Monitoring and Assessment of Grazing

and degradation is widely acknowledged as Australia's main environmental problem. Land degradation in the rangelands involves accelerated soil erosion, soil degradation and adverse changes in vegetation composition. Managing existing native pastures is more cost effective than repairing damage after land degradation. Scientists at CAZR have developed improved technologies for measuring land condition in arid and semi-arid rangelands. The technology uses satellite imagery and a method called "grazing gradient analysis" to detect long term changes to the ability of the landscape to produce plant cover.

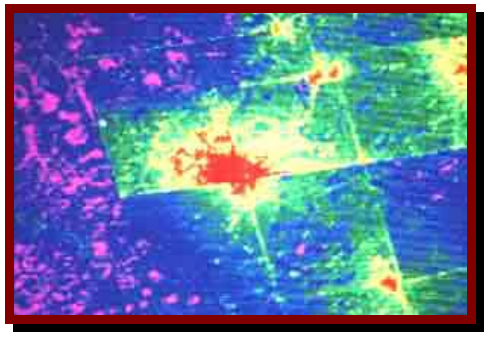
Land Degradation Assessment

The grazing gradient method has the potential to change the way land damage is monitored in the outback. The method uses imagery taken over time to assess the extent, rate and type of degradation in the rangelands. It is based on the assumption that long term damage to vegetation does not occur evenly across paddocks as grazing pressure is focussed on watering points and typically produces a decrease in vegetation cover as water is approached

The grazing gradient method was developed in response to a growing need for fast, accurate and low cost ways of measuring the impact of grazing animals on plants, soil, and land use changes in the outback. Traditionally, land degradation has been difficult to measure in arid rangelands because of highly variable rainfall, diverse landscapes and difficulties in sampling very large areas. Conventional ground-based work assessing land condition has logistic problems in making rapid, accurate and repeatable measures of plant characteristics over extensive areas.

This is not to deny the importance of ground-based monitoring because it is only through close inspection that we can obtain information on species composition and forage quality.

Satellite images show that in vegetation communities preferred by sheep or cattle, areas closest to watering points are most affected by grazing, while areas furthest from water are less affected (see example from the Nullabor Plain). CAZR scientists have improved this technology by taking into account the way grazed pasture respond after major rainfall.



This image shows part of the Nullabor Plain grazed by sheep. Paddocks can be clearly seen and cover is lowest close to water because this is where grazing is concentrated.

Satellite images taken of the same area before and after rain can be analysed to determine the ability of pastures to regrow following grazing. After rain, areas that have suffered permanent damage from grazing recover more slowly and grow less pasture than those which are grazed less heavily.

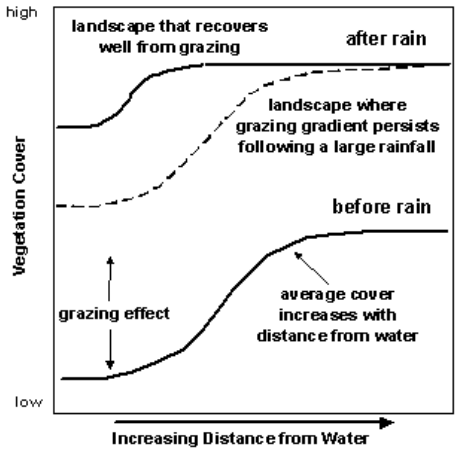
Grazing Gradient Techniques

Two different grazing gradient techniques have been developed, the resilience method and the wet period average cover method.

1) Wet Period Average Cover Method

The Wet Period Average Cover Method provides information on the current condition of grazed country by evaluating the extent of pasture recovery from past grazing following major rainfalls. This method searches for persistent grazing gradients by averaging vegetation cover across separate landscape types at increasing distance from water. This method has the potential to improve land administration and management by: providing holistic information about grazing impact in large paddocks and across regions; providing such information at substantially lower cost and with lower labour requirements than ground-

based monitoring methods; providing timely information about grazing impact; objectively targeting land administration and extension resources towards those areas with land degradation problems.



2) The Resilience Method

The Resilience Method shows where the best and poorest vegetation response to rainfall occurs in a paddock. This method compares the observed vegetation response to major rainfalls with the response that could be expected given temporary grazing effects and full recovery. From this, a map can be produced which shows where vegetation response is both above and below average for each landscape type. This method has the potential to improve paddock management.

CSIRO has worked with pastoralists to develop the Resilience Method as a property planning and monitoring tool, and particularly as a way of complementing information the pastoralists on the station presently obtain at ground-based sites.

Implications of Grazing Gradients

The results of the grazing gradient analysis can help graziers better manage their country. By moving watering points or fencelines and adjusting stocking rates, rangeland managers can ensure paddocks are grazed more evenly throughout. This work, although costly, minimises the risk of areas near water becoming permanently degraded while other areas nearby remain relatively untouched.

Stock production also improves, as animals have access to wider areas of pasture in good condition and the effects of grazing are no longer concentrated in certain areas. Rangelands that are grazed evenly and lightly recover and grow more pasture after rain, compared with over grazed pastures that may never recover.

Significance of Grazing Gradient Research

While remote sensing technology has been used in rangelands previously, the grazing gradient method is innovative to range assessment because it has the capacity to separate degradation from temporary grazing effects and from changes due to rainfall variability.

The methods are now being used by: South Australian Department of Environment and Heritage in their northern pastoral area. CSIRO customised software and provided extensive training and documentation to assist Departmental officers to implement the technology. Northern Territory Department of Lands, Planning & Environment on the Barkly Tableland. CSIRO again modified software and provided training, and assisted in the development of a vegetation cover index for the grey cracking clays of the region. Overseas scientists, in particular in a project in India's Thar Desert, where CSIRO is working with Indian scientists to adapt the technology to assess the extent and cause of degradation in arid community rangelands.

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