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Pastoral land degradation
the Fitzroy as a case study

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Advisers, Rangeland Management Branch

When large numbers of domestic livestock are superimposed on native vegetation in semi-arid and arid areas of the world, the ecological balance inevitably changes. In extreme cases these changes include such degradation as drastic losses of vegetation and active soil erosion. Areas affected in this way are unproductive for most purposes.

Western Australia's Fitzroy River valley has deteriorated in this way. Today this once-productive grazing country is so degraded that it has become a matter of concern to Governments, the pastoral industry and others.

This article gives a brief history of land degradation in parts of the Fitzroy River valley, and outlines methods of rehabilitation.

Historical background

Settlers moved permanently into the Fitzroy River valley in the 1880s. Those approaching from the west were mostly sheep men from southern parts of Western Australia. They came by sea and moved their flocks inland along the river, following the pioneer pattern already established along the Murchison, Gascoyne and Fortescue Rivers.

Simultaneously, cattle men moved into the valley from the east after overlanding herds from Queensland and the Northern Territory. The two prongs of settlement met around the present location of Fitzroy Crossing.

The sheep men in the west fenced their paddocks, but in the east cattle were run mostly under open range conditions. The rugged nature of some of the country east of Fitzroy Crossing and the ready availability of natural water supplies favoured this type of pastoral use at the time.

In either case, stock were concentrated on the river frontages for most of the year. These frontages provided the best pastures and ready access to water. The inevitable result was an excessive grazing and trampling of the frontage vegetation. In the early years, this degradation was masked by favourable seasons and the country's recuperative powers. But ultimately, a sequence of below average seasons revealed the extent of the damage.

This process of pasture degradation caused a decline in cattle numbers in the Kimberley, and in the Fitzroy River valley in particular, in the period from 1920 to the mid 1950s. Since 1950 a late development of water supplies away from the river systems and the total replacement of the sheep by cattle has resulted in an increase in total cattle numbers.
Table 1. Estimated areas (sq. km.) of levee crests and levee back slopes in the erosion and condition classes shown (to nearest 5 sq. km.), Djada and Gogo land systems.

<table>
<thead>
<tr>
<th>Erosion</th>
<th>Djada</th>
<th>Gogo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>170</td>
<td>235</td>
<td>405</td>
</tr>
<tr>
<td>Minor</td>
<td>455</td>
<td>345</td>
<td>800</td>
</tr>
<tr>
<td>Moderate</td>
<td>245</td>
<td>250</td>
<td>495</td>
</tr>
<tr>
<td>Severe</td>
<td>405</td>
<td>410</td>
<td>815</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1275</strong></td>
<td><strong>1240</strong></td>
<td><strong>2515</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range condition</th>
<th>Djada</th>
<th>Gogo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1275</td>
<td>1240</td>
<td>2515</td>
</tr>
<tr>
<td>Fair</td>
<td>445</td>
<td>455</td>
<td>900</td>
</tr>
<tr>
<td>Bad</td>
<td>790</td>
<td>710</td>
<td>1500</td>
</tr>
</tbody>
</table>

Identifying the problem

The degradation of native pastures and increasing areas of erosion in the Fitzroy River catchment were first recorded in 1910. In 1959, a CSIRO Division of Land Research and Regional Survey field party described the area on a land system and pasture land basis. (Speck et al., 1964). This survey classified the West Kimberley into a number of different types of country. In particular it described the Fitzroy valley frontage country in terms of two distinct land systems named Djada and Gogo. The areas of severe degradation and erosion in the Fitzroy valley were confined mostly to these two classes of country.

The Djada and Gogo land systems consist of a number of smaller land units such as levee crests, levee back slopes, black soil plains and channels and billabongs. The CSIRO study showed that the levee back slopes, which slope gradually away from the river, were the most sensitive to degradation. The back slopes can be up to four kilometres long and one kilometre wide. In some places they slope at about 0.5 per cent and are areas of sheet water flow. They, and the levee crests, are highly susceptible to both wind and water erosion when their vegetation is removed.

The most detailed examination of the Fitzroy valley to date was conducted by a survey team commissioned by the former Pastoral Appraisal Board—now the Pastoral Board. The survey report (Payne et al., 1979) describes the nature, location and severity of erosion as well as the condition of native pastures in the West Kimberley area. This survey, conducted jointly by officers of the Department of Agriculture and the Department of Lands and Surveys, was completed in 1972. It includes an assessment of the condition and erosion status of the Djada and Gogo land systems. The information used to determine erosion and condition estimates was derived from traverse records taken during the survey and from detailed soil and vegetation measurements made on precisely located parts of the frontage country.

The condition of the levee crests and back slopes is shown in Table 1.

Moderately and severely eroded areas both represent gross degradation of the surface and a much reduced capacity to produce feed for stock. Therefore they may be considered together as requiring remedial treatment. At least 1300 sq. km. of the Fitzroy river valley needed rehabilitation at the time of the survey in 1972.

The present situation

In December 1980, ground photo sites which were established during the 1972 survey were relocated and rephotographed to identify any further change in the condition of the frontage lands between Liveringa and Christmas Creek stations.

The inspection of these sites indicated clearly that most of the Fitzroy frontage lands had deteriorated over the eight year period. In some instances there was evidence of further soil erosion and vegetation loss. The dramatic nature of this denudation is clearly evident from the photographs. It was also apparent that areas in good condition in 1972, which were generally those sites most favourable for plant growth, had not deteriorated seriously in recent times.

Observations on Department of Agriculture research plots on the frontage country have shown that natural regeneration of a productive vegetation cover on severely degraded areas will take many years. No such cover has been restored on severely degraded sites protected from grazing for up to 12 years. These observations, together with the lack of improvement on the frontage generally, point to the need for special regeneration methods.

Potential for improving productivity

There is good potential for improving productivity from regenerated frontage country.

The levees and levee back slopes should support a pasture type known as 'frontage grass pasture'. Estimates of the potential capacity of this pasture show that it could carry about 38,000 cattle units compared to 10,000 cattle units in its present condition. (Payne et al., 1974). Thus it would be possible to carry up to 3.8 times the present number of cattle on the degraded levees and back slopes if they were rehabilitated.

The other parts of the Djada and Gogo land systems support 'black soil plain pastures'. These are not as degraded as the 'frontage grass pastures' but their carrying capacity in their present condition is still much lower than their potential capacity. The situation on the Djada and Gogo country of the Fitzroy is summarised in Table 2.
This reduction in capacity of 34,000 cattle units represents an annual turn-off loss of about 6000 cattle.

These figures are based on the assessed carrying capacity of native pastures only. Any reseeding programme would use introduced species such as Birdwood grass (Cenchrus setigerus) extensively. Experience with this species in the Fitzroy River valley suggests that its carrying capacity is higher than that of native pastures. Thus the potential increase in productivity suggested in Table 2 should be accepted as the lower limit of the possible gains. If Birdwood grass is established satisfactorily, about 10,000 to 12,000 additional beasts will be turned off annually from the frontage.

**Programmes for regeneration**

Rangeland research workers believe it would be possible to re-establish productive pastures and prevent soil erosion on the Fitzroy frontage through programmes developed co-operatively by Governments and pastoralists.

The key aspects of any regeneration programme would be:

- fencing and stock control on the degraded areas;
- cultivation and reseeding affected areas;
- vermin control.

The areas requiring treatment on each station would be defined so that a fencing and treatment programme could be designed, consistent with the needs of reclamation. Recent aerial photography of the frontage would be essential for this task. It would help define the areas in need of reseeding and cultivation, the best lines for new fencing, taking station practice into account, and the location of watering points. Station lessees would need to co-operate actively and the plans would need to describe the specific treatments for areas on each station property.

The fencing of the degraded areas to exclude stock would have to precede any of the reseeding and cultural treatments.

Cultivation and reseeding techniques would be based on those already well proven in other parts of Kimberley, in particular the Ord River Regeneration Project in the East Kimberley. In general terms, about ten per cent of the area would be strip cultivated using chisel ploughs and other implements, and sown with a mixture of Birdwood and buffel grasses (Cenchrus setigerus, C. ciliaris) and kapoik bush (Aerva jauonica) at a rate of about three kilograms per hectare.

Stock would have to be excluded from the cultivated area until the grasses sown were well established.

It is not possible to define the duration of the restocking period as this would depend upon the effects of seasonal conditions on germination and establishment. Normally it would not be necessary to delay stocking until all of the area between the cultivation strips was revegetated. But stock control would be necessary for some time after the initial cultivation, particularly in terms of season of use and intensity of use.

Some parts of the levee back slopes would be more difficult to vegetate than others. These areas would not be treated until research had indicated the most suitable plant species and cultivation treatments.

If the seasonal conditions were not favourable, it could be necessary to repeat the initial treatments. If the spread of plants between cultivated strips were impeded by glazed surfaces, additional cultivation work between the strips will be needed to encourage establishment and spread.

Sandy wallabies and feral donkeys would probably require control in all treated areas. The techniques of control are known and the assistance of the Agricultural Protection Board would be required to reduce the numbers of these animals where they were expected to hinder recovery of the frontage.

Given the experience in range regeneration already accumulated in the Kimberley environment, together with a continuing research programme and active co-operation between Governments and the pastoral industry, the Fitzroy frontage lands could be restored.

**Table 2. Potential and present carrying capacity of the Djada and Gogo land systems and current loss of production (in cattle units).**

<table>
<thead>
<tr>
<th>Pasture type</th>
<th>Potential capacity</th>
<th>Capacity now</th>
<th>Loss of capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontage grass</td>
<td>37,900</td>
<td>10,000</td>
<td>27,900</td>
</tr>
<tr>
<td>Black soil plain</td>
<td>22,400</td>
<td>16,300</td>
<td>6,100</td>
</tr>
<tr>
<td>Cane</td>
<td>60,300</td>
<td>26,500</td>
<td>34,000</td>
</tr>
</tbody>
</table>

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References

