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THE RETENTION OF MATURE FOREST AND OTHER AREAS OF NATIVE VEGETATION FOR NATURE CONSERVATION IN THE WOOD PRODUCTION ZONE OF THE WOODCHIP LICENCE AREA

by

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INTRODUCTION

The introduction of the concept of multiple use forestry in W.A. led to two forms of conservation strategy within the karri forest. The first included discrete blocks of forest reserved from cutting operations which can be broadly grouped as conservation MPA's and National Parks. These areas were chosen with the overall emphasis of conservation at the level and scale of the karri forest.

A second strategy of conservation specifically in the zones allocated to wood production was also adopted. The aim is to retain, uncut within the wood production zone, 20% of the forest in any block (Forests Dept.). This is to ensure the regional conservation of species and communities and hence enhance the conservation values of the wood production zone. Thus a series of strips or corridors of forest were left uncut on a block by block basis forming a network of uncut corridors of road, river and stream reserves to connect with conservation MPA's and National Parks. Conservation MPA's were initially designated. Subsequently road reserves of 800m total width, river reserves

of 400m total width and stream reserves of 200m total width were allocated in turn up to the point where 20% of the forest block lay within the reserve system.

This second strategy for conservation was adopted prior to the instigation of detailed research in many areas of the world, on the value to conservation of different sites in a landscape and with the assumption that relatively narrow corridors may have poor sustainability.

There has since been a considerable growth in knowledge in this area through work carried out in eastern Australia and North America in particular. Broad principles have been established that now place us in a much better position to formulate guidelines to enhance the conservation values of the wood production zone.

Four approaches to conservation in areas subject to intensive harvesting operations can be defined:

1. manage for selected components of the habitat that are known to be limiting. Trees bearing hollows suitable as nesting sites for those species requiring them are limiting in regenerated forest. Hollows are a long time in formation (Mackowski 1984, Inions 1985). This option has the problem that retained elements of habitat can reduce productivity by

suppressing growth (Rotheram 1982). A reliance on the retention of single trees is also open to question. Dead trees pose fire and safety hazards and have poor sustainability as habitat trees.

2. extend rotations so that there is time for suitable habitat to develop and be recolonised by breeding populations from other suitable habitat before it is logged again. Present yield forecasts and cutting levels preclude this option until the second rotation.

3. Reduce coupe size or change cutting regimes to a form of selection cutting. The adoption of this option would still lead to the completion of cutting within a forest block during the same time scale as occurs using a clearfelling system. Hence; whatever form of cutting is practiced, differences in the age of regrowth within a forest block would be considerably less than 75 years.

4. retain strips or patches of mature forest within the harvested areas. This option has been found to be most useful in Australia. It is particularly attractive where important areas or sensitive wildlife occur in patches. Riparian zones, and areas of high nutrient status are outstanding examples.

The fourth option was chosen when the E.I.S. was drawn up at the introduction of woodchipping in the Karri forest in 1975. Thus 20% in any forest block in the wood production zone was allocated in strips for retention as road, river and stream reserves. It is clear that the fourth option remains the most tenable and also the most valuable for wildlife conservation.

This paper is concerned with the most appropriate pattern of retained vegetation within intensively managed stands in the karri forest. I aim to examine the value of various sites for wildlife and the sustainability of buffers. I thus aim to determine whether the existing pattern of reserves is the most appropriate for wildlife conservation within the wood production zone. I then examine six case studies of a reallocation of the existing reserve system to better enhance the conservation value of the wood production zone. I assume that the committment to retained uncut forest within a forest block in the wood production zone remains at 20% and that the yield is not reduced through the reallocation of reserves. I will also address other measures that will add to the conservation value of recently logged coupes without affecting the current or subsequent yield.

THE VALUE OF RETAINED MATURE FOREST FOR WILDLIFE

Remnants of retained mature forest are vital to the regional conservation of a broad spectrum of species (Loyn 1980, Loyn *et al.* 1980, Loyn 1985, Recher *et al.* 1980, Recher *et al.* 1985, Recher *et al.* in press, Shields *et al.* 1986). This includes species requiring hollows in trees as nesting sites. Thus 23% of Australia's vertebrates or nearly 350 species use hollows in trees in some way (Ambrose 1983).

Thirty three (20%) forest birds in Western Australia use hollows. Twenty of these species occur in the karri forest. Wardell-Johnson (1984) found that 14 of 44 species observed in spring 1982 (32%) used hollows in trees as nest sites. This also included 34% of all bird detections (4327 total). Thus hollows are important for the total numbers in bird communities in the karri forest as well as the numbers of species.

This trend is also known for mammals. Sixty seven percent (20 species) of the species of mammals occurring in the forest of the south west use hollows. Nine species (30% of the total forest mammal fauna) require hollows in trees in the karri forest.

Mature forest is required by animals for many purposes besides nest sites. Mature trees are also perching and shelter sites and foraging substrates. Some of these purposes may be

ed initially by isolated small dead trees
ll-Johnson own data) although the sustainability and hence
value of such trees for wildlife conservation is open to
on.

UE OF RETAINED VEGETATION IN STREAM ZONES FOR WILDLIFE

t valuable areas for conservation tend to be those lowest
profile (Dobyns and Ryan 1983, Loyn 1980, Smith 1985,
et al. 1980, Recher *et al*. in press, Shields 1984)
ose with the highest nutrient status (Braithwaite *et al*.

lowest in the profile are most valuable for the full
trum of bird species found in any particular habitat type
nclude greater numbers of individuals than upland sites
n 1980, Recher *et al*. 1980, Recher *et al*. in press,
ins pers. comm., Wardell-Johnson own data). The structure
habitat (Recher 1971) and the position in the profile are
discriminants (Howe *et al*. 1981). Sites lowest in the
le are also most valuable for other vertebrate groups
r *et al*. in press).

small mammals reach their greatest numbers in sites low in
rofile in the karri forest (Christensen and Kimber 1975).
terrace areas are also critical habitat for the Quokka in

the karri forest (Christensen and Kimber 1975). Sites lowest in the profile are also most valuable for the full spectrum of amphibians found in the karri forest (own data) and are important to invertebrate conservation.

Riparian zones occupy a minor proportion of the total forest area (see Churchward *et al.* in press) but are a critical source of diversity within the forest system. The greatest proportion of land units are based on Riparian zones but occupy a minor proportion of the total landscape (see Churchward *et al.* in press). Riparian zones are also relatively sensitive to disturbance. Although the communities in these zones can recover rapidly, they can also be altered by compaction and erosion during operations more than other land elements.

Thus a shift in emphasis is required from road reserves to stream reserves in the context of the maintenance of habitat in intensively managed forest in the karri forest. This shift in emphasis is necessary because, although effective where allocated, large areas of stream zone and also certain other relatively sensitive and important fauna habitat receive little protection under the current scenario. Similarly, following the completion of cutting and the establishment of the first rotation within a forest block, large areas of regeneration occur between retained strips (see Fig 2, 3a, 4a). Species

dependent on mature forest will not be catered for by differences in the age of adjacent coupes cut during the same cutting cycle. This is because hollows take much longer to form than the envisaged differences in the age of the regrowth within a forest block.

The effectiveness of this shift in reserve emphasis will depend on the sustainability of reserves low in the profile and also on the reserve being of adequate width for fauna conservation within stream zones in the karri forest.

There are significant areas of relatively narrow road reserves adjacent to cleared private property. Observations of these areas and the variation in age classes within such stands suggest that relatively much narrower reserves than existing 800m total width reserves along roads will be sustainable. Similarly buffers on stream zones are likely to be better protected from windthrow than upland sites.

THE WIDTHS OF RESERVES NECESSARY FOR WILDLIFE CONSERVATION

Recher *et al.* (in press) recommend wide reserves and movement corridors based on the theory of central place, due to many species at Eden requiring patchy resources over a large area of undisturbed habitat (e.g. various species of glider). Thus many

iders require large, approximately circular territories which e inadequately catered for by narrow reserves. The gliders e not present in south Western Australia although this theory y hold for some bird species. These are nevertheless more obile.

her *et al.* (in press) found that buffers of 40m total width re inadequate for fauna conservation in pine plantations in tern Australia. Not only were such reserves too narrow to provide the resources necessary for wildlife but also trees retained within such buffers were found to be subject to dieback (loss of vigor) and windthrow. Total reserve widths less than the heights of the trees are inherently susceptible to environmental perturbations.

erve widths of 50m either side of gullies are likely to be adequate to preserve a high proportion of the conservation alues within coupes in the karri forest based on the species nown to occur there. It will however be necessary to ensure t all streams include such reserves and that the reserves are inked. This will ensure that the conservation values are nhanced in a greater proportion of any forest block within the od production zone of the woodchip licence area. Retained atches of connected forest will thus most effectively serve as ildlife corridors, as areas for dispersal and colonization and ill provide the best opportunity for the conservation of atchily distributed species of invertebrates.

ighest order streams (i.e. rivers) supply greater variation in habitat and harbour more species than low order streams. They usually have a greater width of terracing (where terracing is present) and more areas of steep slope than lower order streams. Thus the larger buffers should be allocated to the largest streams based on the size of the stream.

RECOMMENDATIONS FOR MANAGEMENT

1. All streams, gullies and drainage lines (as marked on CALM 1:50 000 maps and interpreted through aerial photography) in areas subject to intensive harvesting operations be protected by retained vegetation.

2. A width of 50m of retained vegetation be included either side of 1st, 2nd and 3rd order drainage lines. For management purposes this should be considered as a 100m total width, with a minimum of 20m on any one side to enable reserve boundaries to follow ecological boundaries wherever possible.

3. A width of 100m of retained vegetation be included eitner side of 4th order drainage lines. For management purposes this should be considered as a 200m total width, with a minimum of 50m on any side to enable reserve boundaries to follow ecological boundaries wherever possible.

4. A width of 200m of retained vegetation be included either side of 5th order and greater drainage lines. For management purposes this should be considered as a 400m total width with a minimum of 100m on any side to enable reserve boundaries to follow ecological boundaries wherever possible.

5. Ecological boundaries may include terraces on larger streams (e.g. Dombakup Brook, Big Brook) in which case the reserve edge will be above the terrace to thus include a narrow band of mature trees and to ensure that roads are above steep slopes and seasonally moist sites. Although such terraces will lack large numbers of mature trees they will serve as effective movement corridors for a large range of species.

6. Seepage sites and valley headwaters are particularly important in such a scenario. These sites may contain merchantible trees albeit at wide spacing. These areas can be identified by aerial photographs and on the ground by the presence of *Lepidosperma tetraquestrum* or *Oxylobium lanceolatum*. These areas should not be harvested or trafficked and would form the upper slope areas of the buffer system.

7. ovement corridors should cross saddles to join stream headwaters (Recher *et al.*, in press).

a. In the northern area of the karri distribution, karri generally occurs low in the profile (Bradshaw and Lush 1981). Allowance should be made in the silvicultural prescriptions for the jarrah forest for the continuation of movement corridors between catchment areas. The deliberate retention of large habitat trees will be necessary. Similarly timber stand improvement operations that remove the most valuable stems from a wildlife conservation stand point should not be considered in such areas (Figure 1).

b. In the centre of the distribution of the karri (e.g. Warren Catchment) karri forest may occur over the whole landscape (Bradshaw and Lush 1981). The retention of habitat trees to link buffers will thus be necessary.

The retention of trees which are already dead prior to the regeneration burn is likely to add to fire control difficulties and poses a safety hazard in subsequent regeneration as such stems have poor sustainability as habitat trees. Hence large cull trees will be retained. However, in order not to reduce the yield (Rotheram 1983) such retained stems will be poisoned (if necessary) following the regeneration fire.

These reserves will be gained through a reallocation of the currently designated buffer system. Thus road reserves would be reduced to an aesthetically acceptable landscape criterion and the balance made available for stream buffers. Similarly 200metre wide strips along 3rd order or smaller streams would be reduced to 100 metres. The width of buffers to be retained on larger streams will be determined by the order of the stream.

9. The system of reserves here advocated should be considered at the scale of the woodchip licence area. Hence following reallocation stream zones may not be adequately catered for in some blocks due to insufficient road reserve for reallocation. Area for stream zone buffers would then be borrowed from road reserve in other forest blocks so that stream zones are favoured throughout (see page 15).

10. Like the present system of retained buffers, proposed buffers must be allocated prior to the commencement of harvesting operations in a forest block. Thus for many forest blocks, already cut, the introduction of these guidelines will be delayed until the second rotation.

11. No harvesting operations should take place within designated buffer areas. Vehicular traffic and road construction should be minimized within such areas. Where roads cross

alley lines, suitable drainage work must be carried out to ensure the continued stability of the road surface to minimize sedimentation.

12. Coupes in which harvesting operations are being conducted may include streamzone buffers. These buffers can be burnt during the regeneration burn provided that prescribed fire within the buffer system is of low intensity. Adjacent streamzone buffers should not be burnt at the same time unless it is essential to achieve security in the regeneration burn or reduce the risk of fire damage to the reserve itself.

13. Prescribed fire should be specifically excluded from a proportion of stream zone buffers within a forest block in subsequent aerial prescription burns by using roads adjacent to higher order stream zone buffers as burning boundaries. In practice most stream zones in the karri forest are not burnt under conditions generally prescribed for.

14. In addition to the redistribution of the existing reserves which are available, there are other areas which would not normally be logged but which are important fauna habitat. These areas should be recognized.

a) Granite outcrops, some of which have been included in the reserve system, are surrounded by shallow sensitive and usually moist soils. Granite outcrops should be subject to a buffer of undisturbed vegetation (50m form surface rock) at their periphery. Outcrops shown on API plans (.2ha or greater) would be considered in this system.

b) Areas of poor regeneration potential should be considered in the reserve system. These areas designated through site typing have been identified in the jarrah forest (Strelein in press) and include seepage sites mentioned above in the karri forest. Some of these sites contain valuable resources of quartz and sand. Provision would need to be made for these prior to formal recognition of these sites.

c) Areas of flats include valuable fauna habitat. They also include considerable variety in plant community structure and floristics (Wardell-Johnson *et al.* in prep, Burbidge in prep). Such areas are not subject to cutting but may be subject to other operations. Such areas should be considered as having values worth protecting and designated in block plans accordingly.

REALLOCATION IN PRACTICE ON SIX FOREST BLOCKS

In this section I aim to determine whether there is sufficient reserve available for the envisaged redistribution within forest blocks. I have chosen six forest blocks that include the main variation in landscape elements to be found in the woodchip licence area. For the purpose of the exercise road reserves were reduced to 200m either side of roads (in practice road reserves would be reduced to an aesthetically acceptable landscape criterion and the balance made available for stream zone buffers). All 1st, 2nd and 3rd order streams were then allocated a 50m buffer each side to the headwaters of the system as shown on block plans. In practice these would need to be checked by aerial photographic interpretation and in the field. 4th order streams were allocated 100m each side and 5th order and larger streams allocated 200m each side. The balance between areas given up from existing reserves and that taken up from proposed reserves was then determined.

Table 1 shows considerable variation in the balance between loss and gain in area, though an equal number of areas had a credit for available area as had a debit. In practice the area available in road reserves and the climatic situation of the forest block will be crucial to the balance between areas given up and areas gained. Areas in high rainfall sites are likely to include higher numbers of 1st order streams than areas in the

n part of the woodchip licence area. From the rvation viewpoint, the protection of stream zones in the n part of the forest should be considered as a first ty. In addition higher order stream zones should be dered highest in priority so that if on a regional basis, a oss of area is found by reallocation, stream zone buffers d be designated firstly on the largest streams.

2-4 show differences between current reserves and reserves in three forest blocks in different river ems within the wood production zone. The proposed system of rves shows a more effective coverage of the reserve system ch forest block.

aim is to include mature forest as habitat, as corridors of rsal and as avenues for colonisation. Greater provision is provided for linking larger reserves and to enhance the servation values throughout forest blocks within the wood uction zone of the woodchip licence area.

addition to an enhancement of the conservation value of rest blocks this scheme will enable more effective and ficient zoning for priorities within the wood production zone

eater ,efficiency in management will also be gained through is proposal. Thus operations will be encouraged to be confined to certain sites, sub-catchments and particular landscape units. erations will thus more adequately reflect the landform in ch they are imposed.

The knowledge and data base from which these recommendations have been derived like the forest environment for which they are tended is not constant. The above recommendations have thus been prepared within certain realisations (Loyn 1980).

1) whilst there is not the quantity nor quality of data on every wildlife species, there is sufficient knowledge to make a start. A number of principles have been established that enable these guidelines to be derived for the karri forest.

2) If we wait until all the facts and figures become available we may have closed off future options. Habitats may be modified to an extent where it is difficult to reappraise forest management strategies.

3) These guidelines can be revised or improved through an ongoing monitoring and evaluation procedure. To this end I have included as a separate paper recommendations to research concerning the effectiveness of streamzone buffers.

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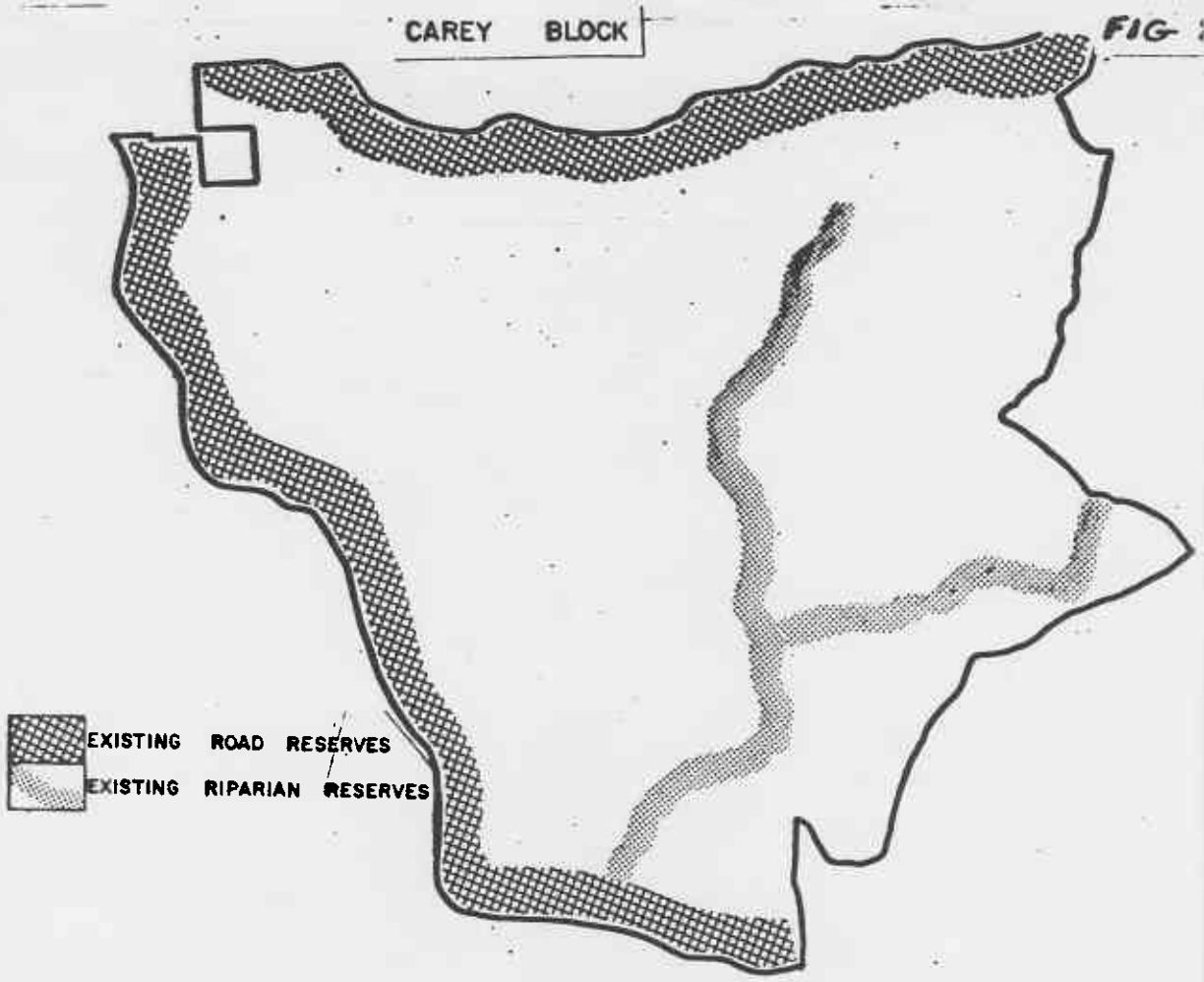
TABLE 1: The reallocation of existing reserves in Road River and stream zones in six forest blocks (source FMIS).

Forest Block	Road Reserves		Riparian Reserves		Balance	Additional
	Current	Proposed	Current	Proposed		Non Forest
Big Brook	982	491	163	352	+302	8
Boorara	429	214	399	828	-231	486
Cary	791	395	380	806	-31	18
Coonan/Warrup	786	393	671	666	+398	323
Dombakup	831	416	742	1671	-514	403
Jane	940	470	597	920	+107	678

CAREY BLOCK

FIG



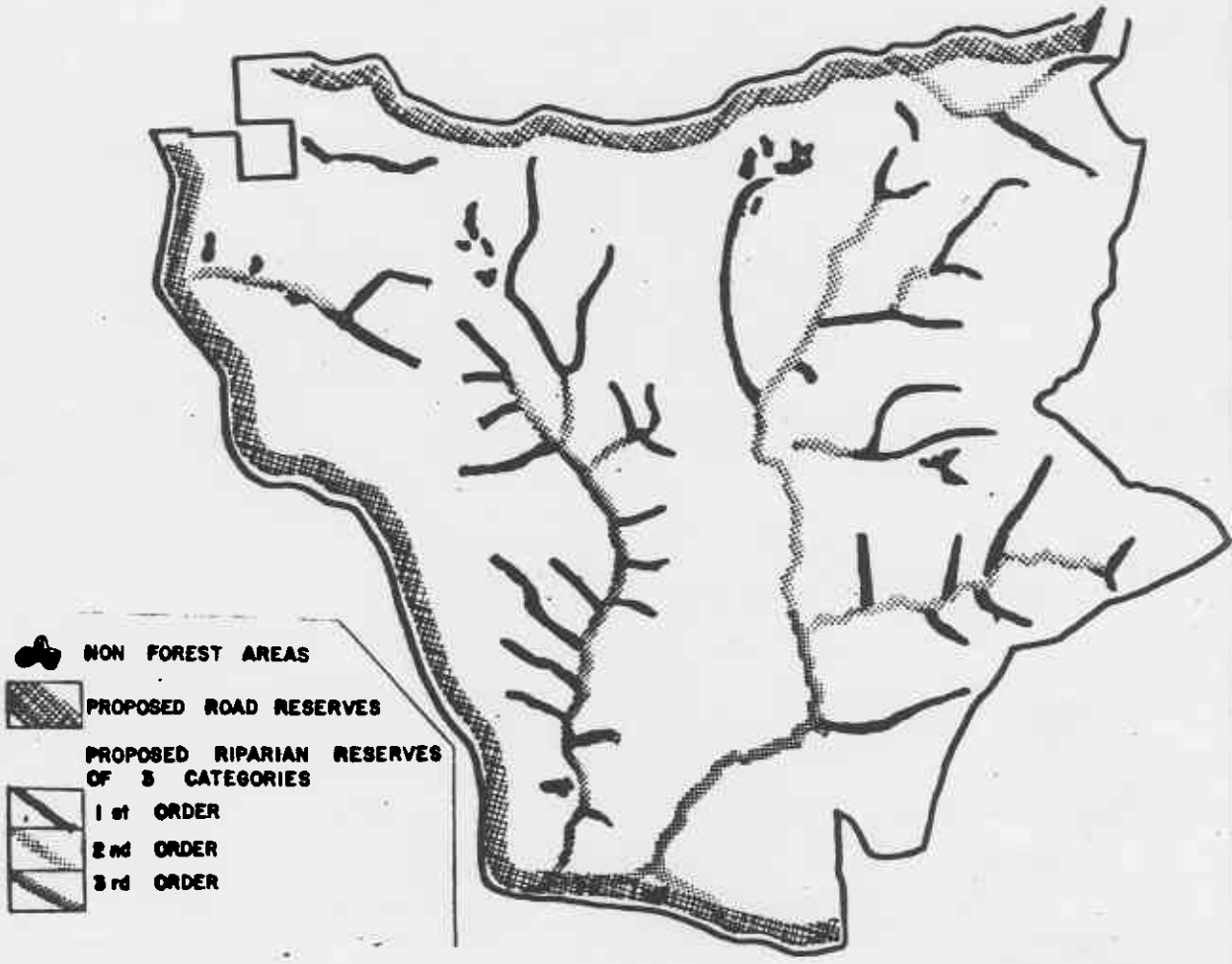


FIG 3a

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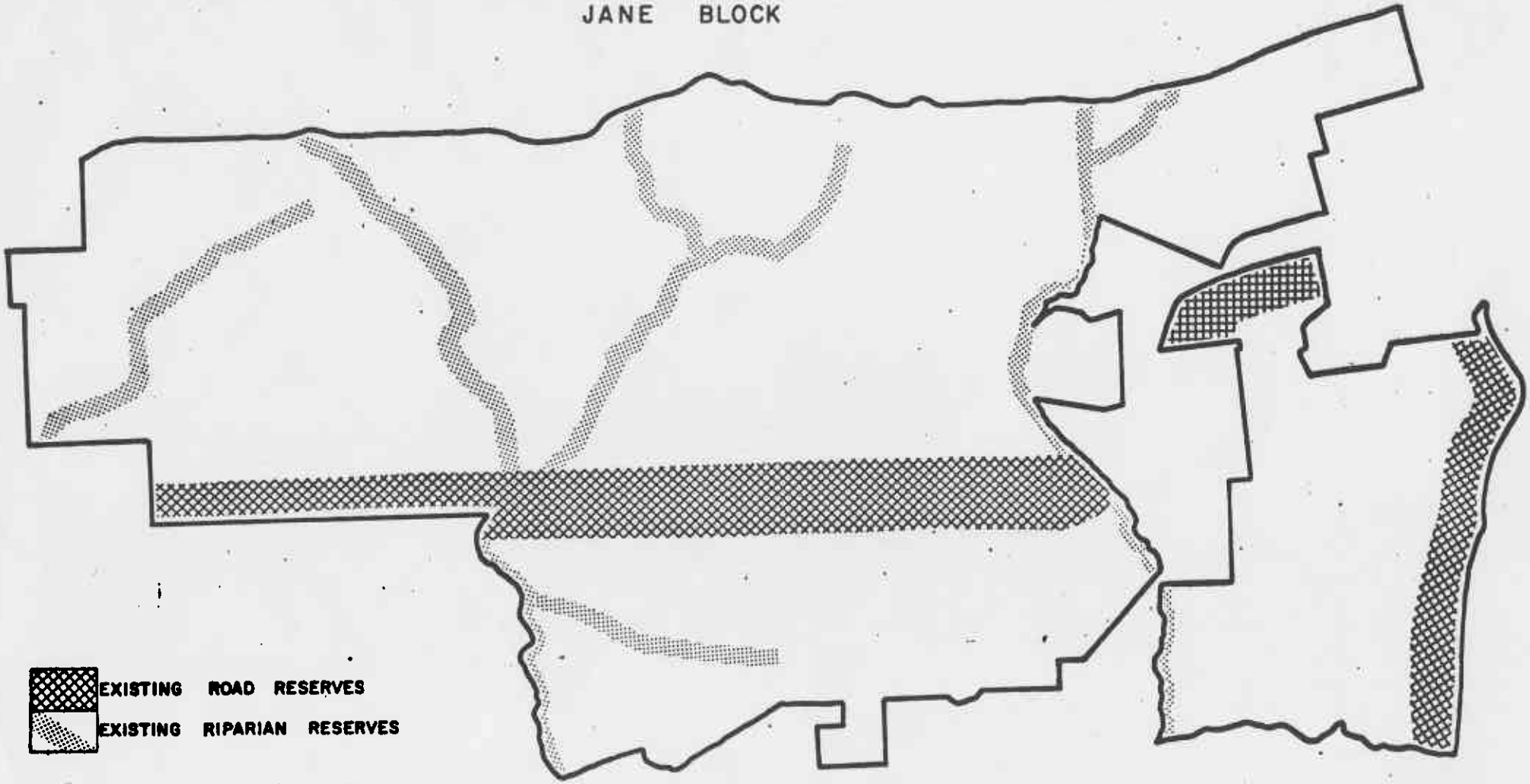

FIG 36

JANE BLOCK