



# SOIL HEALTH FACTSHEET

## Soil Erosion and Sediment Control

This factsheet is part of a series on Soil Health that provide summarised information on a wide range of soil related topics. A summary and collation of information on good erosion management and soil conservation practices that support key principles of soil erosion control is presented in this factsheet.

### Good soil erosion management and soil conservation practices

Soil health is defined as "*the continued capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans*" (Doran & Zeiss 2000). Soil health seeks to maintain or improve the different functions that soils perform. These functions can include retention of nutrients, climate regulation and supporting biodiversity as well production of food and forage (which also benefit from maintaining the other soil functions).

In the agricultural production context, healthy soils help to prevent contamination of waterways, are resilient, and resistant to degradation. One of the most important aspects of soil health relating to erosion is to maintain vegetation cover and avoid bare ground. A soil's health benefits from minimising soil erosion and is achieved by retaining topsoil and its carbon. In addition, management practices that support nutrient and soil water retention help to maintain good crop and pasture growth for production and provide a range of ecosystem services. Benefits include increased carbon sequestration, buffering, improved filtering capacity of soils, flood mitigation, and improved biodiversity.

Topsoil erosion reduces the available water capacity (AWC) of the soil profile, which is important for farm production in dryland areas of hill country. Pasture production on eroded landslide scars can take many decades to recover, if at all. In some areas, it is unlikely that hill country pasture production on slip scars will return to production levels on



*Ahuriri hill country soil erosion (Photo Raphael Spiekermann)*

uneroded sites in human timescales. Soil nitrogen and carbon contents are generally much lower for soils on eroded slip scars than soils on uneroded sites.

A wide variety of erosion and sediment control practices are used in New Zealand, depending on the land use, type of erosion and the erosion process. Table 1 summarises the landscape effects and best practices to control different types of erosion. More specialist advice should be sought from suitably qualified advisors for specific circumstances.

**Table 1 Practices for managing different types of erosion**

Type of erosion	Examples	Best practices for managing the erosion
Runoff-generated erosion	Sheets, rills, and gullies	<ul style="list-style-type: none"> <li>• Water management to control runoff, reduce velocity and sediment generation</li> <li>• Erosion control to reduce sediment generation</li> <li>• Sediment control to trap sediment before it moves offsite and into water ways.</li> </ul>
Mass movement erosion	Landslides, earthflows, and slumps	<ul style="list-style-type: none"> <li>• Practices that influence slope hydrology and/or soil strength</li> <li>• Space-planted trees</li> <li>• Afforestation</li> <li>• Reversion</li> </ul>
Streambank erosion		<ul style="list-style-type: none"> <li>• Riparian planting</li> <li>• Fencing for stock exclusion</li> </ul>

Forestation, space planting, and riparian planting take a long time to become fully effective. For example, afforestation could take up to 10 years, while space-planted trees up to 15 years. Riparian planting or retirement with fencing can take two years to establish and be effective. Control of runoff-generated erosion typically involves a combination of biological control (using grass or cover crops, trees etc), mulches, geotextiles, and structural measures (sediment retention ponds or detainment bunds).

## Soil erosion management for different industries

### Pasture – all farm types (Table 2)

Practices with **high** effectiveness of sediment control include:

- sediment traps and retention ponds to allow coarse sized sediment and associated nutrients to settle out. Traps are ineffective at high flows when most sediment is transported.

Practices with **moderate** effectiveness include:

- A combination of retirement and pole planting on highly erodible land protects soil on steep slopes from mass movement erosion. Effectiveness depends on severity of erosion and the years taken for the trees to grow.
- Natural seepage wetlands at the heads and sides of streams slow water movement and encourage deposition of suspended sediment.
- Fencing to prevent livestock access to streams and riverbanks decreases stream bank damage (and sediment inputs via bank erosion), and bed disturbance of sediments.
- Vegetated buffer strips decrease contaminant loss in surface runoff via filtration and deposition processes.

**Table 2 Practices for erosion control for pastoral farming**

Type of control	Available practices for pastoral farming
Erosion & sediment control	<ul style="list-style-type: none"> <li>• Use minimum or no-till cultivation practices, such as direct drilling</li> <li>• Re-sow areas of bare soil as soon as possible</li> <li>• Avoid heavy stock grazing on steeper, more vulnerable soils, especially when wet</li> <li>• Fence stock out of waterways.</li> <li>• Plant riparian margins. Leave buffers when cultivating, over sowing, topdressing and/or burning.</li> <li>• Install sediment traps (dams or detainment bunds) where appropriate.</li> <li>• Plant trees on vulnerable areas of the farm to reduce erosion.</li> </ul>



*The "Peep-O-Day Slump" near Kimbolton (Photo Raphael Spiekermann)*

### **Vegetables and cropping (Table 3)**

Practices with **high** effectiveness for erosion and sediment control include:

- Bunds of earth as a barrier constructed along a paddock edge to prevent water flowing. Suitable for use on slopes >3 degrees. Bunds create ponds of water where sediment settles out.
- Green manure or cover crops after harvesting of the main crop is ploughed into the soil stabilising bare soil.
- A 'silt fence' is material fastened to a wire fence for filtering sediment from surface runoff.

Practices with **moderate** effectiveness include:

- Constructed level benched headlands that run across the slope of a field. These are suitable where slopes are >3 degrees and encourage infiltration of water.
- Wheel track dyking is a series of closely spaced indentations in wheel tracks, which slows surface runoff and settles suspended sediment.
- Wheel track ripping is suitable after use of heavy vehicles on cultivated soil. Ripping allows water to percolate into the soil rather than flow down the tracks.

**Table 3 Practices for different types of erosion control for vegetables and cropping**

Type of control	Available practices for vegetables and cropping	
Runoff control	<ul style="list-style-type: none"> <li>• Pasture management to maintain grass cover</li> <li>• Constructing contour furrows.</li> </ul>	
Erosion control of shallow landslides, slumps, and earthflows	<ul style="list-style-type: none"> <li>• Spaced-tree planting</li> <li>• Afforestation</li> <li>• Reversion</li> <li>• Surface and sub-surface drainage</li> <li>• Surface recontouring.</li> </ul>	
Gully erosion control	<ul style="list-style-type: none"> <li>• Spaced-tree planting</li> <li>• Afforestation</li> <li>• Graded banks</li> <li>• Flumes and chutes</li> <li>• Pipe drop structures</li> </ul>	<ul style="list-style-type: none"> <li>• Sink holes</li> <li>• Diversion banks</li> <li>• Grassed waterways</li> <li>• Drop structures</li> <li>• Debris dams</li> </ul>
Streambank erosion control	<ul style="list-style-type: none"> <li>• Tree planting</li> <li>• Vegetation lopping &amp; layering</li> <li>• Engineering works (rip rap, groynes, gabion baskets)</li> <li>• Debris traps</li> <li>• Gravel extraction</li> </ul>	<ul style="list-style-type: none"> <li>• Bank shaping</li> <li>• Channel diversion &amp; realignment</li> <li>• Riparian fencing</li> <li>• Controlled grazing</li> </ul>

### Forestry (Table 4)

There are a range of practices available to the forestry industry for controlling different types of erosion.

**Table 4 Different types of erosion control for the forestry industry**

Type of control	Available practices for the forestry industry	
Runoff control	<ul style="list-style-type: none"> <li>• Diversion channels &amp; bunds</li> <li>• Contour drains &amp; cut-offs</li> <li>• Broad-based dips &amp; rolling dips</li> <li>• Flumes and outfalls</li> </ul>	<ul style="list-style-type: none"> <li>• Dams</li> <li>• Water table drains</li> <li>• Culverts</li> <li>• Sumps</li> </ul>
Erosion control	<ul style="list-style-type: none"> <li>• surface roughening</li> <li>• log corduroying</li> <li>• slash &amp; mulch placement</li> <li>• grassing &amp; hydroseeding</li> </ul>	<ul style="list-style-type: none"> <li>• Rock lining of channels</li> <li>• Geotextiles</li> <li>• Benched slopes</li> <li>• Slash management</li> </ul>
Sediment control	<ul style="list-style-type: none"> <li>• Haybale barriers</li> <li>• Earth and slash bunds</li> <li>• Silt fences</li> </ul>	<ul style="list-style-type: none"> <li>• Silt traps</li> <li>• sediment retention ponds or traps</li> </ul>
Stream works control	<ul style="list-style-type: none"> <li>• Planning of harvesting operations to minimise impacts on stream channels</li> <li>• Dry or permanent stream crossings</li> <li>• Dams and temporary waterway diversions</li> </ul>	

## Links to further information

Beef+Lamb. Practices to improve water quality

<https://beeflambnz.com/sites/default/files/factsheets/pdfs/drystock-menu-book.pdf>

Environment Canterbury. Industry agreed good management practices

<https://www.ecan.govt.nz/your-region/farmers-hub/gmp/what-are-industry-agreed-good-management-practices/>

Greater Wellington. Erosion Control.

<https://www.gw.govt.nz/environment/land-use/erosion-control/>

New Zealand Forest Owners Association. Forestry resources and practice guides.

<https://www.nzfoa.org.nz/resources/publications>; <https://docs.nzfoa.org.nz/forest-practice-guides/>

Waikato Regional Council. Resources for farmers.

<https://www.waikatoregion.govt.nz/community/your-community/for-farmers/farm-menus/>

## References and further reading

Auckland Regional Council. (2007) Forestry operations in the Auckland region: A guideline for erosion & sediment control. Chapter 7.0 Sediment control practices. TP223: 54-75.

<http://www.aucklandcity.govt.nz/council/documents/technicalpublications/ARC-TP-223%20F%20-%20Practices%20-%20Sediment%20Control.pdf>

Barber A. (2014). Erosion and sediment control guidelines for vegetable production. Good Management Practices. Version 1.1. Agrilink New Zealand, Auckland. 40 p.

<https://www.hortnz.co.nz/assets/Compliance/Erosion-and-Sediment-Control-Guidelines-for-vegetable-production-v1.1.pdf>

Basher LR. (2013). Erosion processes and their control in New Zealand. In: J. Dymond, editor. Ecosystem services in New Zealand. Manaaki Whenua Press, Lincoln. Pp 363–374.

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<https://content.aucklanddesignmanual.co.nz/regulations/technical-guidance/Documents/GD05%20Erosion%20and%20Sediment%20Control.pdf>

Leersnyder H, Parsonson M, Bunting K, Stewart C. (2021). Erosion and sediment control guide for land disturbing activities in the Wellington region. Revision 1. Prepared by Beca Ltd and Southern Skies Environmental for Greater Wellington.

<https://archive.gw.govt.nz/assets/Resource-Consents/Erosion-and-Sediment-Control-Guide-for-Land-Disturbing-Activities-in-the-Wellington-Region.pdf>

McDowell RW, Schallenberg M, Larned S. (2018). A strategy for optimizing catchment management actions to stressor–response relationships in freshwaters. *Ecosphere* 9: e02482. <https://doi.org/10.1002/ecs2.2482>

McIvor I. (2017). Trees for the farm: A decision support tool for farmers. Plant & Food Research. <https://beeflambnz.com/sites/default/files/factsheets/pdfs/trees-for-the-farm.pdf>

Ministry for the Environment (MfE) (2001). Soil conservation technical handbook. June 2001. [Soil Conservation Technical Handbook: Part A - Principles \(environment.govt.nz\)](https://www.environment.govt.nz/soil-conservation-technical-handbook-part-a-principles)

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## Website

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