

FACTSHEET

Phosphorus loss to water from sheep and beef farms

June 2024

Sheep and beef farming can impact freshwater quality and stream health. Predominantly the risk comes from the loss of four key contaminants to water. These are sediment, *E. coli*, phosphorus (P) and nitrogen (N). It is important to understand the risks to freshwater from your farming operation and to put into place actions to mitigate, minimise or eliminate those impacts.

This factsheet relates to phosphorus (P) loss from drystock farms. At the end of this document there is a link to the other three factsheets in this series.

The National Policy Statement for Freshwater Management 2020 (NPS-FM) tells Regional Councils to set desired targets for phosphorus levels in rivers and lakes to help achieve community desired outcomes for freshwater. It is the role of Regional Councils to then set plans and rules to meet these in-stream targets over time.

Summary

The drivers for phosphorus loss are similar to those for sediment. P is bound to soil particles and thus is lost when soil is lost via overland flow pathways. P loss to water can also occur directly from stock access or improper fertiliser applications resulting in direct deposition in water. High soil Olsen P levels (above the agronomic optimum) also increase the risk of P loss to water. Erosion and stream bank damage are two major causes of soil and thus phosphorus loss.

The risks of phosphorus loss are individual to each farm, as are the best ways to manage and mitigate those risks. To protect your productivity and support healthy ecosystems, it is important

to understand the risk on your farm and to have a comprehensive long-term risk management plan. It is also important to monitor erosion, soil Olsen P and adapt management practices to prevent erosion when new risks emerge.

Phosphorus loss to water is bad for waterways because:

- It results in undesirable plants and animals in waterways
- It results in the death of fish and invertebrates from lack of oxygen caused by the growth exotic weeds.

Phosphorus loss is bad for the farm because:

- It is a loss of a key nutrient that would be better used for plant growth.

How is Phosphorus lost?

Phosphorus is mainly lost via overland flow, also called surface flow or runoff. This is because P is attached to soil particles and lost during erosion events. Some is lost via subsurface flow.

Risk factors for Phosphorus loss

- 1 Soil type, topography
- 2 Bare soil
- 3 Critical source area management
- 4 Stock type - heavy animals on high risk areas
- 5 Stock access to waterways
- 6 Location of tracks, troughs, gateways and high traffic areas
- 7 Location of winter grazing
- 8 Stocking density
- 9 High soil Olsen P. Rate, location and timing of fertiliser applications



What causes P loss?

Phosphorus is attached to soil particles and is lost when soil is washed into waterways during erosion, rainfall, flood or overland flow events.

When soil Olsen P levels exceed the agronomic optimum there is an increased risk of P loss.

Inherent risks: the risks associated with land and location

(See graphic on risk factors for phosphorus loss)

- Topography – This has a significant impact on P losses with steeper slopes having an increased risk of sediment and thus P loss. **1**
- Rainfall – Particularly high intensity and long duration, which can cause overland flow events.
- Soil properties – the soil texture and soil structure influence the infiltration rate of the soil and therefore the potential for overland flow. Soil types with low P retention are at higher risk of P loss. **1 2**
- Vegetation cover. Vegetation cover impacts soil infiltration rates and volume and rate of overland flow.

What are the risk factors associated with farm systems and management practices?

(See graphic on risk factors for phosphorus loss)

Factors that influence the loss of P that are within the control of the landowner and are related to farm management and the farm system include:

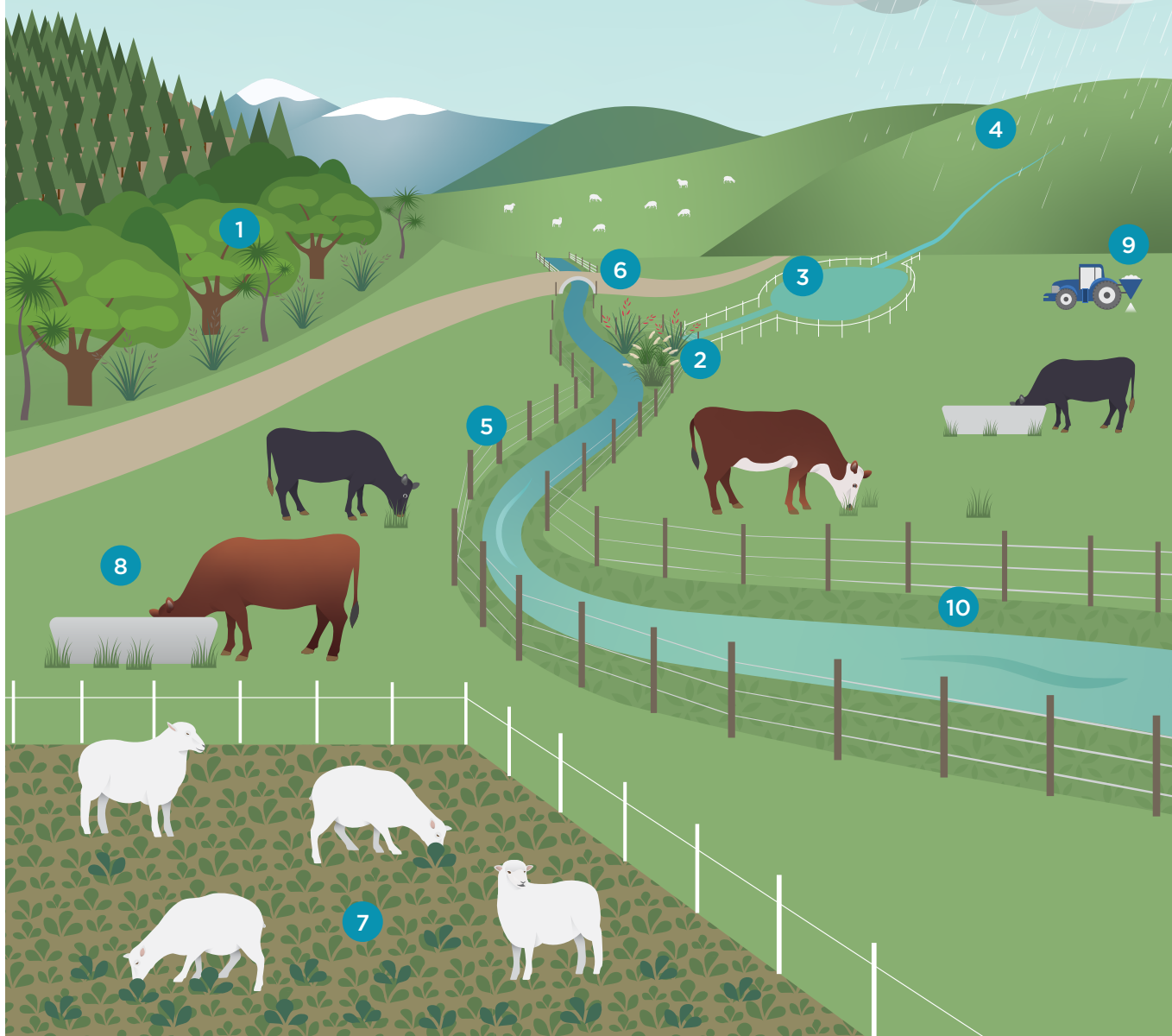
- Stock management – erosion, access to streams, wallowing and fence pacing. **1 3 4 5 8**
- Soil Olsen P levels above the optimum range for the pasture or crop results in increased risk of P loss. **9**
- Stock access to waterways. Fencing of streams with riparian margins has been shown to decrease in stream P loads by 32 - 86%. **5**
- Critical source area (CSA) management **3**
- Fertiliser form, placement, timing, loading and proximity to waterways. Applications of fertiliser that coincide with rainfall events causing overland flow can result in losses of P. Readily available forms of P fertiliser have a higher risk of losses than slower release forms such as reactive phosphate rock (RPR). **9**
- Cultivation – this can leave soil exposed and vulnerable to erosion which takes with it P that is adhered to the soil particles. **2**
- Irrigation – specifically when ponding or runoff occur.
- Intensive grazing on wet soils. **2 7 8**
- Location and management of winter grazing **7**
- Location and management of of tracks, yards and other high traffic areas. **6**

In summary, the main drivers of P loss are:

- Losses of sediment and soil: This occurs in Critical Source Areas (CSAs) and a small area of the farm can be contributing the majority of the P loss.
- Soil Olsen P levels: Levels above the optimum for pasture or crop result in increased P losses.
- Fertiliser form, timing of applications and loading. Applications of fertiliser coinciding with rainfall events causing overland flow can result in losses of P. Readily available forms of P fertiliser have a higher risk of losses than slower release forms such as reactive phosphate rock (RPR).

Management actions to reduce the risk of P loss

- 1 Retirement of erosion-prone areas
- 2 Riparian protection and increased buffer widths in high-risk areas
- 3 Stock exclusion from critical source areas
- 4 No heavy animals on high-risk areas during high-risk times
- 5 Stock exclusion from waterways
- 6 Location of tracks, troughs, gateways and high traffic areas
- 7 Winter crop location and management
- 8 Avoid soil damage from pugging or working soils when wet
- 9 Timing, application rate and form of P fertiliser
- 10 Buffer strips to filter sediment and thus P



Management actions to reduce phosphorus loss

(See graphic on management actions to reduce the risk of P loss)

- Erosion control management
 - Pole planting.
 - Maintaining soil cover.
 - Retirement of unproductive areas. **1**
- Management
 - Manage grazing animals (either all animals or heavier animals) on high-risk areas at high-risk times of the year. **4**
 - Avoiding soil damage during intensive winter grazing **7** or on wet soils or with high stocking rates. **8**
 - Stock exclusion from waterways. **5**
 - CSA management – Stock exclusion from CSAs at high-risk times of the year **3** and riparian planting or wider buffer strips where CSAs connect with waterways. **2 10**
 - No or minimum till cultivation on slopes to reduce sediment and P loss.
 - Improved fertiliser use, including use of slow-release rather than fast release P fertiliser), concentration, rate, timing of fertiliser applications. **9**
- Maintenance and location of tracks, yards and other high traffic area to prevent P loss through runoff. **6**

- Intercepting sediment also intercepts phosphorus bound to the sediment particles;
 - Buffer strips: An ungrazed strip of grass or riparian planting left next to a waterway to decrease P, sediment and *E. coli* in runoff by a combination of filtration and improved soil infiltration rates. **10 2**
 - Sediment traps.
 - Natural and constructed wetlands.

Links to further information

For factsheets on Sediment, Phosphorus, *E. coli*, and Nitrogen loss to water from sheep and beef farms, visit the [B+LNZ webpage on managing stock near water](#)

Landcare Trust – Nutrients and CSAs factsheet <https://landcare.org.nz/wp-content/uploads/2023/01/Nutrients-Critical-Source-Areas.pdf>

Ballance – Managing phosphorus loss <https://ballance.co.nz/advice/phosphorus/managing-p-loss>

DairyNZ – reducing phosphorus loss <https://www.dairynz.co.nz/environment/nutrients-and-contaminants/reducing-phosphorus-loss/#:~:text=The%20loss%20of%20phosphorus%20to,estuaries%20and%20leads%20to%20eutrophication>

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