Erosion control in grazing lands

About 80% of Queensland is available for grazing in lands extending from the humid tropical coast to the arid western rangelands. All of these lands are subject to soil erosion, most commonly by water but also by wind in more arid areas. Erosion can seriously affect the productivity of grazing lands. The movement of sediment, nutrients and organic matter may also adversely affect water quality in streams.

As reclamation of seriously eroded grazing lands can be of doubtful economic benefit, it is essential that graziers attempt to minimise the effects of erosion.

How erosion begins

Erosion by water begins when raindrops fall on bare soil. The raindrops dislodge soil particles, washing them into pores which causes the soil surface to 'seal' as the pore spaces are blocked. This prevents water from infiltrating into the soil, resulting in runoff.

A downward spiral of degradation begins when high runoff rates result in reduced entry of water into the soil and consequently less plant growth. With less surface vegetation to impede flows, runoff starts to concentrate and its erosive power increases.

The impact of raindrops is minimised if the soil surface is protected by plant or litter cover. Bare soil surfaces are also susceptible to wind erosion. Winds move much faster over a soil surface without vegetative cover.

Image 1: Raindrop impact on a bare soil.

Forms of erosion

Soil erosion comes in different forms, including sheet erosion, rill erosion, gully erosion, tunnel erosion, stream bank erosion, scalding and wind erosion.

Image 2: Rill erosion.

Image 3: Gully erosion.

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Image 4: Tunnel erosion.

Image 5: Wind erosion.

Extent of the problem

In the arid inland of Queensland, it is estimated 590 000 ha are affected by scalding. A survey of 9 million ha of mulga lands in the south west has shown that 30% of the area has been affected by extensive sheet erosion.

Gully erosion occurs in drainage lines or other areas where runoff has concentrated. It may occur as an isolated event or over large areas, especially where there are soils with highly erodible subsoils.

Stream bank erosion is a common problem in most Queensland river systems. The river frontage is particularly subject to erosion in areas where stock congregate. This is a significant problem in inland streams especially those flowing into the Gulf.

Impacts of erosion

Erosion removes valuable topsoil which is the most productive part of the soil for agricultural purposes. This results in poorer pasture growth and lower yields. Eroded soils are subject to higher temperatures, have lower porosity and lower microbial activity.

Higher rates of runoff from eroded surfaces wastes valuable moisture—the principal factor limiting productivity in arid lands. Runoff containing sediments, nutrients and organic matter can have an adverse effect on water quality.

Infrastructure such as dams, waterways, fences, roads and tracks can be affected by erosion.

Erosion prevention

The three main principles to control erosion are:
1. Use land according to its capability
2. Provide soil surface cover, and
3. Control runoff.

Land capability

Soil erosion can be avoided by using land within its capability. The steeper the land, the greater the risk of erosion, however, serious erosion problems may also develop on relatively flat slopes or even flood plains. All soils are erodible—but some are more erodible than others. Of particular concern are those soils with dispersive subsoils which are subject to serious erosion by tunnelling and gully formation.

Broad scale maps showing land types in particular regions are available for most areas. These give graziers an indication of what soils may occur on their property and are a useful planning tool. Where paddocks contain a mix of land types requiring different management, it is preferable to fence them off separately.

Cover

Surface cover is the key to erosion control in grazing lands. It prevents erosion by reducing the impact of raindrops falling on bare soil. Any runoff that does result will be impeded by the cover and is less likely to concentrate into an erosive force.

The critical level of cover for pastures in tussock grasslands is about 40% cover and 1000 kg/ha of dry grass. Ideally this level of cover will exist at the beginning of the summer storm season.

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Table 1 demonstrates the importance of cover as shown in an experiment at Mt Mort, near Ipswich. In treatment C (maintained in an almost bare condition), 70% of the rainfall from a 54 mm storm was lost as runoff. The resulting soil loss from this one event was 22 t/ha. Treatments A and B (which had higher cover levels) had much less runoff, soil and nutrient loss.

Table 1: Results from a 54 mm storm at Mt Mort, near Ipswich.

Treatment	A	B	C
Per cent cover	87	69	6
Total runoff from storm (mm)	1.5	14	38
Per cent of rainfall that ran off	3	26	70
Soil loss (t/ha)	0.03	0.3	22
Depth of soil lost (mm)	0.002	0.02	1.7
Sediment concentration (g/L)	1.5	1.9	63
Nitrogen removed (kg/ha)	0.14	1.9	15.3
Phosphorous removed (kg\ha)	0.02	0.26	4.3

Grazing pressure significantly impacts on surface cover. The ideal stocking rate is flexible, matching stock numbers to available feed. Regular monitoring of pastures is necessary to achieve this. Long-term weather forecasting, using predictive tools such as the Southern Oscillation Index (SOI), has improved the options available for predicting droughts.

When assessing stocking rates, the effects of native animals such as kangaroos and pests such as rabbits need to be considered. Sheep and goats graze closer to the base of plants than cattle do and in dry periods can put more pressure on pastures.

Opportunistic spelling should be part of a grazing strategy. A total spell in a good year may be required to allow desirable grasses to recover from past grazing. Grazing pressure can also be managed by the location of watering points. They need to be located to minimise stock concentration in areas vulnerable to erosion.

Trees play a vital role in grazing landscapes by providing shade and shelter, by recycling nutrients and by using moisture that may 'leak' into groundwater (that may otherwise contribute to salinity problems).

Trees also provide stability to stream banks and prevent landslip on susceptible steep slopes. However trees provide little protection from erosion caused by raindrop impact and overland flow, as the bare areas beneath trees are vulnerable.

Image 6: Clearing and grazing pressure significantly impact the level of surface cover.

Managing runoff

A well-managed pasture with good cover will ensure that runoff spreads rather than concentrating and causing erosion. As bore drains, tracks, roads, cattle pads and fences cause concentration of runoff, careful planning is required to ensure property improvements are located where they will not contribute to erosion.

Rehabilitation

Although reclamation techniques may be available, they are often not economic. Prevention is far better than cure. Pasture spelling, shallow water ponding, pitting, ripping and use of implements such as the ‘crocodile seeder’ can be effective in reclaiming eroded pasture land. An option for rehabilitating seriously degraded areas is to fence them off to exclude all grazing animals. These areas may be strategically grazed for short periods if cover levels improve.

For more information, refer the *Soil Conservation Guidelines for Queensland* and the erosion section on the Queensland Government website www.qld.gov.au/environment/land/management/soil/erosion

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