Rangeland surveys: a basis for improved land use

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In mid 1988, the Department of Agriculture started a three-year programme to assist pastoralists in the Murchison River catchment to update land management planning of their stations. This project, which is funded by the National Soil Conservation Program, will use interim results from a recent rangeland survey which has investigated and mapped the grazing resources throughout the region.

Elsewhere in Western Australia’s pastoral areas, information on the productive potential of each area - and the management problems inherent for each class of land - are being used to help pastoral managers of Soil Conservation Districts rehabilitate degraded areas. This information will also encourage them to adopt management practices that conserve the land and improve the long-term economic performance of the grazing enterprise.

Statewide surveys
CSIRO carried out the State’s first detailed and objective surveys of land resources of arid and tropical areas in the 1950s. Since 1969, the Departments of Agriculture and Land Administration have jointly conducted a continuing programme of rangeland surveys.

Comprehensive surveys have been completed for about 548,000 sq. km of rangeland, or about two-thirds the pastoral land in Western Australia. Fieldwork on a survey of the Murchison River catchment was completed in early 1988, while work on the next major area, the north-eastern Goldfields, started that same year. Rangeland surveys of the remaining areas of the State’s pastoral lands should be completed by the year 2000.

Surveys and monitoring
Two important tools to help pastoralists improve their use of the rangelands are the rangeland survey and rangeland monitoring.
Rangeland surveys

A rangeland survey of a region provides thorough, once-off descriptions of the naturally occurring land systems and vegetation as they relate to grazing usage. These data are then transformed into land classification maps. Where surveys have not been undertaken, existing knowledge and maps of the land and vegetation are generally inadequate as a basis for planning improved grazing practices and station infrastructures.

When all data from a rangeland survey are assembled they provide the first clear indication of the relative proportions of well-preserved land and degraded pastoral land throughout the region (Table 1).

If 60 per cent of the land in a region is now in fair or poor condition, it means that this proportion is now less or much less productive than it was originally. Much of the country in poor condition was formerly the best in terms of its productive potential. This is often the land that was initially over-used and unwittingly degraded many years ago and has not since had the chance to recover.

Between 1 and 2 per cent of the total pastoral area surveyed so far is in poor condition and is severely degraded and eroded to the point that only strict control of grazing, combined with expensive rehabilitation works, will reverse the self-perpetuating processes of accelerated erosion and loss of suitable soil niches for plant germination. Because of the importance of these areas in terms of lost ecological functions, reduced or lost production, increased run-off and dust hazard, such areas are delineated and mapped.

Elsewhere, in less severely affected areas, more appropriate and controlled use of the rangelands appears to be encouraging the processes of natural recovery.

Range surveys started and completed in Western Australia.

Range condition in arid areas relates primarily to the long-term status of perennial plants and soil surfaces, not to transient appearances of seasonal herbage and availability of feed at the time of the survey. These photos were taken two months apart, the top one in June 1986, the other in August.
### Table 1. Range condition classes for five surveyed areas

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage of traverse assessments in each range condition class</th>
<th>Total area (sq. km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region good</td>
<td>Good, Fair, Poor</td>
<td></td>
</tr>
<tr>
<td>Murchison (1970)</td>
<td>21, 37, 42</td>
<td>83,000</td>
</tr>
<tr>
<td>Gascoyne (1970)</td>
<td>32, 53, 15</td>
<td>63,400</td>
</tr>
<tr>
<td>West Kimberley (1972)</td>
<td>20, 50, 30</td>
<td>89,600</td>
</tr>
<tr>
<td>Nullarbor (1974)</td>
<td>50, 10, 40</td>
<td>47,400</td>
</tr>
<tr>
<td>Ashburton (1976-78)</td>
<td>64, 27, 9</td>
<td>61,200</td>
</tr>
<tr>
<td>Carnarvon Basin (1980-82)</td>
<td>45, 32, 23</td>
<td>74,500</td>
</tr>
<tr>
<td>Percentage of areas combined</td>
<td>36, 37, 27</td>
<td>419,100</td>
</tr>
</tbody>
</table>

### Rangeland monitoring

Many survey sites in good condition show no obvious signs of decline of the rangeland. Some sites in poor condition show signs of recovery, others a continuing decline. The techniques of assessing long-term changes by rangeland monitoring will confirm or deny the persistence of such trends, which a once-only survey cannot properly address.

A rangeland survey establishes a baseline of geographical information upon which land use and appropriate management can be planned. To make this possible, the survey must identify the characteristics of beneficial changes or those changes likely to cause degradation in each type of land unit throughout the region.

Rangeland monitoring will detect changes and long-term trends in the soils and vegetation, and interpret these changes. The vastness and variability of soils and vegetation on pastoral leases dictates that monitoring schemes being operated jointly by station managers and Department of Agriculture staff must be planned strategically, using the information and insights provided by regional surveys.

### Evaluating grazing potential and land condition by land systems

The concept of mapping land systems was first developed in Australia to classify and map rangelands on a small scale (1:250,000 or 1:500,000) over extensive areas. Although technological innovations such as satellite images and computerized map bases are now common-place in preparing such maps, the basic concept has withstood the test of time.

A ‘land system’ is an area, or group of areas, throughout which there is a recurring pattern of topography, soils and vegetation. (Map 2 here)

Each land system is made up of ‘land units’. These land units, with their varied drainage characteristics, soils and vegetation, occupy different parts of the topography. They often respond to grazing and other management practices in different ways. A land system will often include one or more land units which are particularly vulnerable or sensitive to management practices. Once these various land units have been identified, the overall success of a land management scheme can generally be assessed from its effects on key land units.

### Systematic coverage

During each survey, rangeland survey teams compile essential data for each land system by sampling at inventory sites. These sites are specially selected for their representative features which need to be recorded so that each part of a landscape can be characterized. The sites are repeated within each major land unit throughout its variations found across a region. In this way, patterns of landform, drainage, soils and vegetation emerge within tracts of country surveyed. Land systems can be defined, indentified and mapped on stereoscopic aerial photographs.

Maps of land systems and colour-coded pasture types prepared by the Department of Land Administration show the grazing resources of a station as simply as possible. By knowing the extent and key features of each type of land on the station, a pastoralist can plan the grazing use and management appropriate for each area of rangeland.
The framework of resource inventory is then used to assess the condition of the land. Condition relates to the cumulative impact of pastoral use and management. Knowledge of the land's condition is important, both for matching grazing use to land capability and for devising management objectives appropriate for a particular paddock or area of interest. The condition of soil surfaces and vegetation are assessed across each type of rangeland.

Observations are made at one-kilometre intervals during vehicle traverses. Traverse ratings are calibrated against objective measurements of composition of vegetation and soil stability taken at 'condition sites' selected within the major land units. Condition sites are established at pre-selected locations to record the status of soils and vegetation on major, well-known land units and to highlight the differences between such country in good, fair or poor condition when grazed.

Condition sites are also being used to test popular hypotheses about variations in the condition of land and vegetation within the 20 to 100 sq. km paddocks common in the rangelands. For example, sheep often graze into the wind. Does the upwind side or quadrant of a paddock lose its condition more than other sectors of the paddock? How different are such effects in various types of country? How far apart can watering points be sited without restricting the grazing radius of stock and causing the development of range condition gradients (variable patterns of grazing impact) within the paddock?

Surveys also provide new information on the exact locations of fences, stock watering points and other station developments that can be accurately depicted on updated station plans. It is now possible to produce station plans and other thematic maps (such as of erosion hazards for mining exploration) at a range of scales to suit users' needs because all of the survey's information that can be mapped is stored in a geographical information system.

Footslopes below lateritic breakaways in the upper Murchison originally supported stands of palatable perennial saltbushes and bluebushes which have been widely over-grazed by sheep, feral goats and kangaroos. Conserving or reclaiming this vegetation and soft soils poses special problems for management of the paddock.

Top: Areas where low shrub vegetation and soil surfaces are in very good condition are now rare.

Middle: Shrub cover is patchy, plant composition is degraded and bare areas are eroding.

Lower: Shrubs are almost eliminated and the whole soil surface is eroding by sheeting and micro-terracing.
Native perennials, soil conservation and grazing management

Recent fieldwork in the Murchison catchment south and west of Meekatharra has shown that young perennial plants have re-established naturally over wide areas within vegetation that has been degraded to a varying extent.

On some types of soil, such as the red earthy sands of wanderrie banks and sand plains, or shallow gradational calcareous soils of major watercourses, key perennials include several genera of native grasses such as Eragrostis, Monachather, Ermeapogon and Thrydolepis. Otherwise, shrubs and perennials herbs are the mainstay of the region. Shrubs of the chenopod family, often found only as understorey vegetation in mulga country, are frequently key species in the recovery of such rangeland.

Chenopod shrubs are an important source of browse for stock during dry years. The shrubs also preserve otherwise erosion-prone soil surfaces on many of the more productive land units, such as tributary drainage plains and alluvial footslopes. By correctly managing these natural events in re-vegetation through conservative stocking and by tactically seasonal (rather than perpetual) use of paddocks, such rare events in the regeneration of quality browse species can be coaxed along and transformed into long term gains in pasture condition and soil conservation.

Discovering new species of shrubs

A wide variety of native plants contributes to pastoral production in the winter rainfall areas of the pastoral zone. Many of the not so widespread species are little known, either botanically or in terms of their responses to grazing management practices.

Rangeland surveys have added considerably to our knowledge of the geographical range, abundance and occurrence of such species in relation to basic characteristics of land form, soil type and associated vegetation. Several species new to science have been discovered through the survey programme, while other ‘lost’ plants have been found again.

Reporting the essential information for long term use

Technical reports from regional surveys now cover a much wider range of resource features than previously. Subjects in the final report include climatic patterns, groundwater resources and vertebrate pests, all in recognition of their importance to pastoral management.