Water Authority
of Western Australia

PRELIMINARY ASSESSMENT OF THE EFFECTS OF GRAZING ON THE REMNANT VEGETATION IN THE KENT RIVER WATER RESERVE

Report No. WS106
August 1992

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Surface Water Branch

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D. E. True, G. Kikiros
and R. Froend

Water Authority of Western Australia
629 Newcastle Street
LEEDERVILLE WA 6007
Telephone (09) 420 2420

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1.0 INTRODUCTION

1.1 Background

The deterioration of water resources due to salinity became increasingly apparent through the 1960's and 1970's and led to the government progressively introducing controls on land alienation (release of Crown Land for private ownership). It was soon realised, however, that this action would not be sufficient to maintain satisfactory stream salinity levels in some marginal catchments.

In November 1976 the Country Areas Water Supply Act 1947 was amended to provide control of clearing of indigenous vegetation within the Wellington Dam Catchment Area by the then Public Works Department. The amendment provided for persons wishing to clear to apply for a licence. In December 1978 the Act was further amended to extend the controls to the Mundaring Weir and Denmark River Catchment Areas and to the Kent River and Warren River Water Reserves. The Kent River Water Reserve was included, although slightly brackish, because of its proximity to Albany and the Lower Great Southern Water Supply.

If an application to clear is refused, the Applicant has a right to claim compensation. Since the introduction of clearing controls, $35.5 million has been paid in settling claims for compensation on all controlled catchments.

In negotiating to settle claims for compensation, it is accepted that limited grazing of the remnant vegetation will occur. This is on the premise that degradation of vegetation will be minimal if grazing is limited. Heavy grazing of the understorey will however result in degradation of remnant vegetation through 'passive' clearing.

Since the introduction of clearing controls, no monitoring of the effects of grazing, and other uses of remnant vegetation, has been undertaken. It has been obvious however that degradation of the vegetation has been occurring.

Voluntary guidelines for the management of remnant vegetation on private property, therefore, are necessary to minimise further degradation and promote rehabilitation. The development of such guidelines, through the co-operation of the Departments of Agriculture and Conservation and Land Management, the Water Authority and farming organisations, depends on an accurate assessment of the impact of grazing on remnant vegetation. It is believed that the guidelines will be adopted by farmers through the on-farm benefits of the retention of remnant vegetation being emphasised.

1.2 Objectives

In line with these management guidelines, the Water Authority of Western Australia (WAWA) commissioned Denise True to undertake a comprehensive survey of the native vegetation remnants in the clearing-controlled Kent River Water Reserve. The objectives of the study were to -

1) Identify the extent of remnant vegetation on private land within the catchment;

2) To assess the impact of grazing on remnant vegetation within the catchment, and determine the range in vegetation condition;

3) To classify the remnant vegetation according to the degree of grazing disturbance, other forms of degradation, and vegetation type;

4) Contribute to the formulation of guidelines on the management of remnant vegetation in the Kent River catchment.

This preliminary report details the assessment of the impacts of grazing on the remnant vegetation, provides a description of the range in vegetation condition, the degree of grazing disturbance and other forms of degradation.

2.0 STUDY AREA

The Kent River Water Reserve is located approximately 350km south of Perth within the Shires of Plantagenent, Denmark and Cranbrook. The catchment is divided into 3 major zones based on the potential for secondary salinity. The study took place in Zone A, the Rocky Gully to Tenterden Section which is the zone of highest potential.

The study area lies in the Menzies Sub-District of the Darling Botanical District a sub-division of the South West Botanical Province (Beard, 1981).

The sites selected were mainly a mixture of Jarrah - Marri - Wandoo woodland, Jarrah forest and a few sites in tall Karri forest to the south of the study area. These communities are described by Beard (1981), in the Kendenup, Kwornicup and Kent Systems, respectively.

3.0 METHODS

The northern half of the catchment was divided into five areas, A, B, C, D, and E (Fig. 1). These areas were defined by rainfall isohyets, soil/geology, vegetation and drainage.

Within each area five (5) properties were selected at random giving a total of twenty-five (25) properties for potential investigation. Twenty one (21) of these properties, four each in Area A, B, D, E and five in Area C underwent a comprehensive field survey that involved an assessment of every remnant on each of the selected properties.

There are several components contributing to the degradation of remnant bushland in the Study Area namely, salinity, introduced grazing, native grazing, feral grazing, historical uses and the effects of the adjoining agricultural land use. It was therefore important to use a survey method that would assess all of these factors.

A survey form was designed to enable an objective and consistent assessment of all the factors affecting each remnant. From the scope of information collected it was then possible to determine for each remnant:

- the general condition,
- the effects of grazing on the vegetation, and
- other degradative factors affecting the condition of the remnant vegetation.

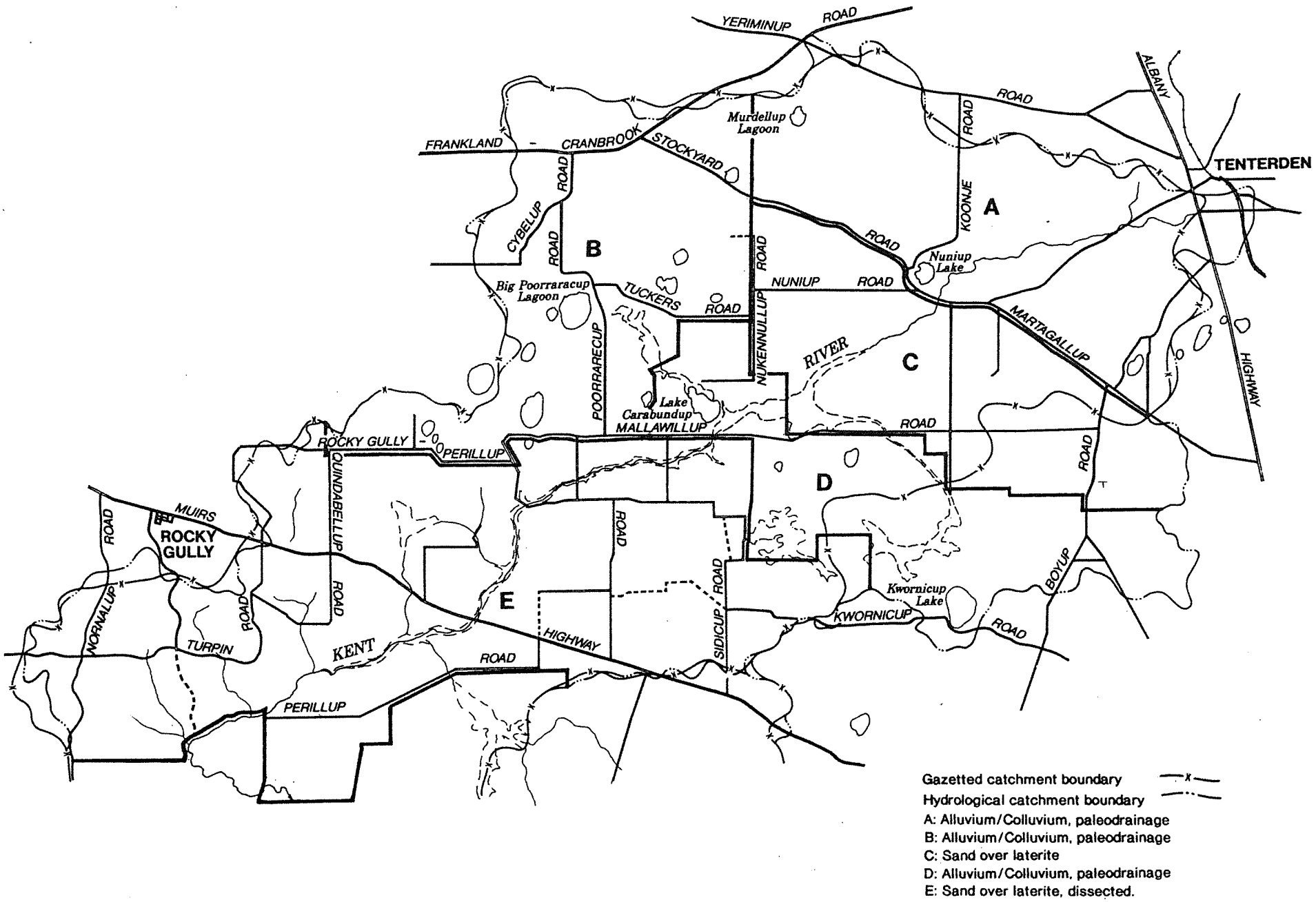

FIGURE 1. KENT RIVER WATER RESERVE SHOWING SAMPLE AREAS

The following are some of the detailed parameters recorded at each site:

Date
The date of observation was recorded in the field to assist any future comparisons that may be made and to indicate any plant identification flowering periods.

Landholders Name
The landholders name was recorded as a reference for each property. This information has not been recorded in the database.

Location No.
The location number of each site was recorded on the data sheet as another means of identification of each remnant for future reference.

Remnant No.
Each remnant visited was allocated a unique number commencing with 'K'.

Site No.
The number of each site was recorded independent of the remnant number as some remnants required more than one site.

Size of the Remnant
The size of the remnant is to be calculated accurately using a GIS database at the Department of Agriculture.

Position in the landscape
The location of the remnant in the landscape was recorded as this is important in determining if other factors are affecting the remnant.

Soil type
A basic description of the soil type at each site was made to assist in classifying the remnants.

Soil colour
The colour of the soil at each site was recorded to assist in identification of the soil type.

Soil compaction
The presence of soil compaction resulting from stock trespasses was noted. Compaction has severe effects on soil and plant growth.

Presence of soil crusts
The presence of soil crusts such as lichens and mosses were recorded. Soil crusts are broken up by the sharp hooves of domestic stock and this contributes to soil decline.

Plant litter
Litter is reduced by stock trampling and was used, depending on the vegetation type, as a further indication of stock disturbance. Plant litter was naturally low in plant communities that contained a wetland.

Evidence of Erosion
Soil erosion is a natural process caused by wind and water. It is increased by hooved stock movement, plant denudation and results in vegetation decline.

Adjoining Land Use
The types of land use adjacent to the site surveyed were noted from aerial photographs and ground surveys as this can influence the condition of the remnant.

Connectivity
Other forms of vegetation connected to the survey site were noted as vegetated corridors connecting remnants add to the value of the remnant and provide an avenue for the movement of wildlife and hence the dispersal of seed. The natural recolonisation of small areas already degraded is possible by linking with corridors (Breckwoldt, 1990).

Number of Structural Layers
The number of structural layers is critical to this type of assessment, as in disturbed communities, the number of layers is reduced. (E.M. Mattiske & Associates, 1991).

Evidence of Regeneration
The competition with weed species, defoliation of palatable seedlings by stock, alterations in the soil structure and compaction of the soil limits seed penetration, these affect plant regeneration and ecosystem function and results in vegetation decline. The presence/absence of regeneration of dominant species was recorded at each site.

Vegetation quality
Considering the dominant species only, the average health of the remnant was assessed.

Weed Invasion
For the remnant as a whole, the weed invasion was categorised as follows; 0-20%, 20-80%, >80%.

% Weed Cover
Weed invasion follows disturbance. Dispersal into the edges of the remnant is aided by wind and carried further by stock. Weeds compete successfully with native vegetation for space and nutrients. Weed cover was assessed to be compared with native cover, bare ground and plant litter.

% Bareground
The amount of bareground was assessed.

% Plant Litter
A layer of litter is important in protecting soil minerals against erosion by wind, rain and extreme temperatures. Litter is reduced by stock trampling.

Other Disturbance
Other forms of disturbance such as Fire, Salinity, Insect damage, Grazing, Vermin, Rubbish, Mining, Logging, Dieback were recorded.

Browsing Line
The presence of a browsing line on plant species was recorded as in some cases complete defoliation of shrubs can occur, if the tips of plants are within reach.

Physical Damage
Evidence of physical damage of ringbarking and trampling to plants by stock was recorded, as this contributes to the decline of plant individuals and species.

Grazing Rating
The level of damage by grazing was rated from no evidence, to death.

A series of questions regarding the management regimes used on the properties were directed to the landholders. These included whether the remnant was fenced, what type of stock, stocking rates and the frequency of stocking of adjacent paddocks, when was the most recent fire in a remnant and importantly, the time since surrounding land was cleared. This provided valuable site information that was used in the assessment of the health of the remnants on each property. The information from the landholders can also be used in the development of management regimes for the remnants, by providing an insight into how agricultural practices affect the remnants. The interviews for this information also provided the opportunity to gauge the reaction of the sampled landholders to the survey and the proposed management guidelines.

Dominant vascular plant species were collected opportunistically at each site. All plant specimens collected were pressed, dried and fumigated in line with current practices of the Western Australian Herbarium, and were identified and compared with collections at the herbarium.

4.0 RESULTS

A total of 130 sites were surveyed and databased. The following summaries have been produced to provide a description of the general condition of the remnants of native vegetation in the Study Area. The Research Section of the Surface Water Branch at the Water Authority of Western Australia, will undertake most of the analysis with regards to the effects of grazing on these remnants, and the implication for the Kent River Water Reserve.

The frequency of the various parameters recorded to assess the condition of the remnants, and the effects of grazing at each site were summed and are presented in Table 1.

TABLE 1 : Summary of the Percentage of each Parameter Recorded within the Study Area

Parameter	Total No of Sites	%
Compaction		
- none	18	13.8
- tracks only	54	41.5
- whole area	58	44.7
Soil crusts	91	70.0
Plant litter		
- abundant	80	61.5
- sparse	37	28.5
-.none	13	10
Waterlogging	22	17.0
Type of Stock		
- sheep only	91	70.0
- wethers	2	1.5
- cattle & sheep	22	17.0
- horses	10	7.7
- horses and sheep	5	3.8
- previously cattle	16	12.3
Regeneration	75	57.7
Weed Invasion		
- 0-20%	55	42.3
- 20-80%	42	32.3
- >80%	33	25.4
Connectivity	78	60.0
Fencing (fully)	14	10.7
Native grazing		
- heavy	9	7.0

TABLE 1 : Summary of the Percentage of each Parameter Recorded within the Study Area (Continued)

Parameter	Total No of Sites	%
Disturbance Factor		
- fire	33	25.4
- salinity	23	17.7
- insects	74	57.0
- native grazing	67	51.5
- introd grazing	113	87.0
- vermin	79	60.7
- rubbish	13	10.0
- mining	2	1.5
- logging	66	50.8
- dieback	7	5.4
- other	1	0.7
- browse line	85	65.4
- trampling	101	77.7
- ringbarking	74	57.0

Nearly forty five percent (44.6%) of sites showed compaction over the whole area, 41.5% on stock tracks only and no signs were visible, in 13.8%.

The figure for no signs of compaction is largely constituted from sites on deep sands, containing a large wetland or a largely lateritic surface, these types of sites will naturally show little or no signs of compaction. Hence soil compaction is apparent in the majority of sites surveyed in the study area.

Seventy percent (70%) of sites had soil crusts such as lichens and mosses. Sites of deep sandy soils had no evidence of soil crusts.

Plant litter was abundant in 61.5% of the sites surveyed, this is commensurate with most of the sites being Eucalypt woodlands that produce a fair amount of leaf litter. 28.5% of sites had only sparse litter and 10% no litter at all.

Seventeen percent (17) of sites were obviously affected by waterlogging, which contributes to the decline of the remnant but is independent of grazing.

More than half (57.7) of the sites surveyed showed seedling regeneration of the dominant species. Seedling growth would be expected at the time of year that surveys took place, that is late spring/early summer, however it cannot be seen as a direct indication of bush regeneration. Late spring/early summer was also the time that paddocks contained sufficient feed for stock, and therefore the bush was less likely to be grazed. Previous investigations undertaken have shown that grazing pressure on bush remnants is greatest during summer periods and drought, especially if supplementary feed is not provided by the landholder.

Regeneration was evident in those remnants within paddocks that were in crop in 1991, as they are in effect fenced from stock access until after harvest. This effect could be seen in degraded remnants within paddocks that had been cropped for two or three consecutive years which showed significant regrowth not present in similar remnants without adjacent crop paddocks.

It is believed that an autumn survey after harvest and after summer would not show the seedling regrowth observed by the late spring/early summer surveys. This is supported by the lack of an intermediate structural layer of the dominant species in these remnants.

The majority of the sites surveyed are stocked with sheep only (70%), 17% carried sheep and cattle, 3.8% carry horses and sheep, 7.7% were stocked with horses only. Two sites were known to be stocked with wethers at the time of the surveys. These sites were separated in the database from other sheep sites because stocking rates are significantly higher and supplementary feed is not provided. Consequently remnants in paddocks containing wethers are under greater grazing pressure.

Heavy native grazing was only observed in 7% of the sites, and is not considered to be of a major cause of degradation of the remnants surveyed.

Only 10% of the sites surveyed were fully fenced. None of the sites surveyed were known to be under the Remnant Vegetation Protection Scheme.

Interestingly, 60% of sites were connected to other areas of bush, either other remnants varying in condition, windbreaks, nature reserves or vegetated roadside reserves. This is important in creating avenues of movement for native fauna and the maintenance of genetic diversity.

42.3% of the sites surveyed were less than 20% weed invaded as a whole. 32.3% of sites had a moderate to high invasion (20-80%), and a quarter of the sites (25.4%) were very highly invaded, and tended to appear as a dense stand of trees in a crop. This would pose a difficult rehabilitation programme. The major weed species in these sites was ryegrass, *Lolium rigidum* which forms a dense covering smothering native species.

Table 2 represents the number of introduced species as a percentage of the total number of plant species recorded. The majority of sites had less than 20% of the total number of plant species represented as introduced species.

The various disturbance factors examined were used to provide an overall picture of the condition of the remnants.

A negative score (-1) was given for each of the fourteen disturbance regimes examined at each remnant. Additional negatives were scored from the grazing rating, for example, a grazing rating of 3 (significant damage attributable to stock) was scored as -3. These scores were summed for each site.

Sites that scored -1 to -4 were considered slightly disturbed, -5 to -8 moderately disturbed, -9 to -12 significantly disturbed and -12 to -17 very significantly disturbed.

Of the sites examined 8% were slightly disturbed, no sites were undisturbed. 30% of the sites were moderately disturbed and the majority of the sites surveyed (62%) were significantly disturbed. None were considered to be very significantly disturbed. (Table 3)

TABLE 2 : Number of Introduced Species as a Percentage of the Total Species.

% Introduced Species	No. Sites	% Sites
0	3	2.3
1 - 5	21	16.2
6 - 10	28	21.5
11 - 20	25	19.2
21 - 30	10	7.7
31 - 40	10	7.7
41 - 50	9	7.7
51 - 60	8	6.2
61 - 70	12	9.2
71 - 80	4	3.0
81 - 90	-	0
91 -100	-	0

TABLE 3 : Ranking of the level of Disturbance in the Sites Surveyed

Disturbance Score (-ve)	Total No of Sites
1	0 undisturbed - 0%
2	1)
3	5) slightly disturbed - 8%
4	4)
5	8)
6	9)
7	14) moderately disturbed - 30%
8	8)
9	25)
10	28)
11	22) significantly disturbed - 62%
12	6)
13-17	0 very significantly disturbed - 0%

5.0 DISCUSSION

The impetus behind this study was the concern as to whether the remnant vegetation in the study area, the Kent River Water Reserve, was in decline. Summaries produced from the survey data so far indicate that this is the case. There are two main causal factors involved:

- the rising salinity in the catchment, and
- grazing by domestic stock.

Although seedlings of the overstorey species were present during the survey, the vegetation structure of the remnants, mostly mature plants, indicated that the seedlings are not surviving. Seedling survival and regeneration of the remnants in the study area is threatened by grazing domestic stock, mainly sheep.

Although there is an awareness by farmers of the affect of grazing on native bush, there is little or no action to prevent the process. The survey and the idea of voluntary guidelines to assist in managing the bush was received well by more than half of the landholders surveyed. Approximately a quarter were disinterested, and the remainder were relatively negative. The negative attitudes were directed more at the Water Authority of Western Australia stemming from the introduction of the clearing controls. It was encouraging to hear most farmers discussing their bush with a positive attitude and looking for management guidelines, even those with limited cash-flow at present.

The health of the remnant bushland in the study area can be characterised in two ways:

- Firstly the condition of the overstorey, that is, are the trees healthy or is there a lot of crown death?
- Secondly, the condition of the remnant as a whole, that is, what number of species remain representing the original diversity?

The condition of the overstorey in the majority of sites in the study area was good. Although there was some death from ringbarking of trees, this was caused mainly by cattle in the past. The sites where vegetation quality of the dominant species was poor or dead, could be attributed to other factors such as salinity, waterlogging and poor drainage.

Grazing by domestic stock has its main affect on the second characteristic, the lowering of understorey diversity, integrity and destruction of invertebrate and vertebrate fauna habitats and the cessation of regeneration. If the natural ecological processes of regeneration cannot be maintained, the remnant will decline.

There seems to be a misconception that groups of trees are remnants. Trees, although dominant in the landscape, are only part of the remnant and all the components are required for the remnant to be sustainable. In the Kent River Water Reserve, grazing is removing these other components, and resulting in the decline of the remnants in the long term.

Although statistics have not been applied to the data on an area basis, generally the condition of the remnants appeared to be poorer in the areas of the Water Reserve that had been cleared the longest, mainly Area A and C (Fig. 1). Area E vegetation, although low in the catchment was generally in relatively good condition by comparison, at present.

Another area for concern with regard to the conservation of remnant vegetation in the study area is drainage. The Colman and Miers report (1985) identified insufficient and interrupted drainage as the main cause of land degradation in the area. Poor drainage is having a direct detrimental effect on the vegetation in the Kent Catchment. Most farmers were unaware of the requirement to notify the Department of Agriculture of the intention to drain.

The aim of drainage in the Kent River Water Reserve is to drain excess water and associated salt from farmland to other areas. Other areas are namely, roadside drains, adjacent properties and of primary concern to this study, remnant vegetation. The remnants affected occupy both public and private land. For example, a major sump for a number of properties in the Area D is Lake Kwornicup Nature Reserve. Uncoordinated drainage puts the remnants at risk. Evidence of this was obvious in remnants on a few of the locations visited. The irony of this situation was demonstrated in one case, where a person who was draining saline water into a remnant, was also planting non-indigenous species adjacent to the remnant to combat salinity.

The vegetation in the study area can be considered to be under threat. Active steps need to be taken to conserve what is left by replanting other areas in the catchment to limit the effects of rising salinity on remnants and fencing of the remnants to encourage regeneration.

The current conception, that the larger the remnant the more resistant it is to effects of disturbance, did not always hold true in this study. Some of the larger remnants were as degraded as the smaller ones.

With additional information on remnant size and shape, further conclusions as to the optimum configuration of remnant vegetation required to maintain high conservation values and hence water quality, can be made.

6.0 RECOMMENDATIONS FOR MANAGEMENT

The following is a summary of recommendations for the introduction, design and implementation of management guidelines.

Replanting

Encourage tree plantings of indigenous species where possible. Obviously in some areas the salinity is already too high for local species to tolerate.

"Projects to manage and conserve existing vegetation should be given priority. Existing trees are a valuable resource often neglected, especially when resources and time given to new plantings is considered. Natural regeneration is often easier, cheaper and less time consuming than planting." (Countrywide, 1988)

Long Term

Complete management guidelines regarding water utilisation (on-site and offsite) are essential, not only for the remnants but for each property in general. Although some farmers do not believe they require farm plans, their use may have a wider acceptance if the effectiveness of sub-catchment and catchment plans could be demonstrated, showing how one person's action affects another person's property. The management guidelines should take an overall view of the catchment looking at conservation issues including bio diversity, as well as farming practices and water quality. The collaborative CSIRO research project on the Kent Catchment should contribute significantly to these needs. The aims of the WAWA remnant vegetation management guidelines should be advertised to the Kent LCDC and the wider farmer community. Workshops could be conducted with this theme to improve communication and relations with the landholders.

The land degradation occurring in the Kent Catchment is of concern to the farmers of the area and integrated management guidelines for the Catchment would be well received by most. Specific management regimes regarding the vegetation that would enhance farming practices and consequently halt degradation is needed.

Education

The Water Authority could also have some input at the school level. The Department of Agriculture of Albany have an Education Liaison Officer that fulfils this role with Land Conservation District Project Officers.

Expert assistance from other agencies such as the Department of Agriculture will be essential for the acceptance of some of the management ideas in a farming community.

Fencing

One of the arguments that farmers have against fencing remnants is that stock will be excluded from the shelter of the bush. This can be viewed in other ways:

1. If they are not fenced there will be no new vegetation to replace the existing stands once those trees die.

2. There is better shelter and protection from a remnant when both shrubs and trees are present.

3. The stock do not need to be in the remnant to gain shade and shelter from normal weather conditions, the perimeter of the patch provides this sufficiently.

A number of farmers put forward the suggestion that if the fencing materials were provided they would fence their remnants. It is just as important that they appreciate the need for management of the remnants, not just fencing funds. If funding is to be provided, some of the experience gained by the people administering the Remnant Vegetation Protection Scheme should be sought. It can also be argued that fencing and rehabilitation of remnants is cheaper for the farmer than replanting by him in the future.

Economics
Although economics is a key factor it should not dominate the reasons for retention and replanting. The intrinsic, aesthetic and natural values of the indigenous bush should be appreciated. For many farmers, the bush has more value than just dollars, and this attitude should be nurtured.

Timing
Some important aspects of the management guidelines are that they should not take too long to produce, the design of the content and presentation should be well considered, and the landholders in the Kent River Water Reserve be well educated as to the contributions to the catchment that each of their actions make. For example, the issue of drainage - the questions of where is it going, what and who will this action affect, need to be foremost in the farmers thinking before such an action is taken. It is pointless for a farmer to fence and attempt to manage a remnant that another farmer higher in the catchment is draining saline water into.

Viability
Fencing of small areas that would be ecologically and/or economically unviable should not be enforced. For example, small isolated linear strips are costly to fence for the amount of remnant that you are actually protecting, the cost may be better spent elsewhere. Issues such as, where cattle are stocked in the paddock, an electric fence is necessary and electrifying the fence would be difficult in a isolated position, need to be considered.

Most importantly the ecological viability of small remnants have not been examined in detail to date, although the perimeter to area ratio of a small patch would indicate that weed invasion would be high and the isolation means that there are no corridor benefits for the movement of fauna and the dispersal of seed. If small, isolated remnants exist in recharge areas that are considered to be of hydrological importance, incorporating vegetated corridors to link remnants is advised.

An overall plan incorporating wildlife corridors in the retention and replanting schemes for the catchment should be considered. The benefits of these corridors are twofold, they enhance the long term viability of each patch of remnant and they can easily be incorporated into farm plans and used as laneways through paddocks.

Finally, for a greater acceptance of the management guidelines by the farming community the following ideas are suggested -

1. The Water Authority play a larger, more active role in their business, and their community

2. Continue visits by the people involved in the formulation of the management guidelines to the Kent LCDC meetings

3. The Kent LCDC needs to reach more of its farmers. The recent Field Day held did not attract a high proportion of farmers from the area, and only one from the sample for this study. Perhaps the Water Authority of Western Australia can assist with this.

4. Ask for input from the farmers at an early stage. They can provide a lot of on-ground knowledge. Maintain communication with those that respond.

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