

ADAPTING TO A CHANGING CLIMATE: FACT SHEET 7

STRONG WINDS
Climate change may blow you away

CLIMATE PROJECTIONS FOR NEW ZEALAND

- More easterly winds are expected in summer, except for Otago and Southland, and also more westerly winds in winter, except in Northland.
- Extreme winds will happen more often in winter, and less often in summer.
- Extreme wind speeds are expected to increase by only a small margin.
- More cyclone activity is expected over the Tasman Sea in summer.

THE IMPACT OF STRONG WINDS

- Wind erosion could reduce soil quality by removing topsoil and organic matter and exposing subsoils.
- In dry areas or regions experiencing drought, constant winds can reduce productivity through increased evapotranspiration and soil moisture loss.
- Spring cultivation and planting could be susceptible to stronger and more frequent wind events.

Vegetative cover is one of the keys to effective erosion control. Vegetation holds soil particles together, slows wind and traps any moving particles.

This fact sheet explores the potential impact of stronger and more frequent winds on New Zealand's land-based sectors. Information specific to Hawke's Bay has been used to illustrate potential impacts.

Stronger winds will impact on many land-based sectors. Sustained strong winds can accelerate soil erosion, increase water loss in pastures and crops, "sand blast" susceptible crops and increase fire risk in dry conditions. Damage to forest plantations, trees and structures is also possible.

Wind can cause cosmetic defects in fruit crops such as wind-rub and blemishes, fruit drop and affect pollination. It can also carry spray drift and reduce the number of hours available for spraying.

Young stock are particularly susceptible to wind, especially when combined with cold or wet conditions. Increased rainfall in the west and south of the South Island, in conjunction with increased westerly wind flow, has the potential to create higher risk conditions during the winter and spring months.

For anyone designing new structures or buildings, site selection is an important consideration in light of the potential for stronger winds in future.

HOW SOIL MOVES

Wind moves soil particles in three main ways, depending on their size and weight: suspension, creep, and saltation.

Small particles are suspended in the wind; larger particles creep along the soil surface and those in between (about 50–80 percent of soil movement) saltate or vibrate and collide with each another to create thick soil clouds moving downwind.

Saltating particles are the main cause of seedling and crop damage. Techniques that control saltation can significantly reduce both erosion and crop loss.

ADAPTING TO STRONGER AND MORE FREQUENT WINDS

Landowners can control wind speed, soil cover and soil condition to reduce the effects of wind erosion.

MANAGING WIND SPEED

Wind erosion starts when wind speed reaches a critical level – known as the threshold velocity. For many Hawke's Bay soils, for example, this is only about 20–25 km/hour. Once wind speed doubles above this threshold, eight times more soil movement occurs.

Shelter is the only way to reduce wind speed. Effective shelter reduces the risk of wind erosion on cultivated soils; protects stock, crops, buildings and yards; minimises moisture loss from plants and soil; and could provide a potential source of future timber.

The aim of shelter is to filter the wind – not stop it entirely – so the effect is maximised downwind as far as possible. Well-maintained shelter creates a sheltered zone about 10–15 times its height, so a shelterbelt 10 metres tall protects about 100–150 metres of ground. Shelterbelts should be continuous, with no gaps for the wind to funnel through, but not be too dense. About 50 percent permeability is best, as a solid barrier will create turbulence and may increase wind speeds and erosion downwind.

Current and traditional shelter spacing may be inadequate for stronger and more frequent winds. It's a good idea to start planning shelter early as trees take a while to establish, especially in exposed sites.

SHELTERING FRUIT CROPS

Site selection is important when establishing fruit crops: grow wind-sensitive crops such as kiwifruit, avocados, pears and plums in the better sheltered areas. By comparison, crops such as apples and grapes can stand more wind.

Natural or artificial shelterbelts can be very effective in reducing wind damage and fruit drop. Overhead nets are also good for reducing wind run and have the added advantage of protecting against hail damage. It is important to use adequate support structures that won't fall over in high winds, particularly when supporting the full weight of a crop.

SHELTERING STOCK

Cold, wet, windy conditions in spring and insufficient shelter can impact on the survival of young stock. This is well known, but the future possibility of increased wind in winter and spring may require more planning.

CONTROLLING VEGETATIVE COVER

Vegetative cover is one of the keys to effective erosion control. Vegetation holds soil particles together, slows wind and traps any moving particles. A minimum of 20 percent vegetative cover is required and needs to be well attached to the soil. The cover can be alive or dead.

Minimum tillage maintains a protective cover of organic material on the soil surface after harvest, to effectively prevent erosion. The protective plant cover allows the soil to maximise water infiltration, retain moisture, minimise run off events, and reduce wind speed at the soil surface. Crop residue also provides a constant build-up of soil organic carbon.

No-till systems are preferred on very light soils as even minimum cultivation exposes fine, highly erodible particles.

Saltation – or the movement of soil particles – increases at an increasing rate across an exposed field. Soil type and wind speed determine the width of cultivated soil that is needed for effective soil erosion control.

Maintaining vegetative cover.

The table below illustrates the maximum width of cultivated soil needed for erosion control in Hawke's Bay when winds are at 65 km/hour. (Source: Hawke's Bay Regional Council.)

SOIL TEXTURE CLASS	MAXIMUM CULTIVATED STRIP WIDTH (METRES)
Sand	6
Loamy sand	8
Sandy loam	30
Silty clay	50
Loam	75
Clay loam	100

Light Hawke's Bay soils are prone to wind erosion and are particularly susceptible during cultivation and planting in spring. Napier weather station records show spring wind speeds of 65 km/hour can be expected most years and winds exceeding 96 km/hour can be expected about twice a year. While more common in spring, these high winds can occur at any time.

Hawke's Bay paddocks are commonly 200–400 metres wide, and as soil movement multiplies across the paddock, losses increase as the width increases. Creating narrow "isolated" fields within each paddock will control saltation and minimise erosion.

Isolated fields can be created by shelterbelts and/or grass borders, strip cropping, strip cultivating or by using trap strips of stiff upright plants (such as corn), that catch the saltating soil particles. Trials showed single or double rows of 1.2 metre stiff grasses (such as corn) planted about 9 metres apart reduced wind and cut erosion by more than 90 percent.

Strip cropping can be effective if strips of fast growing crops, such as maize or oats, can be established in fields of more sensitive crops, such as asparagus or squash.

CONTROLLING SOIL CONDITION

Wind erosion can also be reduced by controlling soil conditions. Avoid over working soils as this creates smaller soil particles that blow away more easily. Avoid cultivating during strong winds – it can set off saltation, which leads to more erosion.

Irrigating during a wind erosion event is ineffective. It's generally impossible to apply enough water to settle the soil and saltation can be triggered by the impact of the water droplets on dry soil. Water must be applied before problems begin – even though moist soils blow less easily than dry. Wind will quickly dry the soil surface so moisture alone is not enough to control wind erosion.

A smooth soil surface increases wind erosion – a rough soil surface slows wind speed and reduces wind erosion. Research shows that creating ridges 50–100 mm high, at right angles to the wind, reduces erosion. But if the ridges are higher than 100mm, erosion increases again. A cloddy surface will also slow wind and trap smaller soil particles, therefore reducing saltation and erosion.

Key points

1. **Climate change research shows more easterly winds are likely in summer, and more westerlies in winter.**
2. **More wind will increase the risk of losing topsoil, evapotranspiration may increase, damage to infrastructure may increase and stock could be placed under more stress.**
3. **Management techniques can help reduce the effect of winds on soil productivity. Consider planting shelter belts, paddock selection for young stock, and infrastructure design that take account of wind loading.**

FOR MORE INFORMATION

- Visit the National Institute of Water and Atmospheric Research (NIWA) to read Climate change scenarios for New Zealand: **www.niwascience.co.nz.**
- Hawke's Bay Regional Council has published fact sheets on soil management topics including flood protection, wind erosion, minimum tillage, and shelter planting. Visit **www.hbrc.govt** and go to "Read about it", then "Environment Topics".

THIS IS ONE IN A SERIES OF FACT SHEETS CALLED ADAPTING TO A CHANGING CLIMATE

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