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# **Land Degradation In The Fitzroy Valley Of Western Australia**

**Rangeland Management Branch  
of the Division of Resource Management**

**Resource Management Technical Report No. 1**

## **Disclaimer**

The contents of this report were based on the best available information at the time of publication. It is based in part on various assumptions and predictions. Conditions may change over time and conclusions should be interpreted in the light of the latest information available.

## Contents

1. Summary.....	1
2. Introduction .....	2
3. Description of the Fitzroy Valley Area .....	3
4. The Extent and Distribution of Fitzroy Frontage Erosion .....	5
5. The Present Situation on the Frontage .....	9
6. The Plates .....	10
7. Current Knowledge of Reseeding Techniques and Anticipated Problems .....	34
8. The Potential For Improved Productivity From Regenerated Frontage Country.....	35
9. The Value of Increased Productivity.....	37
10. An Outline for a Programme of Regeneration .....	38
10.1 Planning, Fencing and Stock Control .....	38
10.2 Treatments.....	38
10.2.1 Reseeding and cultural treatments .....	38
10.2.2 Subsequent stock control .....	39
10.2.3 Difficult sites .....	39
10.2.4 Fill-in work .....	39
10.2.5 Seed supplies .....	39
10.3 Vermin Control .....	39
11. The Cost of the Programme .....	40
12. References .....	40



## 1. Summary

The report reassesses the condition of formerly valuable grazing lands of the Fitzroy River valley frontage lands. It is hoped that the submission will promote discussion on the problems of degenerated pastoral land and increase the resolve of all concerned to take the necessary action for their restoration.

The frontage lands flank the major rivers of the area, the Fitzroy, the Margaret and the Meda and their tributaries. The frontage is capable of supporting the best pastures in the Kimberley, but unwise and uncontrolled stocking has profoundly degraded and eroded the most productive parts.

There are about 5,800 square kilometres of frontage country in the West Kimberley. Studies by CSIRO and by Western Australian government departments have shown that about 1,300 square kilometres of the frontage are in bad range condition with moderate or severe erosion.

Although the degradation has been known to exist for many years, there have been no sustained attempts to overcome it or to restore the land to its former productive status. A collection of twenty-two plates in this report shows that the country has not improved over the past eight years and has deteriorated even further in some places.

It is suggested that frontage country can be rehabilitated if the proper measures are taken. If action is not taken the situation can only worsen. The frontage country has the potential to support about 60,000 cattle units, but today it is estimated that 26,000 only can be carried. This represents a loss in turn-off of about 6,000 cattle a year worth well over one million dollars annually.

The work of rehabilitation will involve fencing and stock control and the ploughing and reseedling of the degraded country.

## 2. Introduction

Permanent pastoral settlement of the Fitzroy River valley commenced in the 1880's. Settlers moving into the valley from the west were basically sheep men from the southern parts of Western Australia. They came by sea and moved their flocks inland along the river, following the pioneering 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 practised paddocking of stock, but in the east cattle were run under open range conditions. The rugged nature of some of the country to the east of Fitzroy Crossing and the ready availability of natural water supplies favoured this type of pastoral use at the time. In either case, for the greater part of the year, stock was concentrated along the river frontages, which provided the best pasture and ready access to water. The inevitable result was an excessive grazing and trampling of the frontage vegetation. The degradation was masked initially by favourable seasons and the recuperative powers of this fertile country, but ultimately, excessive use and a sequence of below average seasons revealed the extent of the damage. In 1953 Bolton<sup>1</sup> observed, "Hardly a beast could be seen about the frontage, which was bare and almost nothing but a lot of scalded ground. The effect was so disastrous that all the pastures of the river frontages had completely disappeared for the time being".

This process of pasture degradation was associated with a decline in cattle numbers in Kimberley, and in the Fitzroy River valley in particular, in the period 1920 to the mid-1950s. Since 1950 a late development of water supplies away from the river systems and the replacement of the sheep by cattle has permitted an increase in total cattle numbers. No such improvement can be seen in the productive frontage lands, which are still for the most part bared and scalded as a result of the treatment they received under uncontrolled use.

### 3. Description of the Fitzroy Valley Area

The first definitive description of the Fitzroy River valley area was completed by CSIRO and reported in the resource survey of the West Kimberley area undertaken in 1959 (Speck *et al.* 1964)<sup>2</sup>. This survey classified the West Kimberley into a number of kinds of country and in particular described the Fitzroy valley frontage country in terms of two distinct classes of land, which were labelled Djada and Gogo by the survey team. The areas of severe degradation and erosion on the Fitzroy Valley were confined in the main to these two classes of country.

Djada and Gogo are very similar in make up as Table 1 shows. They differ chiefly in having different proportions of the various elements listed in the table.

**Table 1. Composition of frontage land systems**

Element	Soil Type	Vegetation	Per Cent Djada	Occurrence Gogo
Main channels	Soil on banks	Fringing woodland	5	6
Levee crests	Alluvial clays	Grassy woodland	8	20
Levee back slopes	Juvenile cracking clays	Grassy woodland	24	47
Backplains	Self-mulching clays	Mitchell grass	46	11
Depressions	Heavy clays	Tall grassland	7	6
Minor channels	Silty clay	Woodlands	10	10
<b>TOTAL</b>			<b>3,981 sq. km</b>	<b>1,847 sq. km</b>

The CSIRO study showed that the *levee back slopes* were the most sensitive to degradation. The back slopes, which can be up to four km long and one km wide, slope in places at about 0.5 per cent and are areas of sheet water flow. They are highly susceptible to both wind and water erosion and were thus extremely vulnerable to erosive processes following the removal of the vegetation cover.

The *back plains*, which consist of heavy cracking clays are the lowest elements in the landscape and are not subject to sheet erosion. The boggy nature of the soil also affords a natural protection to the pastures in the wet season when they are making their most important growth. These two factors have combined to allow the back plains to be relatively resistant to erosion.

The *levee crests* have undergone considerable degradation and erosion. They can be up to one km wide locally and slope at about one per cent. They are susceptible

to wind and water erosion. As they flank the watercourses and natural surface water supplies they have undergone considerable degradation and erosion. As they have a greater recuperative capacity than the back slopes their present condition is somewhat better.

The other elements of Djada and Gogo do not show any significant deterioration.

## 4. The Extent and Distribution of Fitzroy Frontage Erosion

General reports on the degradation of the Fitzroy frontage have been made by many authors including Bolton(1), Speck *et al.*(2) and Fitzgerald. The "Floodplain" soils of the levee backslopes were described by Fitzgerald, in an internal departmental report, as the most seriously eroded areas of the Fitzroy Valley.

The most detailed examination to date of the Fitzroy Valley was conducted by a survey team commissioned by the Pastoral Appraisal Board. The report of the survey (Payne *et al.*)<sup>3</sup> describes the nature, location and severity of erosion and degradation 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 and includes an assessment of the condition and erosional status of the Djada and Gogo lands. Additional information gathered by the team enabled a station by station analysis to be made of the condition of the Djada and Gogo country. The survey report concluded that:

Some of the most severe degradation seen during the survey occurs on the Djada and Gogo land systems. These high pastoral value systems are derived from alluvium and flank the Fitzroy, Lennard, Meda and Margaret Rivers and Christmas Creek. The black soil plain (BSP) pastures are in poor condition with minor erosion. The frontage grass (FG) pastures are in very poor condition and erosion is usually severe.

Erosion on the levee crests and back slopes is frequently in the form of large wind scalds and sheeting, extending for many kilometres. Wind piling and some root exposure of trees such as coolibah (*Eucalyptus microtheca*) and bauhinia (*Lysiphyllum cunninghamii*) is fairly common. There are restricted areas of active gullying. The most severely affected areas are found on Kalyeeda, Noonkanbah, Cherrabun, Gogo and Christmas Creek stations.

On many areas, perennial grasses are virtually absent and the principal feeds available for stock are annuals such as rice grass (*Xerochloa* spp.). These annuals produce little dry matter and are grazed out by stock during the early dry season. Bare ground therefore predominates during most of the year, exposing the unprotected loamy soils of the levee back slopes to wind and water erosion.

Such bad range condition areas require complete withdrawal from grazing for a number of years. In many cases, regeneration by cultural and seeding techniques would be possible. Even if these techniques are adopted, regeneration is likely to be long term (5 to 20 years). Considerations such as this would impose grazing restrictions upon many stations in the survey area.

The information used to determine erosion and condition statements for the Djada and Gogo country was derived from traverse records taken during the course of the survey and from detailed soil and vegetation measurements made on precisely located parts of frontage country. These traverse data are summarised in Table 2

which shows the percentage of the land affected by wind and water erosion as well as the summaries of pasture condition and range condition. The traverse record provides a biased estimate of the condition of Djada and Gogo as a whole as the traversing routes were invariably along the backslopes and levee crests, the boggy crabholed backplains being avoided. Nevertheless, they provide an accurate assessment of the condition of the traversed elements, which are fundamentally the subject of this memorandum.

**Table 2. Wind, Water and Total Erosion, Pasture Condition and Range Condition On Djada and Gogo Land Systems**

	Djada Per Cent	Gogo Per Cent
<b>Wind erosion</b>		
Nil	29	33
Minor	32	31
Moderate	22	21
Severe	17	15
<b>Water erosion</b>		
Nil	23	31
Minor (a)	5	2
Minor (b)	31	26
Moderate	29	24
Severe	12	17
<b>*Total Erosion</b>		
Nil	13	19
Minor	36	28
Moderate	19	20
Severe	32	33
<b>Pasture condition</b>		
Excellent	1	1
Good	2	5
Fair	15	18
Poor	35	38
Very poor	47	38
<b>+Range condition</b>		
Good	3	6
Fair	35	37
Bad	62	57

\*Total erosion is a combination of wind and water erosion measurements.

+Range condition is a combination of total erosion and pasture condition. It is a classification of the health of the range into three simple, easily defined classes.

The area of levee crests and back slopes is known to be 1,273 sq. km and 1,237 sq. km in Djada and Gogo country respectively. If the percentage values for total erosion and range condition in Table 2 are used, the area of each kind of country in the various condition classes can be derived. This is shown in Table 3.

**Table 3. Djada and Gogo Country Estimated Areas of Levee Crests and Levee Backslopes in the Erosion And Condition Classes Shown (nearest 5 sq km)**

	Djada sq. km	Gogo sq. km	Total sq.km.
<b>Total erosion</b>			
Nil	170	235	405
Minor	455	345	800
Moderate	245	250	495
Severe	405	410	815
	<b>1,275</b>	<b>1,240</b>	<b>2,515</b>
<b>Range condition</b>			
Good	40	75	115
Fair	445	455	900
Bad	790	710	1,500
	<b>1,275</b>	<b>1,240</b>	<b>2,515</b>

Moderately and severely eroded country both represent gross degradation of the surface and a much reduced capacity to produce. They may therefore be considered together as requiring remedial treatment.

These calculations show that at least 1,300 sq. km of the Fitzroy River valley was in need of rehabilitation at the time of the survey (1972).

## 5. The Present Situation on the Frontage

Following presentation of the 1972 survey report, a management committee consisting of an Adviser of the Rangeland Management Branch, Department of Agriculture, a Pastoral Inspector of the Department of Lands and Surveys and the lessee or his representative was established for each pastoral lease on the catchment. For most stations, these committees reached agreement regarding stock number reductions and the removal from use of badly degraded and eroded areas. These agreements were concluded in 1975. On some stations a concerted attempt has been made to reduce stock numbers on badly degraded areas, particularly the river frontages.

In December 1980, officers of the Department of Agriculture inspected a considerable tract of the frontage between Camballin (Liveringa Station) and Christmas Creek Station east of Fitzroy Crossing. During this visit, ground photo sites which were established during the 1972 survey were relocated and rephotographed in an effort to document any improvement or otherwise in the condition of the frontage lands. A collection of general photographs was also assembled. These photographs are shown in plates 1 to 22 in this report.

The photographic record clearly indicates that for the most part, the frontage lands of the Fitzroy have not improved over the past eight years. In some instances there is evidence of further soil erosion. Only in one or two favourable locations do the photographs suggest any improvement in condition and then only marginally. The dramatic nature of the denudation of the frontage is clearly evident from the photographs. It is also apparent that areas originally in good condition, generally those sites most favourable for plant growth, have not seriously deteriorated in recent times.

The failure of the seriously degraded and eroded areas to regenerate, points to the need for additional restorative measures. It is also apparent, as documented by the photographic evidence, that in such situations destocking alone will be almost totally ineffective in restoring a productive vegetation cover. No such cover has been restored on scalded soil surfaces, which have been destocked, within Department of Agriculture research plots, for up to 12 years; see plates 21 and 22.

*The conclusion which must be drawn from the evidence is that the prevention of soil erosion on the Fitzroy frontage, and the re-establishment of a productive pastoral resource, can only be achieved by a planned programme of stock and vermin control in combination with cultural operations, including reseedling with native or exotic species.*

## **6. The Plates**

The following twenty-two plates show changes occurring between 1972 and 1980 on a number of positively identified sites in the Fitzroy Valley.

## 7. Current Knowledge of Reseeding Techniques and Anticipated Problems

Officers of the Department of Agriculture have accumulated considerable experience in the cultural techniques appropriate to the regeneration of degraded rangeland in the Kimberley. Successful regeneration programmes have been undertaken on a limited area of frontage country (approximately 500 ha) at Collins Yard near Fitzroy Crossing and on a much larger scale on the Ord Regeneration Project area. A considerable amount of successful regeneration work was also carried out on some badly eroded areas of the Fitzroy frontage in the 1960s. These areas have now largely reverted to their former denuded condition due to an inability to regulate grazing. Nevertheless, a reasonable body of information exists regarding the cultural techniques, the species suitable for sowing and the pasture management strategies necessary for the revegetation of degraded frontage lands.

The species commonly used for range regeneration in the Fitzroy have included Birdwood grass, Buffel grass and Kapok bush. These species are ideally suited to the alluvial soils of the levee crests, and in general the levees should present no difficulties in terms of regeneration. There are also extensive areas of the backslopes that appear to offer no serious problems or limitations to regeneration by conventional techniques.

The backslopes have some problem areas that will be difficult to reclaim without some further investigatory work. They represent a complex mosaic of soil types further compounded by greatly varying degrees of surface stripping by wind and water. A number of difficulties are likely to be encountered and these include -

1. Formations consisting of very hard pan surfaces that are difficult to cultivate.
2. Surface accumulations of salts that may inhibit regeneration by non-salt tolerant species, in some situations.
3. Occurrence of naturally solonetzic (sodium affected) soils which are difficult to work and exhibit poor physical properties.
4. Occurrence of juvenile cracking clays which are poorly drained and may require different species to those widely used to date.

At the present time, the proportions of 'suitable' and 'problem' soil types are unknown. As part of any comprehensive regeneration programme it will be necessary to identify these areas and to undertake a research programme aimed at elucidating appropriate cultural techniques and species for difficult situations while regeneration proceeds by conventional methods on suitable areas.

This part of a programme for frontage land rehabilitation will be undertaken by officers of the Department of Agriculture as a new initiative developed in the course of their normal duties.

## 8. The Potential For Improved Productivity From Regenerated Frontage Country

The number of cattle currently supported on the Fitzroy frontage is unknown and cannot be determined as the cattle, in general, roam unchecked by fences. The safe carrying capacity assessments made by Payne *et al.*(3) for the 25 pastoral leases on which Djada and Gogo country occur suggest a potential safe carrying capacity for the frontage, in good condition, of 60,000 cattle units or 70,500 total cattle. The safe carrying capacity of the frontage based on the 1972 condition classification was considered to be only 26,300 cattle units (30,000 total cattle). Restoration of stable and productive pastures thus has the potential to double the productivity of the frontage.

The above figures refer to the total productivity of all of the Djada and Gogo country. This includes large areas of black soil plain pastures where improvements in productivity can be achieved by stock management alone. Experience has shown that these pastures respond rapidly to destocking or to a reduction in stocking pressure. The levees and levee back slopes will not respond to these simple rehabilitative measures. Cultural treatments will be necessary to restore them to productivity.

The levees and levee back slopes should support a pasture type known as 'frontage grass pasture'. Estimates of the potential carrying capacity of this pasture type (Payne *et al.*)<sup>4</sup> on the Fitzroy frontage are 37,900 cattle units or 44,600 total cattle compared with the present safe carrying capacity of 10,000 cattle units. Thus a production increase of up to 3.8 times the present would be possible from the degraded levees and back slopes if they were rehabilitated.

The situation on the Djada and Gogo country of the Fitzroy is summarised in Table 4.

**Table 4. Potential and Present Carrying Capacity of Elements of the Fitzroy Valley and Current Loss of Production (in Cattle Units)**

<b>Pasture Type</b>	<b>Potential Capacity</b>	<b>Capacity Now</b>	<b>Loss of Capacity</b>
Frontage grass	37,900	10,000	27,900
Black soil plain	22,400	16,300	6,100
	<b>60,300</b>	<b>26,300</b>	<b>34,000</b>

This reduction in capacity of 34,000 cattle units represents a loss of carrying capacity of 40,000 cattle, which at today's turn off figures represents an annual loss of 6,000 cattle to operators in the area.

It should be noted that the above figures are based on the assessed carrying capacity of native pastures only. In any reseeding programme extensive use would have to be made of introduced species such as Birdwood grass. Experience with this species in the Fitzroy River valley suggests that its carrying capacity is higher than

that of native pastures. The potential increase in productivity suggested in Table 4 should thus be accepted as the lower limit of the gains that could be achieved. The increases if Birdwood grass establishes satisfactorily will be of the order of 10,000 to 12,000 additional beasts turned off annually from the frontage.

Despite the considerable increases in productivity that can result from the reseeded of degraded pastures there has been a marked reluctance on the part of the industry to undertake such measures. Part of this reluctance almost certainly arises from cost considerations.

## 9. The Value of Increased Productivity

The reclamation of the frontage can be viewed in both economic and environmental terms. In the previous section it was suggested that rehabilitation of the frontage would eventually result in the turn off of an additional 6,000 cattle a year at least. At today's prices of 95 cents per kilogram and assuming a carcass weight of 200 kg, this represents an increased return of approximately *\$1.14 million* a year to the area. In general terms this is also equivalent to a 15 per cent increase in returns to cattlemen in the West Kimberley.

Better frontage pasture will also result in better weight gains by the animals grazing them. This should allow more animals to be turned off as reproductive rates will be greater and mortality rates should be lower.

It is safe therefore to assume that improvement of the frontage can only result in better returns for pastoralists.

In environmental terms the benefits of rehabilitation are best measured against the results of failure to attempt regeneration. The photographic evidence supplied shows convincingly that the country in question is severely degraded and erosion is continuing. Progressive deterioration of the landscape can only destroy the natural habitats of many native birds and animals and reduce fragile environments to levels from which rehabilitation will become almost impossible.

## **10. An Outline for a Programme of Regeneration**

The foregoing sections have dealt with the deterioration that has occurred in the Fitzroy frontage and with the benefits that would follow should it be rehabilitated. This section describes the parts of a programme that would need to be implemented to overcome the degeneration that has occurred and to restore the area to its former productive condition.

***The key aspects of the regeneration programme would be:***

- (i) planning, fencing and stock control on the degraded areas
- (ii) reseeding and cultural treatment of affected areas
- (iii) vermin control
- (iv) a target date for completion of seven years.

### ***10.1 Planning, Fencing and Stock Control***

The areas requiring treatment on each station would need to be defined accurately so that a fencing programme consistent with the needs of reclamation could be designed. New aerial photography of the frontage would be required so that a programme would be devised for each station. This would help to define the areas in need of reseeding and cultural treatment, the best lines for new fencing bearing in mind station practice, and the location of watering points. The preparation of these plans would involve the active co-operation of the lessees. The plans would describe the specific treatments for each property and would delineate the areas on which forms of stock control would be required.

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

### ***10.2 Treatments***

#### ***10.2.1 Reseeding and cultural treatments***

The work of reseeding and cultivation would be carried out using the techniques already briefly described.

The techniques that could be adopted generally require ten per cent of the areas to be cultivated using chisel and other ploughs and for the cultivated areas to be sown with Birdwood and Buffel Grass or with either of these species at a rate of three kilograms per cultivated hectare.

### **10.2.2 Subsequent stock control**

Stock will have to be excluded from the cultivated areas until the grasses sown are well established. It is not possible to define the length of the destocking period as this will be dependent upon the seasonal conditions and the success of the germination and establishment following seeding. It would normally not be necessary to delay stocking until all of the area between the cultivation strips was revegetated. Stock control in terms of season and intensity of use would, however, be necessary for some time after the initial cultivation.

### **10.2.3 Difficult sites**

As already noted some parts of the levee backslopes will prove to be less amenable to treatment than others. These areas would not be treated until research has indicated the most suitable methods of attack. Subsequent to treatment such areas may require special grazing techniques in order that the establishment of new species can be assured.

### **10.2.4 Fill-in work**

If the seasonal conditions are not favourable it may be necessary to repeat the initial treatments. Alternatively, if the spread between cultivated strips is impeded by glazed surfaces it may also be necessary to do additional cultivation work between the strips in order to encourage the spread of the introductions. The amount of fill-in work that will be necessary cannot be estimated. It may be about ten per cent of the area actually treated.

### **10.2.5 Seed supplies**

It is not considered that seed supplies would be difficult to obtain. Local seed can be harvested, or seed can be purchased through one of several commercial sources.

## ***10.3 Vermin Control***

It is expected that agile or sandy wallabies and feral donkeys will require control in all treated areas. The techniques of control are known and the assistance of the APB would be required in a campaign to reduce the numbers of these animals where they are expected to hinder the recovery of the frontage after its treatment.

## 11. The Cost of the Programme

The exact cost of any programme will depend on the amount of fencing required, the rate at which seeding can be carried out and the nature and response of the various soils. Preliminary estimates suggest that the total cost would be around \$2.0 million spread over 7 years. This compares to a conservatively estimated increase in return to the Industry of \$1.14 million per year. Additional environmental benefits are expected.

## 12. References

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<sup>1</sup> Bolton, G.C., 1954. The Kimberley Pastoral Industry; in Western Australian University Studies in History and Economics. University of Western Australia Press.

<sup>2</sup> Speck, N.H. et al., 1964. General report on the Lands of the West Kimberley Area. Land Research Series No. 9. CSIRO Melbourne.

<sup>3</sup> Payne, A.L., Kubicki, A., Wilcox, D.G. and Short, L.C., 1979. A report on erosion and range condition in the West Kimberley area of W.A. Tech. Bull. 42 W.A. Dept. Agric.

<sup>4</sup> Payne, A.L., Kubicki, A. and Wilcox, D.G., 1974. Range condition guides for the West Kimberley area W.A. West. Aust. Dept. Agric.