2016 Paddock Case Study—Grazing

Effect of grazing on gully erosion rates in red goldfields soil in the Upper Burdekin catchment

About this case study

This study monitored the rates and drivers of erosion of individual gullies under three levels of grazing intensity to better understand gully erosion behaviour. The study examined the sediment source areas within gullies and how sediment yield related to the catchment area, length and vegetation cover of a gully, and to annual rainfall. The project focused on gullies in red goldfields soil (Chromosol) on granite rocks in the Upper Burdekin catchment which has the highest density of hillslope gullies in the region. Hillslope gully erosion, which is one of the primary sources of fine sediment to the Great Barrier Reef, cuts deep branching channels along what were once surface flow paths and drainage lines.

Methods

The study monitored six gullies in the Weany Creek catchment (30 kilometres east of Charters Towers), where grazing involved wet season spelling. The longer term history of gully erosion in this catchment is discussed in another case study published in 2013, *Tracking gully activity in the Burdekin range lands,* available online at www.reefplan.qld.gov.au.

Key findings

- Gullies in hillslope drainage lines are vulnerable to ongoing erosion because they concentrate runoff and have steep walls.
- The largest source of sediment from hillslope gullies under grazing in the study area is erosion of gully walls through runoff and rain splash. Head cut erosion also contributes.
- Sediment losses are lower from gullies with more vegetation cover.
- Hillslope gully erosion rates are correlated with annual rainfall.
- A layer of high clay content below the soil surface (a duplex texture profile) can restrict rainfall infiltration and increase saturation of the surface layer in red goldfields soil.
- When vegetation becomes degraded, red goldfield soils generate more surface runoff due to poor soil surface and perennial shrubs condition, reduced pasture basal area and root mass.

Implications for management

Gully erosion rates can be reduced by:

- fencing off gullies and limiting gully grazing to short periods during the dry season
- maintaining a thick cover of native tussock grasses with a large basal area and perennial shrubs in and around gullies and their drainage areas to reduce runoff
- maintaining stocking rates within sustainable levels (grazing should utilise less than 10 to 30 per cent of the forage available at the end of the growing season)
- gullied paddocks should be prioritised for wet season spelling at least every second year to allow the perennial composition of pastures to be maintained
- seeding with a mix of native perennial grasses can assist gully revegetation if conditions are suitable. Exotic grasses tend to have smaller effect on soil surface condition.

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On nearby properties we also monitored two gullies under continuous heavy stocking, and nine gullies under long-term grazing exclusion.

Each dry season gully head erosion was measured by surveying the gully heads, and wall erosion was measured in three cross sections of each gully based on the length of erosion pins exposed above the soil surface (Figure 1; Figure 2).

The eroded soil was partitioned into fine (silt and clay) and course (sand and gravel) sediment fractions, with fine sediment being of primary concern for water quality. The study also measured the vegetation cover around and inside each gully, the rainfall and surface runoff.

Figure 1: The amount of erosion each year was measured by surveying the gully head (left) and measuring the length of erosion pins above the soil surface at gully cross sections (right). Photos by Scott Wilkinson (left) and Aaron Hawdon (right).

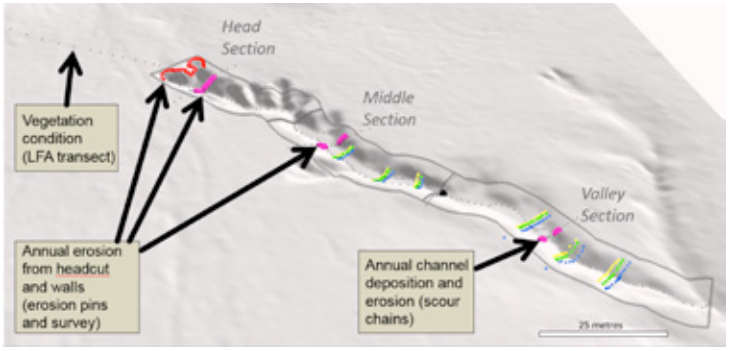

Figure 2: Layout of gully erosion monitoring. Gully wall erosion was measured at three cross sections along the gully (shown in pink), termed the head, middle and valley sections. Changes in bed level were also measured in the valley section using scour chains which record the rise and fall of the bed (LFA – landscape function analysis).

Results

Most of the sediment lost from gullies in grazed catchments came from wall erosion. Gullies in non-grazed catchments delivered 70 per cent less fine sediment than gullies in grazed catchments over two years, mainly because the gullies in non-grazed catchments were shorter and had slower wall erosion rates. The sediment yield of gullies under wet-season spelling could not be differentiated from that of gullies under continuous heavy stocking, although there was less redistribution of sediment within gullies under wet season spelling.

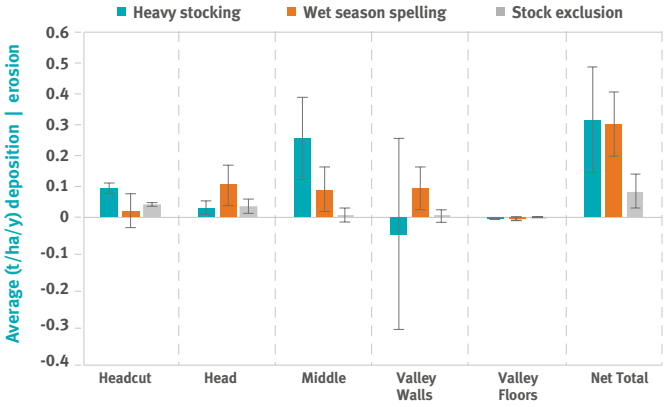

Figure 3: Mean-annual fine sediment yield from each section of the gully. Gullies under livestock exclusion delivered 70 per cent less fine sediment than in grazed catchments.

Gully walls under heavy stocking had sparse covering of Indian couch or became bare during droughts, while gully walls in the non-grazed catchments had good coverage of perennial grasses. Wall erosion rates tended to be higher where wall vegetation cover was low (Figure 2).

Authors

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About the Paddock to Reef program

Paddock monitoring trials are conducted as part of the Paddock to Reef Integrated Monitoring, Modelling and Reporting (Paddock to Reef) program. For more information on the Paddock to Reef program and case studies, including references, please visit www.reefplan.qld.gov.au.