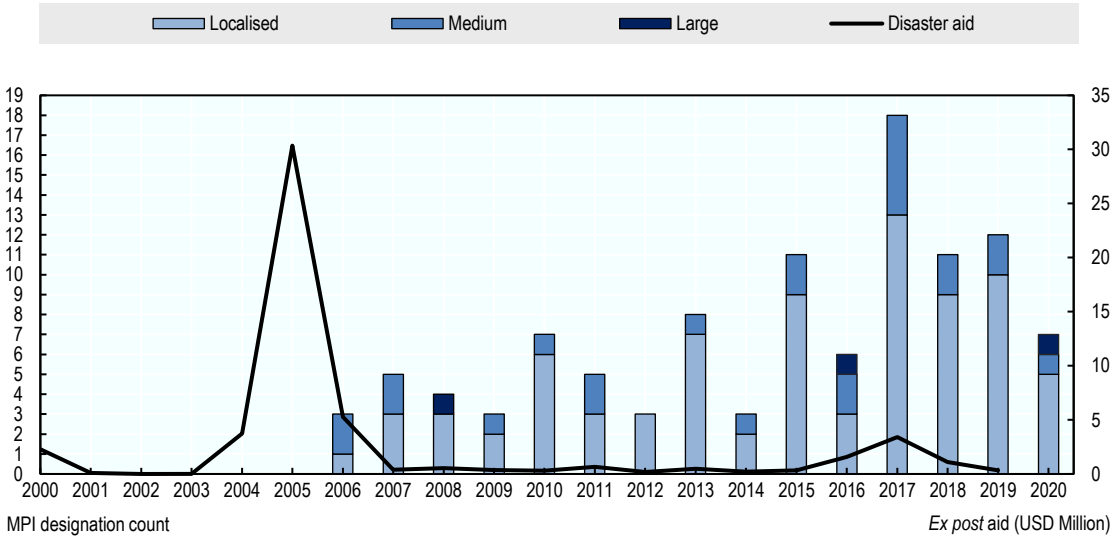
76. MPI may also seek assistance under the Primary Sector Recovery Policy for support programmes that are delivered by the Ministry of Social Development. These programmes may provide labour assistance via the Enhanced Taskforce Green, which provides jobs to the unemployed to assist with clean-up and repairs; or income support via the Rural Assistance Payments (RAPs), which help rural families whose income has been affected by an adverse event to meet living needs expenses. RAPs are linked with the general social welfare system to ensure equity between farm and non-farm sectors. On top of these measures, and in the case of large-scale events, the government may also trigger payments for repairing uninsurable infrastructure on farms. This Special Recovery Measure covers a share of the costs to restore uninsurable on-farm infrastructure; re-establish uninsurable pasture, crops and forestry (excluding slips); and undertake an initial clean-up of silt and debris (where uninsurable). Support is cost-shared at 50%, with an excess of NZD 10 000 (USD 6 500) or 10% of damage costs (whichever is greater). Assistance is capped at a maximum of NZD 250 000 (USD 164 000) per farm business. MPI may apply for increased one-off funding from the central government where it deems necessary.

77. Nevertheless, it should be noted that only three events have been classified as large-scale events by MPI since the advent of the Primary Sector Recovery Policy in 2006

[28] Funding for farmer support following a biosecurity incursion does not come from the Adverse Events Contingency Fund, but will be included within funding requests to government as part of decisions in how to respond. An example is responding to the cattle disease *Mycoplasma bovis* where farmer welfare was a key consideration (MPI, 2018[81]).

(known as the Adverse Events Recovery Policy until 2017),[29] and none of them resulted in the full activation of this Special Recovery Measure, although a restricted form of grants was made available following flooding in two regions (Taranaki and Horizons, classified as a medium-scale event) in 2015, the Hurunui-Kaikōura earthquakes in 2016 (classified as a large event) and the Bay of Plenty flooding in 2017 (classified as a medium-scale event).30 Of the 106 events shown in Figure 2, MPI provided support in response to 72 events (24 medium and 3 large-scale). More broadly, data suggests that since its introduction in 2006, the Primary Sector Recovery Policy has served to discipline *ex post* disaster aid, even as the sector experienced multiple hazards.

Figure 2. Ex post disaster aid for primary producers related to adverse events identified by MPI, 2000-2020



Note: Axis on the left expresses the count of adverse events affecting the rural sector as classified by MPI. Data is not available for the period before 2006. Axis on the right expresses *ex post* disaster aid (USD million) for the primary sector. Data for 2020 not available yet.
Source: Author's elaboration, based on data received from MPI, and OECD (2020[67]), "Producer and Consumer Support Estimates", OECD Agriculture statistics (database), https://doi.org/10.1787/466c3b98-en.

78. It is likely that the relatively low levels of support provided to farmers after a crisis provides an incentive to farmers to adapt and transform after a disaster has occurred. However, more proactive incentives have been provided in certain instances to support "building back better." For example, in 2020 the central government provided NZD 2 million (USD 1.3 million) in additional funding to help primary sector industries recover from a large-scale drought (Figure 2), as well as a package of other support measures, including urgent water infrastructure funding. In particular, the government established the Drought Recovery Advice Fund to help farmers to plan for future droughts (MPI, 2020[68]). The fund is capped at NZD 3.5 million (USD 2.5 million) and will provide

[29] The large-scale events identified are: 2008 National Drought; 2016 Kaikōura earthquake; 2020 Drought (while the COVID-19 pandemic was not classified as an adverse climatic event *per se*, some forms of support, similar to those made available for the drought, were extended to non-drought impacted regions with the rationale of recognising the compounding impacts of these two events and that non-drought regions also required similar forms of support).

[30] A review of the policy is currently underway to review the application of this measure, based on communication with MPI officials (April 2021).

support for farmers to access professional advice, to a maximum of NZD 3 500 (USD 2 500) per farm business. A Primary Industries Earthquake Recovery Fund was also established to support long-term land use changes in the regions most affected by the 2016 Hurunui-Kaikōura earthquake (MPI, 2017[69]). The Primary Industries Earthquake Recovery Fund provided funding for projects and direct-to-landowner grants. Almost NZD 1 million (USD 700 000) in grants was provided to farmers for professional advice on land use suitability and optimisation, with a limit of NZD 5 000 per farm (USD 3 300).

Box 6. The Primary Sector Recovery Policy – An *ex ante* framework to provide *ex post* assistance

The Primary Sector Recovery Policy administered by MPI establishes an *ex ante* framework to guide government decisions on recovery assistance following adverse climatic events and biosecurity incursions impacting farms. The policy provides a consistent framework for government support to facilitate the recovery of the sector, while limiting farmers' overreliance on government assistance.

In particular, the Primary Sector Recovery Policy was developed with a view to:

- protect the government from making decisions that are precedent-setting and have greater fiscal risk
- help to constrain government spending by setting guidelines for on-farm recovery assistance
- provide stakeholders with confidence that their risk management investments will not be undermined by ad hoc government decisions taken under political pressure after a shock – that is, to avoid disincentives to risk-reducing actions by relevant stakeholders.

Assistance is contingent upon the expectation that reasonable steps to mitigate and cope with risk have been taken by individuals, local communities, local governments and industry. Accordingly, each event is classified as either localised, medium or large-scale, based on consideration of the risk management options available for farmers to prepare for the event; the magnitude of the event/incursion; and the capacity of the community to cope economically and socially. The focus on the community context simultaneously avoids assessments of individual cases, while granting flexibility for situations where there are compounding effects from multiple smaller events.

Finally, this classification helps the government to decide what recovery help is made available for each event from among a menu of pre-defined options. Any assistance is intended to meet basic family welfare needs, if necessary, through appropriate and equitable measures; to restore community capacity for self-help; and to ensure that recovery can occur more quickly. The type of support made available also depends on whether the event in question has attracted resources from other areas, such as for example private donations towards Mayoral Funds.

Source: (MPI, n.d.[70])

79. Evaluation and adjustment of DRM frameworks in preparation for future crises is also important for ensuring gaps and vulnerabilities are understood and addressed. Under the National CDEM Plan, all agencies with responsibilities under the Plan should monitor and measure progress against their goals and objectives, and ensure that they have the

capacity and capability to perform their CDEM functions across the '4 Rs'. While the emergency system has undergone many changes and is continuously evolving, reviews of disaster responses are undertaken on an ad hoc basis. There is no agreed framework or approach, and it is often dependent upon available resources.

80. Nevertheless, for those post-disaster evaluations that are undertaken, New Zealand has a good record of feeding the findings into reviews of policies and frameworks, leading to corrective actions.[31] In particular, a 2018 *Ministerial Review: Better Responses to Natural Disasters and Other Emergencies* (commissioned after the 2016 earthquake and tsunami and the 2017 Port Hills fire) led to a comprehensive review of the national disaster response frameworks and the establishment of NEMA (MCDEM, 2018[71]). Other review recommendations have also contributed to establishing the current all-hazards approach to disaster risk management. While there is no established practice to undertake agriculture-specific reviews of the response performance, mitigation and prevention measures for the sector in terms of land-use planning and building codes have progressed thanks to lessons learnt as part of these review processes.

4. Analysis and assessment

4.1. Disaster risk management frameworks provide consistent incentives to invest in agricultural resilience, but the devolved governance model can be a barrier to implementation

81. The New Zealand approach to emergency management conceptualises resilience as a cross-sectoral, multi-agency system that spans across the '4 Rs' of disaster risk management: risk reduction, readiness, response and recovery. Within this system, local communities, businesses and individuals – including farmers – are consistently encouraged to take responsibility for reducing their exposure and vulnerability to natural hazard risk, and for disaster preparedness, while the government takes on a more direct, albeit proportional, role in responding to crises and supporting recovery. In line with this approach, agricultural policy frameworks focus on providing incentives for farmers to develop their capacity for managing risk, envisioning only limited *ex post* government support in the case of catastrophic events.

82. Overall, the devolved model that characterises disaster risk management in New Zealand has some key advantages. It ensures that action is grounded in the local reality, and it empowers those who have knowledge of the vulnerabilities and preparedness needs of an area to make decisions about disaster risk reduction activities, including in the agricultural sector. For the devolved model to succeed, however, it is critical that decision makers have the resources and capabilities to identify and address their needs, in addition to the authority and incentives to do so.

83. In New Zealand, stakeholders note that not all communities currently have the necessary information, capabilities and financial resources to identify, assess, mitigate and prepare for risk. Although industry groups often assist farmers and provide specific expertise in relation to risk management for rural areas, those institutional challenges leave some gaps in the capacity of rural communities and farmers to strategically invest in building their own resilience. To address these challenges, regular government assessments of the disaster preparedness of local communities and other rural actors would help to

[31] For example, (Smol, 2018[83]; Rangitāiki River Scheme Review Panel, 2017[63]; Whakatāne District Local Recovery Manager, 2017[64]).

identify critical gaps and inform decisions over how to overcome them (Keating et al., 2014[72]). In this sense, the Community Resilience Group recently established at the national level will provide a forum for assessing resilience gaps and capabilities at the local level, and to start developing solutions to address them.

84. In addition, fragmented disaster risk management frameworks, such as frameworks based on a specific type of natural hazard, sector, or across government agencies, can reduce the effectiveness and efficiency of investments in resilience (OECD, 2009[3]; UNISDR, 2015[5]). Currently, in New Zealand, responsibility for managing the risks of different types of hazards falls under different agencies (Section 3.1). For example, flood risk management is a responsibility of local authorities, without an agency providing strategic guidance and oversight at the national level across the '4 Rs'. Therefore, it will be important to assess if this hazard-specific approach results in either duplication of effort or gaps across agencies, such as a lack of co-ordination and strategic decision-making with regard to certain types of risk for some sectors, or a lack of vision of the risks posed by combinations of different types of hazards. More broadly, ensuring that the perspective of a wide set of stakeholders is included in planning across the '4 Rs' for all types of hazards will be important to ensure that no gaps exist across the disaster risk management cycle.

4.2. Stakeholders have high awareness of natural hazard risk, but there is a need for consistent and tailored information on both immediate and long-term risks

85. A shared awareness of natural hazard risks is important to encourage public and private investments in disaster risk prevention, mitigation and preparedness. To this end, it is important that decision-makers can access science-based and targeted information on the risk environment within which they operate, as well as information on the options to mitigate and prepare for those risks (OECD, 2014[17]; OECD, 2017[73]).

86. Under the CDEM Plan, government agencies, regional and local authorities and research institutions undertake risk assessments for the specific hazards for which they have lead responsibility, as part of their regular activities. However, the current arrangement can lead to fragmentation of information, and in turn create challenges for decision-makers – including farmers – to clearly understand the nature of the risk that they face. Moreover, this structure may lead to gaps in the analysis of cascading and cumulative effects of different types of natural hazards, and of the evolution of the natural hazard risk environment over both the medium- and long-term horizon.

87. In this context, the industry groups in New Zealand have taken on a primary role in raising risk awareness among farmers. For example, the Land and Environment Plans promoted by Beef + Lamb NZ support farmers by translating available risk information into a farm-scale picture of the risks that they face. Farmers can then use this information in their farm management decisions, including in deciding how to adapt to climate and natural hazard risk, and leverage climate change as a business opportunity. In this respect, the industry groups play an important role as intermediaries between policymakers and researchers, and farmers as end-users of this information. Given reports that farmers desire more science-based information and decision-support tools for managing risk (Section 3.2), this role is likely to become more important. In this context, it will be important for researchers and policymakers to have strong linkages with industry groups, to ensure that climate information and decision-support tools are tailored to the short-, medium- and long-term needs of farmers – and equally, that information provided to farmers by industry groups is science-based and proven to be effective in building resilience to natural hazards.

88. Overall, it appears that a lack of data – for example, on disaster damage and losses, and geospatial data – constrain hazard analysis, foresighting exercises and risk-informed decision-making by researchers, policy makers, industry groups, communities and farmers in New Zealand. The Community Resilience Group is expected to play a role in co-ordinating improved data collection across government agencies, and additional funding from government sources, such as MBIE, is being made available to improve the existing knowledge on natural hazard risk. Nevertheless, there remains a need to further invest in developing high quality datasets on the physical, land use, and other characteristics of the agricultural sector that are a necessary input to improving disaster risk assessment. In particular, data on damage and losses from previous adverse events is crucial to understand vulnerabilities during and after extreme events such as floods, in turn informing cost-effective resilience-enhancing investments at the community level and on-farm (IPCC, 2012[74]; De Groeve et al., 2014[75]).

4.3. The New Zealand Government is increasing efforts to intervene in the anticipatory phases of risk management, in particular aiming to build farmers' capacities for risk mitigation and adaptation

89. Applying a resilience approach to natural hazard risk requires stakeholders, both public and private, to shift their focus from coping with the impacts of floods and instead place a greater emphasis on what can be don*e ex ante* to reduce risk exposure and increase preparedness (OECD, 2020[1]).

90. Regional authorities, local communities and individuals are responsible for preventing and mitigating natural hazard risks to their assets, consistent with New Zealand's devolved approach to disaster risk management. Thanks to high awareness of natural hazard risks and of the limited public assistance available *ex post*, stakeholders at all levels are adjusting their policy approach and practices to put greater efforts into prevention and mitigation. In particular, there is growing recognition that at the community-level, some resilience gaps persist because of a mismatch between the disaster risk reduction needs of rural communities and the financial capacities of local authorities to invest in building or maintaining protective infrastructure. In response to these gaps, the government is taking on a larger role where capacities at a local level hinder adequate resilience-enhancing efforts and investments, including through funding. There are also initiatives to build the capacity of regional and local authorities for disaster risk reduction, such as the through the Community Resilience Group.

91. At the farm-level, farmers are adapting their operations to mitigate climate and natural hazard risks. In this they are supported both by industry groups such as Beef + Lamb NZ, Dairy NZ and Federated Farmers, and MPI. Industry initiatives like the Sustainable Dairying: Water Accord or the Land and Environment Plans have proven to be key entry points for raising risk awareness among farmers and building farmers' capacity to identify and implement appropriate measures for reducing on-farm risk exposure. Similarly, MPI programmes also promote strategies to prevent and mitigate the impacts of floods on production, through co-funding and grant schemes for nature-based solutions such as tree planting and soil erosion control. These initiatives also share a number of other strengths, in that they engage with, and benefit from the support of, a diverse range of stakeholders; support on-farm experimentation with adaptation; and prioritise communication with producers.

92. Nevertheless, capacity constraints (both financial and entrepreneurial), combined with behavioural biases – such as a tendency not to plan for a potential hazard event just because it has not occurred in the recent past or the difficulty of perceiving the return value

of *ex ante* investments – and uncertainty regarding risk and the options to manage that risk, have been found to hinder a faster uptake of resilience-enhancing strategies on-farm. In response, the New Zealand government has increased its engagement to build capacities to prevent and mitigate risks and impacts on-farm, focusing on the development of the human capital of farmers and farm advisors. Most notably, MPI has re-entered the extension services space to help farmers make decisions that support sustainable land use and improve farming outcomes. Indeed, experts have noted the value of supporting informed, and continually updated, training and extension programmes in improving the resilience of agricultural households (Caron et al., 2018[76]). This means ensuring that farmers do not adopt riskier, less efficient or unsustainable production strategies by solely focusing on managing immediate risks, but have the incentives and capacities to adapt and transform in response to a changing risk environment. As also recognised by the New Zealand government, ensuring the success of this new extension programme will require the involvement of industry groups and other trusted parties to secure buy-in from farmers. It will also require to collaborate with farmers to co-produce knowledge and solutions that reflect their needs and address their existing constraints (Cornell et al., 2013[77]).

4.4. In New Zealand preparedness is uneven, but some key good practices arise during recovery, in terms of limited ex post disaster aid, support for mental wellbeing after a shock, and incentives to 'build back better'

93. Crisis management in New Zealand is supported by frameworks that clearly outline co-ordinating structures for disaster response, and the roles and responsibilities of different agencies and actors. Crisis response is delivered by the CDEM's professionalised and flexible workforce, and CIMS training is available for any other stakeholder involved in crisis response to harmonise language and facilitate co-ordination.

94. In New Zealand, the emphasis is on individuals and private actors taking responsibility for preparedness to natural hazard crisis management, In the case of floods, individuals are supported by regional CDEM Groups for crisis response. However, preparedness to flood risk in the agricultural sector is uneven. At the farm-level producers can access information to help them prepare for and recover from natural hazards. Industry groups have made significant investments in developing information and resources to help farmers to prepare more effectively and develop contingency plans, including in relation to specific hazards. However, it is unclear whether, and how effectively, producers use these resources, and stakeholders indicate that recovery can still be slow in rural areas, suggesting that producers would benefit from better integrating recovery into their risk management plans. At the same time, regional CDEM Groups are held to focus their efforts on urban areas instead of rural ones in the immediate aftermath of a shock. In particular, stakeholders consider that the effectiveness of regional CDEM Groups during response and recovery in rural areas is hindered by a lack of pre-existing information on the sector's vulnerabilities and specific needs. Some of these challenges are also exacerbated by a lack of accessibility and internet connectivity in rural areas, limiting farmers' access to timely information and creating only limited possibility for two-way communication on needs. Much seems to depend on personal relationships among responders and farmers' networks, which can raise challenges especially for less established farmers that are not as well experienced in managing risk.

95. Thus, to improve the capacity to respond to floods that affect the agricultural sector, it will be crucial to strengthen mechanisms for public and private actors that are involved in disaster response to build their capacities, and to build relationships and devise collaboration strategies before emergencies occur. Pre-existing networks between actors who bring different types of resources to disaster response can be key to fostering

preparedness and avoiding gaps in disaster response (Clarke and Dercon, 2016[78]). To this effect, multi-stakeholder scenario planning exercises can be extremely valuable for consolidating linkages while identifying gaps and vulnerabilities in the system. The recent emergence of the rural advisory groups as a multi-stakeholder partnership to support response for the rural sector represents just such an opportunity. In particular, there may be a role for the government in pursing strategies to more proactively leverage these networks and the expertise that they hold as part of drill exercises, including having farmers participate. A natural opportunity also seems to lie in all stakeholders involved in the rural advisory groups, such as the MPI adverse events teams, industry groups, the RSTs and regional CDEM Groups, to make greater use of the experience that they acquire during response and recovery activities to improve preparedness for future events. For example, their experiences could inform the development of extension services and other preparedness resources for the sector, and help to drive adoption of new practices or strategies on farms.

96. Nevertheless, the policy approach to supporting the recovery of the agricultural sector in New Zealand distinguishes itself for two good practices. First, the MPI Primary Sector Recovery Policy provides an *ex ante* framework to guide decision-making on *ex post* disaster aid for primary producers, avoiding farmers' overreliance on central government support and ensuring alignment of incentives across the disaster risk management system. Second, the New Zealand approach to agricultural recovery stands out for its recognition of mental wellbeing as a driver of resilience. In particular, under MPI's Primary Sector Recovery Policy, when a medium- or large-scale adverse event affects the sector, the RSTs receive funding to support farmers in dealing with the impacts from a psychosocial perspective.

97. In addition, while short-term considerations are a priority for producers following a natural disaster, rebuilding offers an important opportunity to address underlying gaps in resilience and build the capacities needed to manage natural hazards in the future (Gruère, Ashley and Cadilhon, 2018[79]). Moreover, producers may be more receptive to information and technical advice after an extreme event, as a result of heightened risk perceptions (Widhalm, 2019[80]). In New Zealand, in the past, disaster aid under MPI's Primary Sector Recovery Policy has included financial resources reserved for farmers to receive advisory services for reducing their exposure and vulnerability to future risk, namely for droughts and earthquakes. This a key good practice to encourage the sector to transform through the capacity building of farmers, rather than by undermining the incentives for farmers to invest in those improvements themselves. Going forward, there will be scope to further incorporate the principle of "building back better" after a natural disaster into disaster assistance packages to increase the sector's resilience to floods and other natural hazards.

5. Conclusion

98. New Zealand offers many examples of good practices that can boost agricultural resilience to natural-hazard induced disasters, and three examples in particular emerge from this case study.

99. First, the government provides clear and consistent signals to the agricultural sector that individuals and communities are primarily responsible for managing their own risk. This allows the government to focus its efforts towards capacity building, and towards providing relief support in case of catastrophic events. In particular, MPI's Primary Sector Recovery Policy establishes an *ex ante* framework for delivering *ex post* assistance, managing expectations around government support, and thereby encouraging primary producers to innovate and invest in building their own resilience. The recent decision to re-

enter the extension services space also testifies the consistency of the government in supporting the sector to adapt to an evolving risk environment, not by undermining its overarching policy approach, but by enhancing the capacity of farmers to adjust to the long-term challenges that they face. An important feature of this initiative is that it places significant emphasis on the co-production of information and solutions, to maximise their relevance to local contexts and usability.

100. Second, the New Zealand experience demonstrates that when the private sector is encouraged to take responsibility for risk, industry groups can become a valuable source of support for farmers and help them to achieve resilience goals. At present, New Zealand's industry groups help to enhance the resilience of farmers to flood risk by translating risk assessment information into a farm-scale snapshot of risk, stimulating the development of context-specific practices to prevent and mitigate risk at the farm and community level, and providing support during response and recovery.

101. Third, agricultural resilience in the country is considered holistically, in that the mental wellbeing of primary producers is identified as a key enabler of resilience, alongside the financial and production aspects of risk management. In particular, the RSTs have emerged as peer-to-peer regional networks for advising farmers, delivering assistance, and supporting social resilience after a shock. Today, the RSTs receive some financial support from MPI to fulfil this role under the Primary Sector Recovery Policy.

102. Taken together, these elements suggest that resilience in New Zealand is achieved through a mix of policies and strategies in which the public and the private sector successfully and dynamically co-operate, and that are increasingly focused on readiness and on building stakeholders' capacity. The government does not undermine private incentives to invest in resilience-enhancing measures. Instead, it invests in developing the human capital of the sector, and then integrates industry and other private initiatives into policy. This has been the case of the initiatives of industry groups and the RSTs, but also activities from the Māori and *iwi* communities and other networks, such as the rural advisory groups, and Rural Women New Zealand, all of which are formally recognised within the country's disaster risk management frameworks.

103. Nevertheless, in a system like New Zealand's, which encourages communities and individuals to take responsibility for managing natural hazard risk, it is crucial that all actors are provided with an enabling environment that supports their capacity to do so. In particular, previous OECD work has shown that there can be a role for the government where gaps exist in stakeholders' capacities to increase their own resilience – for example, through accurate information about risk to support cost-effective investments in risk prevention and mitigation; through appropriate investments in infrastructure and nature-based solutions that reduce current risk exposure; and through information and training that help farmers to adapt and transform in response to uncertainty and a changing risk environment (OECD, 2020[1]).

104. Given the public good nature of these activities, the government of New Zealand could consider strengthening risk identification and assessment activities across the country – this includes data gathering efforts and crisis simulations, which can help stakeholders to identify their vulnerabilities. This is key to ensuring that public and private investments in prevention, adaptation, and preparedness are undertaken, and that they are fit-for-purpose and cost-effective. Systematic scenario planning exercises would also be important to ensure that gaps in the CDEM response system for rural areas are identified, and addressed, in advance, and for different types of hazards.

105. In parallel, it will be important for the recently re-introduced extension services to deliver a strong message across the country about the changing risk landscape, leading to

the development and diffusion of effective solutions. In particular, the government's involvement in the extension space represents an opportunity to improve the current fragmentation of information sources for farmers, and to stimulate wide-scale adaptation and transformation in the sector. In this sense, publicly-provided extension services represent an opportunity to ensure that the societal objectives and sustainability needs of the sector are considered in individual farm business decisions, and support agricultural resilience in the long-run.

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