ENVIRONMENTAL CONFLICTS ARISING FROM HYGIENE LOGGING; WITH SOME ALTERNATIVE SUGGESTIONS

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SUMMARY

This report contains an analysis of hygiene logging practices and the environmental conflicts associated with them.

Current hygiene logging methods can cause soil damage and erosion. Water quality can deteriorate from sedimentation and turbidity. Extra forest is cleared for low-profile roading.

Alternative logging methods suggested may offer a solution to these conflicts by keeping forests fully productive and dieback spread to a minimum.

TABLE OF CONTENTS

INTRODUCTION

This report will address the problem of other environmental conflicts which arise from the current prescription for dieback hygiene logging in the Southern Forests of Western Austrialia.

Although the hygiene logging prescription offers the first genuine opportunity to limit the introduction and spread of P. cinnamoni (Rands) in the forest, the disbenefits which can be attributed to this logging system on water quality, forest soils, and additional forest clearing may outweigh the hygiene benefit.

The potential for environmental problems caused by low profile roading and downslope snigging patterns will be examined in detail.

The impact of P. cinnamomi on southern jarrah forests will then be discussed and the consequences of impact on Land Use evaluated.

Any consideration of logging prescriptions should be done with due emphasis on the feasibility and practicality of the operation, and costs involved to the Industry. These aspects will be dealt with.

Rather than simply highlighting the environmental problems caused by hygiene logging without attempting to find a solution, some alternative logging systems will be described and will list the advantages and disadvantages of each in terms of dieback hygiene and environmental protection.

This report is based on observations of logging practises carried out at Wye Block in the Walpole Division.

Logging first commenced in Wye in May 1980 after a period of "quasi-quarantine". This virgin forest was predominantly dieback-free and so the all season hygiene logging systems applied there can be monitored quite accurately for disease introduction and spread. In this respect the Wye forest is a useful case study.

Eorest managers, in attempting to overcome a vexing problem such as spread of dieback in jarrah forests, may lose sight of other forest protection aspects in setting down a standardized prescription for operations in all areas. This report aims to widen the vision of the forest manager in respect to operational effects whilst always relating back to the primary Land Use of the Forest concerned.

2. EXISTING HYGIENE LOGGING PRESCRIPTIONS

The prescription for hygiene logging has been developed over the past decade but refined more recently following trials in Disease Risk Areas in Dwellingup and Nannup. The prescription has three essential elements.

2.1 Low Profile Roading

Current prescriptions stipulate that roads are to be located low in the landscape for all risk categories except coupes classified as dieback. Often roads are constructed within a few metres of a watercourse. The objective of low profile roading is to minimize potential spread of disease downslope of roads. The relevant guidelines for roading from the Forest Dept. Dieback Hygiene Manual, Jarrah 81 and the Southern Region Industry Control Manual have been used to locate roads in coupes that have been logged in Wye Block. The prescription recognizes that the most likely source of new disease infection is from roading or hauling activities.

Because of the climate conditions in the Southern forest (1000-1300mm rainfall) roads are built to winter road specific-ations, with only occasional summer tracks being constructed. Roads are necessarily wider to accomodate heavy loads and larger log trucks. Plates 1 and 2 show the width of major access roads. Figure 1 shows how Wye 1 logging coupe was roaded low in the landscape.

PLATES 1 and 2 showing the width of major access roads in the Southern Region.

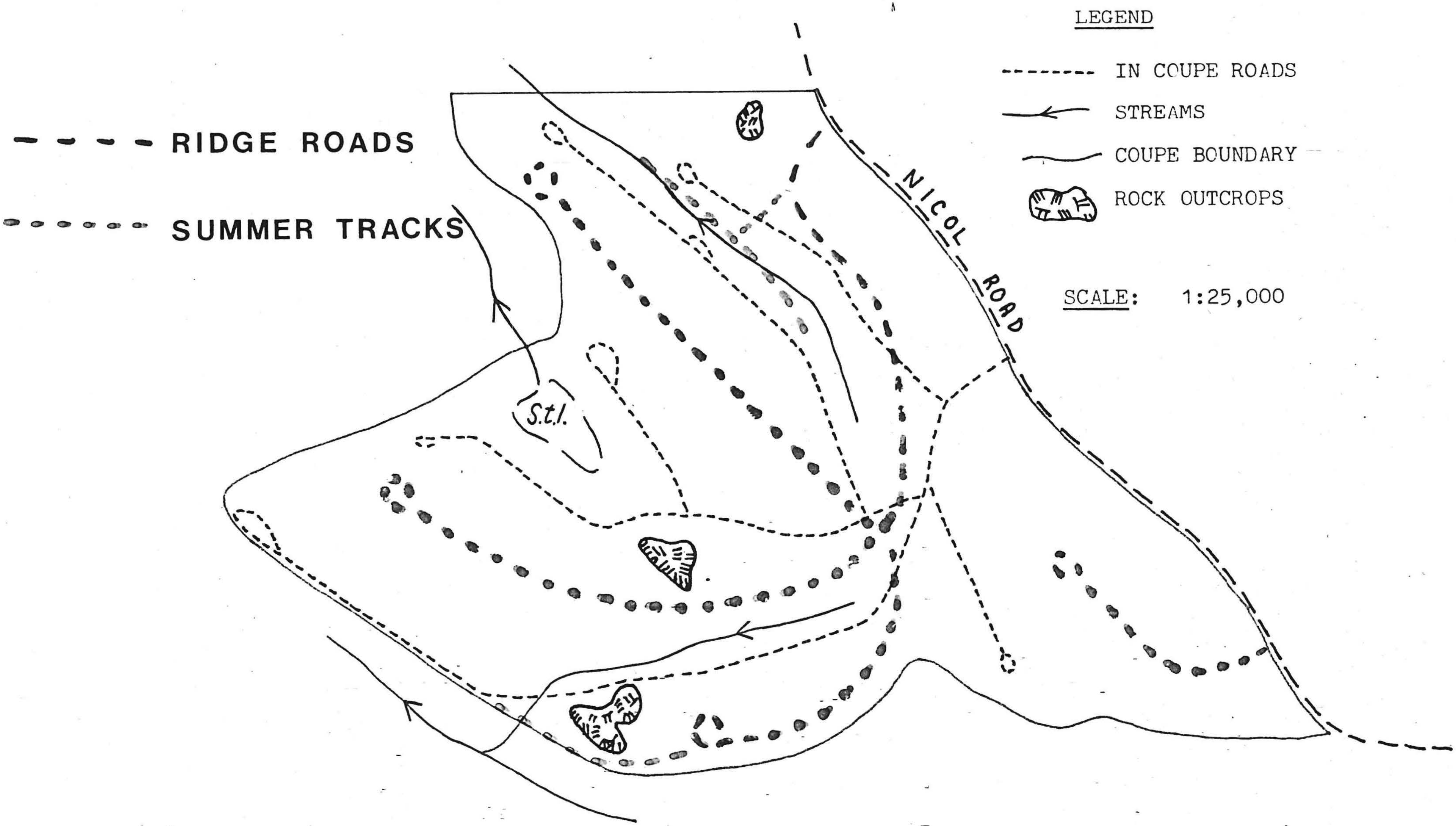


FIGURE 1 - LOW-PROFILE ROADS CONSTRUCTED IN WYE 1 LOGGING COUPE

(OVERLAY SHOWS HOW THIS COUPE COULD BE RIDGE ROADED)

2.2 Compartmentalized Cutting

Once roads have been constructed ridgelines are marked in the coupe. Logs are snigged downslope from the ridges onto landings sited along the low profile roads. The area to be logged between the ridgeline and the road may be divided by spurs running down from the ridge. The area between the spurs, the ridge and the road is referred to as a "micro-catchment".

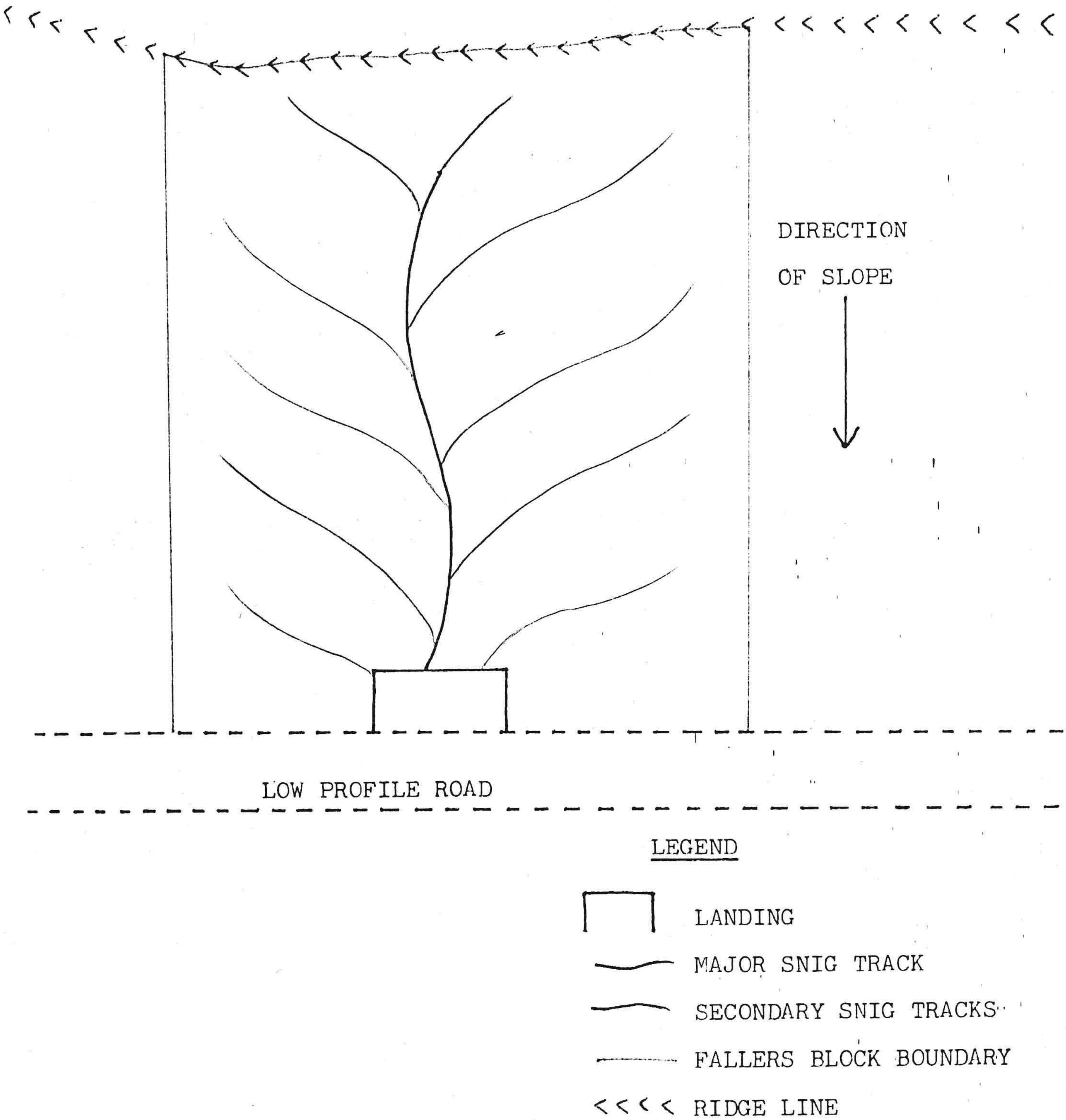
Snigging is not permitted to cross a ridgeline as there is potential to spread dieback from one micro-catchment to another. Micro-catchments may be further divided into fallers blocks of 5 to 10 hectares See Figure 2 . Each fallers block is logged seperately with the following rules applied:-

(a) All machinery must washdown before entering a fallers block.

(b) No snigging is allowed outside the boundaries of the fallers block being logged.

Thus any latent infection that may be present in a block or inadvertently introduced to a block, will be confined to one fallers block of 5 - 10 hectares. This strategy is known as compartmentalization and it provides a secure fall-back position.

FIGURE 2. A TYPICAL FALLERS BLOCK IN A HYGIENE LOGGING COUPE USING A HERRINGBONE SNIG PATTERN



2.3 Split - Phase Logging

Split-phase logging aims to reduce the risk of infection being transferred from roads into forest upslope.

Under this system, all logs to be removed from a fallers block are snigged onto the landing and the block certified as completed by a Forest Officer, before any loading is carried out. Thus the loader which operates at the road/landing interface cannot transfer disease.

Problems have developed where large volumes of timber are to be removed. Landings need to be very large to accomodate all logs. In 1982 a new system termed as "Modified Split-Phase" was introduced.

Under "Modified Split-Phase", snigging machines may enter a fallers block to snig logs onto the landing. A barrier log is situated on the landing, just above the table drain. Log loaders are permitted to load logs over the barrier and onto the truck. Snigging units are not permitted to leave the fallers block and re-enter unless they are cleaned down. Using this technique logs can be snigged and loaded out simultaneously with a minimum risk of transfer of soil into the forest.

Once a fallers block has been certified complete, barrier logs are placed across snig tracks at the back of the landing. After this has been completed the log loader may enter the landing, from the road, without cleaning down. This allows free access to landings for the purpose of "cleaning up".

3. ENVIRONMENTAL CONFLICTS ARISING FROM HYGIENE LOGGING

Considerable emphasis has been placed on hygiene logging to reduce the spread of dieback in the Jarrah Forest. Forest Department strategies and prescriptions have generally been based on conditions which exist in the Northern Jarrah Forest. In the Southern Jarrah Forest the same prescriptions have been adopted. A number of natural factors are different in Southern Forests and therefore other environmental conflicts must be carefully considered.

1 Rainfall is higher, soils are more erodable, the landscape more dissected and slopes are steeper. There are more watercourses, trees are larger and logs heavier

3.1 Additional Road Construction

Low-Profile roading in Wye has been constructed to winter road standards ie: 8 metre clearing with a 6 metre road surface for incoupe roads and 12 metre clearing with a 9 metre road surface for access roads.

Whilst it is recognised that low-profile roading is successful in reducing the spread of dieback, providing guidelines set out in Jarrah 81 are observed. "However, their implementation (guidelines) can cause conflict in the conservation of other environmental values". (Dieback

Review 1982 - Expert Group reports August 82)

The table below compares the environmental impact of low-profile roading and ridge roading.

(2)

PARAMETER	LOW PROFILE ROADS	RIDGE ROADS
1 DISTANCE	Longer distance of roading to cover same area of logging coupe. Greater potential for erosion.	Less distance so less area cleared.
2 WIDTH	Wider roads required because edges of roads are wet and soft. More side cutting therefore greater potential for erosion.	Roads narrower because they are dry so less area cleared.
3 SURFACE	More gravel required on roads to avoid collapse during mid winter.	Less area cleared for gravel pits.
4 DRAINAGE	More pipes required to drain water from top side of road. Discharge closer to watercourse.	Water drains away from roads and filters through the bush.

TABLE 1

(See plates 1 and 2 showing width of roads)

Figure 1 shows Wye 1 logging coupe with the location of constructed low-profile roads. The overlay shows how the same coupe could have been roaded using ridge roading. There is 7.2 km of low-profile roading in Wye 1, all constructed to winter standards. With the alternative ridge roading proposal there would only be 5.0 km of winter roads. An additional area of approx 2 ha has been cleared for roads in a 180ha coupe by roading by the low-profile option.

(3)

Plate 3 shows a low-profile road.

3.2 Soil Disturbance and Potential for Erosion

Figure 2 shows the snigging pattern in a typical fallers block in a hygiene logging coupe. Snigging is carried out on a herringbone pattern with secondary snig tracks leading into the major snig track and then onto the landing.

With the landing located low in the profile, the heavy trafficking is concentrated into the wettest part of the fallers block. The result is that the major snig track (and some of the secondary snig tracks in the low portion of the block) become very boggy with wheel ruts 0.5 to 1.0 metres deep during the winter months. This quite often occurs in the best winter bush. (see plate 4)

The problems associated with this are:-

3.2.1 Muddy soil is carried all through the fallers block.

PLATE 3 showing an incoupe road sited low in the landscape.

PLATE 4 showing soil damage on a downhill snig track.

3.2.2 There is considerable mixing of the A and B soil horizons along the snig tracks causing soil damage.

3.2.3 The mud tends to work its way downhill and onto the landings in the steeper blocks.

If landings were located on the ridges the snig tracks would be concentrated on the driest part of the block. Secondary snig tracks would fan out into the wetter parts and less disturbance would eventuate.

The potential for erosion with the hygiene logging method is very high, especially in steeper areas. To reduce the risks, erosion control drains are put in along the major snig tracks. Soil types and slope determine the spacing of cross drains.

Problems can occur though before the erosion controls are put in, if there are heavy downpoors or rain. Similarly
4 there is potential for erosion if the drains are not constructed properly.

The diagram in Figure 2 also shows how the flow of water is concentrated downslope. Potential for soil erosion is increased by the speed and volume of water. This snigging pattern is counterproductive to erosion control.

"Although erosion is a natural process occuring on the earth's surface, accelerated erosion caused by mis-management could result in loss of top-soil leading to degredation of vegetation cover and poorer tree establishment and growth.

The effects of erosion can also cause a prolonged impact on the visual forest resource by degredation of the landscape." (Walker, 1984)

3.3 Landing Disturbance and Soil Damage

Landings located on low-profile roads become very compacted with considerable mixing of the soil horizons. Soil types are usually sand over clay or loam over clay. Very seldom are deep gravelly soils found low in the profile, in Southern Forest.

If rain is falling during snigging or loading operations the landings become very disturbed and soil damage is high. Landings take longer to dry out and logging efficiency is affected.

Limits are placed on the amount of soil damage that is acceptable. Because of the hygiene logging systems, logging operations tend to run very close to the limits and occasionally exceed them.

5

PLATE 5 showing a downslope snigging pattern.

PLATE 6 shows silt deposited in the table drain
following a winter storm.

3.4 Water quality Deterioration

Erosion can cause water quality to deteriorate through sedimentation and turbidity in streams and rivers. Aquatic fauna is also affected by sedimentation and turbidity.

Since most of the forested catchments in the Southern Region can be considered as potential water supplies it is important that erosion be carefully monitored.

3.4.1 Stream Sedimentation and Turbidity

SEDIMENTATION refers to the deposition of all material across the full range of particle size downstream from a source of disturbance. It includes the fine fraction mentioned below in turbidity.

The only true method of measurement is to sample deposits on the stream bed. The sophisticated technique for measuring sedimentation involves a sampling device which collects a sample from the entire profile of the stream (height and width) without interrupting the velocity of the stream flow.

TURBIDITY is an opthal property - Turbid water is water containing visible amounts of suspended material - silt clay, humus, algae etc. Coloured water is not necessarily turbid.

Turbidity is measured in N.T.U's (An instrument measures the amount of light diffracted by particles in the Water).

The report by the Steering Committee on Research into the Effects of the Woodchip Industry on Water Resources in South Western Australia state:- "The steering Committee points out that there is a risk of increasing sediment load being transported by the rivers, if logging operations are not rigidly controlled (and preferably avoided), when soils are too wet. In particular the layout of roads and snigging tracks must be carefully planned" (Bulletin 81, Dept of Conservation and Environment, July, 1980).

In a letter to the Forests Dept from the P.W.D regarding Stream Reserve and Bufferstrips in the Woodchip License Area, the Director of Engineering points out:- "Major haul roads and winter logging operations contribute substantially to stream turbidity levels. While it is recognised that roads are designed to be low in the landscape to minimise the spread of dieback disease, this strategy contributes significantly to the stream turbidity problem".

In the Woodchip Licence Area stream sediments are low. However, isolated high concentrations have been recorded following logging and roading operations. While coupe regeneration can stabilise exposed soils relatively quickly, permanent road systems can be an ongoing source of turbidity in streamflow.

The current philosophy of locating roads low in the landscape to minimise the spread of dieback disease creates a high risk of increased stream turbidity.
Roads higher in the landscape would minimise turbidity problems but would increase the risk of dieback spread.

Results from monitoring in forested catchments to date show much higher sediment concentration in runoff from road subcatchments than for clearfelled subcatchments without roads.

Most erosion occurs in high rainfall years, particularly during storms. The deposited sediments present an array of particle sizes, and the colonisation by stream biota depends upon the particle size and stability of the beds of sediment.

Unconsolidated silt and other unstable substrates are unfavourable microhabitats for the majority of benthic invertebrates from rivers. Silt distrupts feeding in filter feeders, impairs gill function and is an unsuitable substrate for burrowing and sessile forms. Furthermore, a high content of suspended silt in rivers reduces light penetration and thereby reduces the composition and productive potential of the algal component of a rivers biota.

Few forms are capable of colonising silted or unstable areas.
(Knott 1983)

Worldwide and other Australian research has highlighted the significance of permanent logging roads as the most important contributory cause of high sediment loads in water catchments.
Continued use of roads resulting in surface disturbance and the consequent need for grading of the road surface are contributing factors in the persisting deterioration in water quality.

There is considerable scope for research into the effects of sedimentation and turbidity in streams and rivers other than those considered as potential water supply catchments.

More detailed guidelines for roading and logging are required. (Loh, 1983)

3.4.2 Stream Salination

Stream salination is not considered to be a major problem in the Wye area because of the high rainfall. Further
6. north in the intermediate and low rainfall zones, hydrological research has shown that groundwaters of moderate salinity can be mobilised by a temporary reduction in leaf area. This is best minimised by leaving a substantial buffer of deep rooted vegetation along water courses where groundwater is most likely to discharge.

It is possible that concentration of run-off from roads
7) constructed low in the profile could cause a build-up of *P. cinnamoni* innoculum in low lying sites, shown to be most susceptible to impact of dieback.

This could result in overstory deaths and a consequent reduction in leaf area.

If water tables were to rise, stream salination could result.

Figure 3 shows the rainfall zones in the Southern Region.

4. IMPACT OF P.cinnamomi ON SOUTHERN JARRAH FORESTS

The Southern Jarrah Forest is significantly different from the Northern Jarrah Forest in respect to climate conditions (temperature, rainfall), vegetation types and soil types. Because of these factors the impact of dieback on the Southern Jarrah Forest is consistently lower.

The major site types in the Southern Jarrah Forest are:-

Jarrah forest of high quality with karri type understorey
Jarrah forest on laterites
Jarrah forest on depositional sands
Jarrah forest on quartzites
Jarrah forest on shallow podsols
Jarrah woodlands and low rainfall forest
Flats

Impacts vary in each site type for understorey species and overstorey species.

4.1 Impact on Overstorey Species

In the Walpole area Jarrah Forest on shallow podsols and Jarrah Forest with karri understorey make up most of the site types.

Jarrah on depositional sands and flats account for the remainder with only an odd pocket of Jarrah on laterites.

24

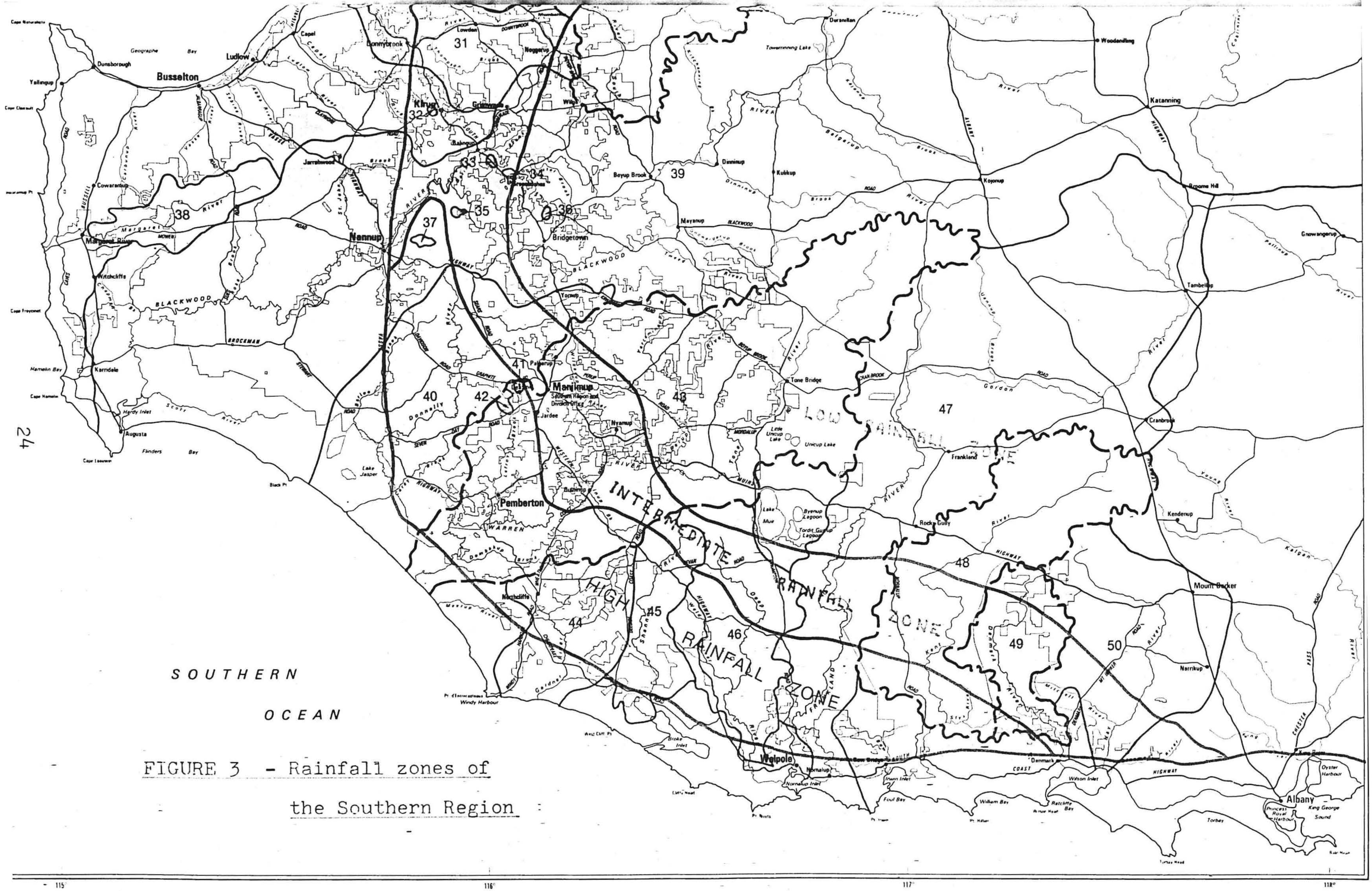


FIGURE 3 - Rainfall zones of the Southern Region

Concreted laterites are the main areas where "graveyard" deaths occur. These sites are rare in the Walpole area. The only known graveyard deaths are several small isolated pockets in Frankland Block.

A 7 Way test that was compiled for Wye 1 states:-

"The major forest type in Wye 1 is a Southern Jarrah over deep and relatively moist soils. The likely impact of P. cinnamomi infection on the overstorey is low. This is based on the observation of similar areas in the Weld Catchment where dieback has been present for approximately 20 years and no effect is observed on the overstorey Jarrah".

The other main species that occur in the Walpole area are Karri, Marri and Tingle, all of which are tolerant species.

4.2 Impact on Understorey Species

The main species affected by dieback in the Southern Jarrah forest are:-

Banksia grandis	(Bull Banksia)
Patersonai xanthina	(Yellow flag flower)
Patersonia rudis	(Hairy flag flower)

and to a lesser degree

Xanthorrhoea preissii	(Blackboys)
Persoonia longifolia	(Snottygobbles)
Banksia quercifolia	(Oak-leaved Banksia)
Banksia ilicifolia	(Holly-leaved Banksia)
Podocarpus drouyniana	(Emu Bush)

Bull Banksias are very scattered in the Walpole area and it is rare to find any large thickets of this species such as occur in the Northern Jarrah Forest.

The Southern Jarrah Forest has a dense understorey of species tolerant to P. cinnamomi (eg Acacia, Trymalium, Bossiaea and Melaleuca) with only minor occurences of susceptible species.

The impact of dieback on the understorey is very low to low for most site types. Observations in Burnside and Mattaband Blocks, where dieback has been recorded as present for at least 30 years, show that understorey layer is fully occupied. There are no bare and open areas such as appear in the Northern Jarrah Forest.

4.3 Consequences of Impact on Land Use

The Primary land use in the study area is Timber Production. Secondary uses include Catchment Protection and Conservation of Flora and Fauna.
The consequences of impact vary for each land use.

4.3.1 Timber Production

As the impact on Jarrah Overstorey is low and Karri, Marri and Tingle are tolerant species, the overall impact on timber production would have to be considered as very low.

The only place where timber production may be reduced is on the fringes of flats where a heavy build-up of P. cinnamoni innoculum may occur. This fringe area is not cut-over as:- "Any stands containing only scattered trees (less than 20 trees per heactare) eg flats and swamps, will not be cut."

Industry Control Manual, Item 11, 1983

4.3.2 Catchment Protection

P. cinnamoni would have virtually no effect on catchment protection in the Southern Jarrah Forest because the resistant species of understorey would fully occupy affected sites within a short time.

The consequences of impact would have to be considered as very low.

As a contrast the consequence of impact of P. cinnamomi on Conservation could be considered as high because the loss of even two or three understorey species on a site would alter the ecology of that area.

5. ECONOMIC FACTORS

The industry is reluctant to give out information on costs for their logging operations. They do, however, state that the cost of landing logs at their mills have increased significantly since hygiene logging was introduced.

5.1 Road Construction Costs

One of the figures that is available to the Forests Department is the cost of low-profile roading in the Shannon Basin. When this area was made an M.P.A for Flora, Fauna and Landscape, Bunnings were asked to submit costs to the Department for compensation of roads that they had constructed. These figures were $4000 per kilometre for incoupe roads and $6000 for major access roads.

From the example shown in Figure 1 of this report it can be seen that there was 7.2 km of low-profile roading constructed in Wye 1 at $4000 per kilometre. The cost of roading that coupe would have been $28,800.

Had this coupe been ridge roaded as shown on the overlay the cost would have been $20,000 for 5km of ridge roads. This is immediately a saving of 30% ($8,800) on costs if the ridge roads were constructed to the same standard as the low-profile roads.

This saving of 30% would be increased when the factors shown in Table 1 are taken into consideration ie less gravel required, narrower roads and less piping required. Added to this is the fact that there is virtually no side-cutting necessary in ridge roads.

5.2 Snigging and Loading Costs

Snigging costs have not increased due to hygiene logging. Time lost by machines becoming bogged whilst snigging downhill is compensated by the extra time and power required to snig logs uphill.

(8)

Loading costs have increased marginally. With landings sited low in the landscape time is lost by log loaders trying to manouvre on boggy landings.

(9) The biggest cost to the industry is machine time and manhours lost on the time consuming duty of washing machinery down to enter new fallers blocks. This requirement would not alter if road location was changed.

5.3 Road Maintenance Costs

Road maintenance costs again are not available from the industry but they do state that it does cost more for maintenance of low-profile roads. This is due to:-

5.3.1 Roads collapsing in very wet areas thus requiring gravel or quartz to be carted, spread and compacted.

5.3.2 The requirement to clean silt from pipes and sumps. Silt builds up quickly on low-profile roads. (see plate 6)

5.3.3 Extra drainage of water which pools on the roadside in the winter. This aspect may not have been predicted in summer during the road construction phase.

5.3.4 Roads remain wetter for longer periods in winter and spring, requiring more potholes to be filled.

5.4 Stockpiling Potential

In the Southern Region there is very little jarrah stockpiling. The costs to the industry of stockpiling are high because:-

5.4.1 Logs deteriorate slightly on each end when exposed to the weather, especially during the summer.

5.4.2 Logs have to be watered with overhead sprinklers to stop grub invasion and to reduce the amount of end checking.

5.4.3 Machinery is idle during the months that logging operations have ceased.

Whilst it is recognised that the costs for stockpiling may be high, it is considered that these could be offset in the Southern Region since:-

5.4.4 Most of the larger mills cut both Karri and Jarrah, so Karri coupes and Jarrah dieback coupes could be cut in the winter because roads are high in the profile.

5.4.5 If there was no winter logging on low-profile roads, the road standard could be dropped substantially.

6. ALTERNATIVE LOGGING SYSTEMS

There are numerous logging systems which have been developed to improve hygiene, with varying degrees of success. The following systems are offered as alternatives to the current practise of hygiene logging with low-profile roads.

6.1 Conventional Ridge Roading and Uphill Snigging

Under this system, roads would be sited near the top of the ridge but always remain on the same side of the ridge. Figure 4 shows were the road is located.

All snigging and loading machines would be washed down and the ramp logging systems used to log the forest hygenically.

The advantages of this system are that landings can be located on the ridges, snig tracks fan out in the wettest area of the fallers block, roads are less costly to construct and maintain, water runoff goes through a filter strip before entering the stream and there is less potential for erosion.

The only disadvantage is that a larger percentage of forest is put at risk of P. cinnamoni infection.

6.2 Truck Washdowns to Prevent Disease Introduction

If logging coupes have been photographed and interpreted and found to be free of dieback,then all vehicles entering the coupe can be washed down to prevent disease from entering the forest.

Vehicles and machinery would be washed down, on a ramp, at a site low in the landscape near at the coupe interface.

It is essential that action is taken to ensure that no vehicles enter the forest without washing down, This can be done by means of a gate which is locked when vehicles are not using the road.

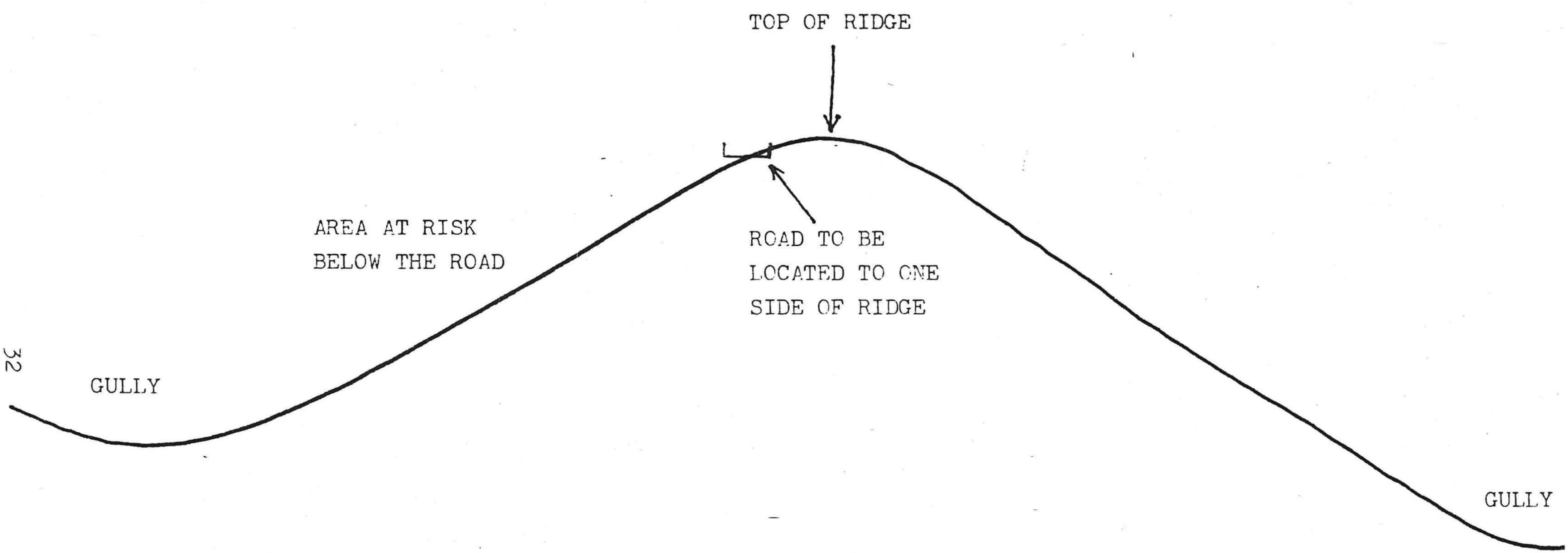


FIGURE 4 SHOWING HOW RIDGE ROADS COULD BE LOCATED ON ONE SIDE OF THE RIDGE.

This practice was implemented at Wye in 1981 and 1982. Data from trials carried out there show that the average time taken to washdown heavy vehicles (eg trucks and loaders) is 21 minutes. The average time to washdown light vehicles (eg cars, utes etc) is 9 minutes.

The industry were most co-operative in this trial and were prepared to accept the costs of time lost in washing down vehicles and machinery. They were also prepared to continue the trial and it was the Forests Departments decision to cease the washdowns.

The trial was stopped because there were positive samples of dieback detected on the roads. The area was not photographed with 70mm photography or interpreted before the trial began so there was no conclusive proof as to whether the trial was successful or not.

Using the current interpretation methods a new trial could be initiated, with careful monitoring, as this method may prove to be successful in preventing disease introduction to dieback free areas. Cost data does not suggest the system to be impractical.

10

6.3 Slip-trailer systems

The theory behind this system is that there would be a barrier at the coupe interface. The coupe size would be 200-400ha. Roads which have been constructed hygenically could be located high in the landscape.

Trucks which are hauling to the mill landing would slip an empty trailer at the barrier. This empty trailer would be loaded by a second truck which is fitted with a boom loader.

The truck with the boom loader would load itself from the roadside. All logs would be snigged to the roadside with a skidder. There would be no need for large landings as the log could be skidded directly at roadside.

Once the truck has a full bay of logs it would return to the barrier at the coupe interface. The logs would then be transferred from the truck to the slip-trailer. It may take several bays of logs to load the slip-trailer as it is envisaged that the truck with the boom loader would not pull a trailer.

The advantages of this system are:-

6.3.1 The only vehicles which would operate in the coupe are the skidders and the boom loader truck. This would put the risk of disease introduction as very low to nil. Service vehicles would remain outside the coupe.

6.3.2 Log trucks and trailers which could be carrying dieback would not go past the barrier and into the coupe.

6.3.3 Snig tracks would not be concentrated to one point and would therefore virtually become secondary snig tracks. (see Figure 5)

6.3.4 Landings would be eliminated in place of small log dumps located along the roadside in natural openings.

6.3.5 Logging operations could be practised during dry or wet conditions with little risk of soil erosion or compaction.

11

6.3.6 Because there would be no landings and only secondary snig tracks, the forest would be 100% productive to grow the next crop of trees.

12

The only minor disadvantage of this system is capital costs. There would be a capital outlay for the trucks with the boom loader and for an extra slip trailer.

The capital outlay would be compensated by the fact that there would be no need for a log-loader which is presently used.

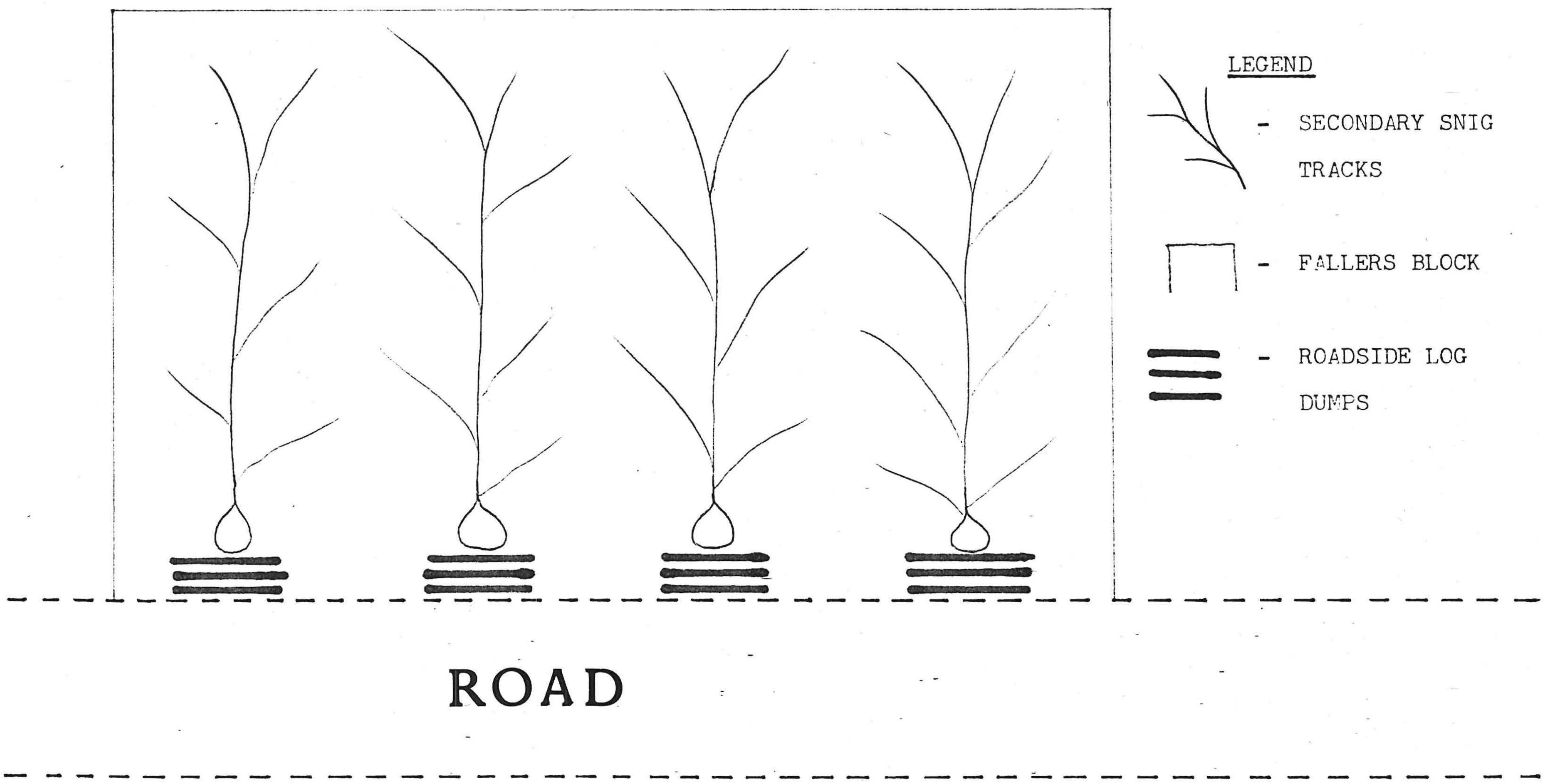


FIGURE 5 SECONDARY SNIG TRACKS AND MINOR LOG DUMPS AS A RESULT OF USING A BOOM LOADER.

CONCLUSIONS

This report has investigated the existing prescriptions for hygiene logging, in particular low-profile roading, compartmentalized cutting and split-phase logging.

The environmental conflicts of this method of hygiene logging are:-

- There is additional road construction by roading low in the landscape.
- Soil disturbance from downhill snigging patterns cause a potential for erosion.
- Soil compaction and damage occur on landings located low in the landscape.
- Logging production is often impeded on these sites.
- Water quality can deteriorate through sedimentation and turbidity.
- Concentration of P. cinnamomi innoculum could cause overstorey tree deaths in the critical hydrological zone near water courses.

The impact of P. cinnamomi on overstorey and understorey species has been examined and shown to be low to very low. The consequences of impact on land use for timber production and catchment protection are assessed as being negligable on Southern Jarrah Forests in the high rainfall zone.

Economic factors have been studied and the results are that existing hygiene logging methods increase costs to the industry for roading and maintenance. The potential for stockpiling has been investigated and shown to be viable.

Three alternative logging systems have been described and the advantages and disadvantages of each have been listed.

RECOMMENDATIONS

The following recommendations are submitted:-

(1) That the co-operation of the industry be sought to set up logging trials using the three techniques described in section 6.

(2) That the logging trials be monitored for:-

13

- (a) P. cinnamoni introduction
- (b) Soil damage and compaction
- (c) Soil erosion
- (d) Water quality deterioration and
- (e) Logging production data and costs involved

(3) That current logging techniques be monitored for erosion potential and stream sedimentation and turbidity so that present prescriptions may be updated.

(4) That stockpiling potential for the Southern Region be further investigated.

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

REFERENCES

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