Erosion control in grazing lands

About 80 per cent 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.

Forms of erosion

Sheet erosion involves the uniform loss of soil over large areas caused by the action of water or wind. This form of erosion is not always obvious but it results in significant loss of productive soil. However in some arid areas all of the topsoil may be removed, leaving a scalded appearance.

Where runoff begins to concentrate both rill and gully erosion may occur. Soils with dispersible subsoils may develop tunnel erosion. Stream bank erosion may occur along creeks and rivers.

Extent of the problem

In the arid inland, it is estimated 590 000 ha are affected by scalding on solodic soils, infrequently flooded alluvials, and seasonally flooded clay soils. A survey of 9 million ha of mulga lands in the south west has shown that 30 per cent 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.

How erosion begins

Erosion by water begins when raindrops fall on bare soil. As a result of raindrop splash and the dislodgement of soil particles, the surface seals, and runoff begins. The uniform removal of soil in thin layers by this process is known as sheet erosion.

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 may then cause rill and gully erosion.

Bare soil surfaces are also susceptible to wind erosion. Winds move much faster over a soil surface without vegetative cover.

Impacts

Erosion reduces productivity by causing loss of topsoils that are often very shallow and which contain most of the nutrients in the soil profile. Eroded soils are subject to higher temperatures, have lower porosity and microbial activity.

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

Sediment from eroded grazing lands does not necessarily have a fast track to creeks and rivers. It may be deposited in areas of lower slope including the drainage lines that feed into creeks. However, the fine colloidal material resulting from erosion may remain in suspension indefinitely leading to a muddy appearance in dams and watercourses. Soils with dispersible sub-soils contribute significantly to this problem.

As fertilisers and agricultural chemicals are rarely used in extensive grazing lands, runoff from such areas will generally be free of these products. However they may be found in runoff from more intensively managed pastures closer to the coast, especially when these areas are heavily grazed.

Erosion prevention

Land capability

Degradation can be avoided by using land within its capability. The steeper the land, the greater the risk of erosion, however, serious erosion problems such as scalding may also develop on relatively flat slopes or even floodplains. All soils are erodible – but some are more erodible than others. Of particular concern are those soils with dispersible 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 maintaining the soil in a condition that absorbs rainfall. 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 per cent cover and 1000kg/ha of dry grass. Ideally this level of cover will exist at the beginning of the summer storm season.

Table 1 – Results from a 54 mm storm at Mt Mort

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

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

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.

Fire is useful for controlling woody weeds but it needs to be managed carefully. Regular burning of pastures will further reduce ground cover and promote runoff and erosion.

Trees play a vital role in grazing landscapes by providing shade, shelter and recycling nutrients by using moisture that may ‘leak’ into groundwater and contribute to salinity problems. They 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. In the control of erosion, surface cover is essential and bare areas beneath trees are vulnerable.

Managing runoff

A well-managed pasture with good cover will ensure that runoff spreads rather than concentrating and causing erosion. As bore’s drain, 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.

Further information

This and other science notes are available from the Queensland Government website www.qld.gov.au – search ‘science notes’ or for further information about this science notes series phone **13 QGOV** (13 74 68) – Ask for science notes – Land series 91. Other science notes related to this topic include:

• L1 Understanding soil.

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