

# Climate Change: Adaptation implications across the agricultural sector



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We can consider the impacts of climate change on agriculture sector-by-sector, and there are a number of reports and fact sheets in this series that do that. But there are some impacts that affect all sectors simultaneously. There are also adaptation options that can be applied across many sectors, or require a multi-sector response. By their nature, these adaptation options tend to be strategic or transformational because they involve quite significant change. A changing climate will also affect biological systems and environmental services that are important to the reliability and performance of production systems.

Secondary impacts should be expected: the effect on infrastructure; changing demands for skills and labour as new management or alternative production systems are implemented; economic and social impacts in the wider community. There are many examples of actions that can spread the direct and indirect impacts of climate change, and which can reduce the risk for businesses and communities.

## Environmental impacts

Under climate change in New Zealand environmental impacts include increased erosion, caused by more intense rain, increased nutrient discharge from efforts to capture carbon dioxide fertilisation, and biodiversity impacts. In some cases, such as erosion, these impacts have 'on site' effects and can limit or restrict production, leading to a shift in the resilience of businesses. There are also 'off-site' effects.

Environmental impacts are often considered negative, but there may also be positive effects, as well as opportunities to improve environmental performance through adaptation responses.

Rising temperatures will strongly affect the abundance and distribution of pests, as well as the viability of controls. General assessments suggest that warming will create more favourable climates for some pests at southerly ranges. However, for other pests, increased temperatures will decrease their range. Initially this will occur as a series of 'hot spots' given the very specific host and population factors that govern pest distributions.

There are also direct impacts on systems of biocontrol of pests and diseases. Increased temperatures, CO<sub>2</sub> concentrations and changes in water availability are likely to affect the individual species in a biocontrol system differentially e.g. changing rates of development and reproduction, and susceptibility to parasitism and diseases. Climate change can have beneficial, neutral or harmful effects on the stability of a biocontrol system by influencing the abundance of pests and control species, their hosts and habitats as well as the relationships between them.

[www.climatecloud.co.nz](http://www.climatecloud.co.nz)

Infrastructure is likely to be at risk. Water supply, both stock water and irrigation, and drainage systems face a range of increased risks. There are also broader implications for transport networks, energy supply and processing facilities and services.

Flooding and storm surges will affect ports, processing facilities and transport connections, particularly in low-lying coastal regions. Slips and erosion could disrupt transport and processing infrastructure. There is a medium to high likelihood of these impacts in the next 20 to 30 years.

Different sectors are vulnerable to different impacts. Dairy, for instance, relies heavily on road and rail freight, while the arable sector is concentrated in areas susceptible to more water stress, which can damage pumping and pipe infrastructure.

Dairy, meat and horticulture are also vulnerable to power outages, which require contingency planning.

### **Socio-economic implications for the wider community**

The production impacts and adaptation options identified for each sector will flow through to the wider community and the New Zealand economy as a whole. Current nationwide assessments indicate that without any adaptation direct impacts from changed climate variability on primary production create 'shocks'. However, there are also large opportunities to be had in good years and 'on-average' under mild climate change scenarios. Flow-on effects to local and regional communities have, in general, not received attention to date. In principle there are secondary flow-on effects from decisions to implement adaptation options such as job creation and new markets.



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### **Adaptation**

A range of tactical and strategic adaptation options exist to manage these risks: whole-farm planning; landscape/vegetation design; more efficient nutrient use; system modifications; and establishing conservation zones.

Building production and income diversity into an operation can be a response that manages risk by exploiting differences in the nature and seasonal timing of effects on alternative enterprises and production systems. A 'mixed operation' approach might be tactical. For example, wintering dairy cows to earn additional income on a sheep/beef enterprise. It can also be a strategic adaptation, by developing mixed farming systems e.g., a fully integrated arable cropping-dairy sector business; or agroforestry. Trade-offs may need to be made but co-benefits may also accrue, for instance shelter from trees. Land use change has been identified in all the sectors as one transformational option. It is driven by many interacting factors, not least climate, which largely determines the practical viability of different land uses. Soils and topography also have a bearing.

Ensuring that infrastructure is fit for purpose into the future is an important part of building resilience and maintaining productivity over the long term. Understanding the risks enables consideration and planning for upgrades, improved maintenance and asset replacement. It is also a starting point for considering

transformational options like shifting locations of key facilities or retiring infrastructure before its scheduled lifetime to avoid impacts. In cases of long asset lifetimes (20–30 or more years) infrastructural decisions made today need to factor in the climate of the future.

Management systems and approaches will probably need to be adjusted to accommodate adaptation options for climate change. Such responses are not always new or novel, many land managers already adopt risk management techniques.

From a growing mix, three useful approaches are:

- Adaptive management – otherwise known as ‘learning by doing’, or ‘continuous improvement’ which follows a cycle of monitoring, review, planning, and implementation. It is particularly useful in the face of uncertainty. Drawing lessons from every drought event is a prime example, as is business benchmarking. This stakeholder report itself is part of an adaptive management process, representing the ‘review’ process in the cycle.
- Decision making that explicitly deals with uncertainty, is a strong theme in climate adaptation. Decision making seeks to find ‘win-win’ strategies that work across the range of future conditions is a useful first step.
- Risk management is a process to assess how a business or production system can achieve specific outcomes given information about the likelihood of an external event, like climate change. Events, such as droughts, should be examined to see how they impact a business, as well as how likely they are to occur. Management responses can then be developed to reduce any negative effects or capture any opportunities that arise from these events.

Land managers will need to look critically at the information decisions are based on and how they are made. Strategies based on flexibility, so as to meet challenges and capture opportunities, are likely to become more important over the long term. Other considerations include the degree of buffer and protection against an adverse event, production diversity to trade off downside risks in one form of production against those in another, and reviewing new climate information as it is developed.

Ownership and governance structure within an individual farm or business can empower adaptation. Identifying institutional barriers, and addressing them, is a relatively new discipline. Business and management structures that achieve better integration, promote a culture of continual learning and promote and reward innovation are key success factors.



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## The Next Steps

A changing climate is both an opportunity and a challenge for land sectors. There are a suite of ‘win-win’ tactical and strategic adaptation options available to manage shifts in production variability in the immediate future. Changes can be made now or in the short term that have economic benefits, as well as increase resilience in the longer term.

Potentially, these options not only reduce the negative impacts from a changing climate but also capture the opportunities from increased plant growth.

A key decision will be when to act, as on one hand continually delaying adaptation builds exposure to climate change over time. On the other hand, investing now in expensive adaptation options comes at a cost. In the face of this challenge there is a natural tendency to maintain existing approaches to management.

There is no 'one size fits all' approach to adaptation. The impacts depend on the production system, management choices, local climate conditions, as well as the rate and extent of the changing climate. The greater the change in climate, or the impacts of that change, the more likely that transformational options will be required. We have made these types of changes in the past and will be able to do so in the future. Action can be taken now to expand our range of options to prepare for the future, no



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matter what climate scenario eventuates. Adaptation is a way of future proofing land-based sectors and the New Zealand economy to a changing climate. There are many reports that identify practical adaptation activities that are or can be part of day-to-day business, as well as those that build on the innovative drive of the land-based sectors. It is up to land managers to take up the challenge and translate this into on the ground action.

## Further Information

The report that this summary is based on is *Impacts of climate change on land-based sectors and adaptation options: Chapter 9. Multi-sector*, and can be downloaded from [www.climatecloud.co.nz/CloudLibrary/2012-33-CC-Impacts-Adaptation\\_SLMACC-Chapter9.pdf](http://www.climatecloud.co.nz/CloudLibrary/2012-33-CC-Impacts-Adaptation_SLMACC-Chapter9.pdf)

Further information providing an over-view and expanding sector-by-sector implications and adaptation strategies are available. These include: Chapter 1- Background; Chapter 2 – Climate; Chapter 3 – Dairy; Chapter 4 – Sheep and beef; Chapter 6 – Broad acre cropping; Chapter 6 – Horticulture; Chapter 7 – Forestry; Chapter 8 - Water resources.

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