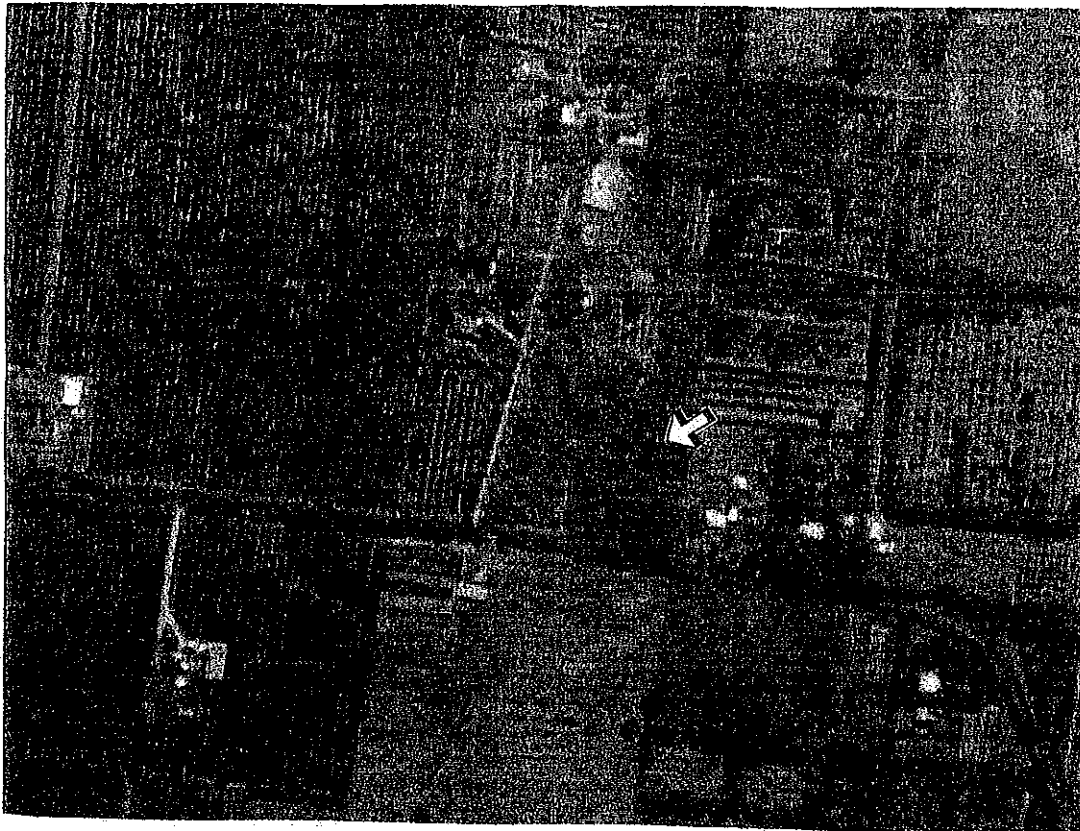


*Big Scrub Rainforest Remnant Care Project.
1997-1999.*

Dalwood Scrub
Rainforest Restoration Management Plan.

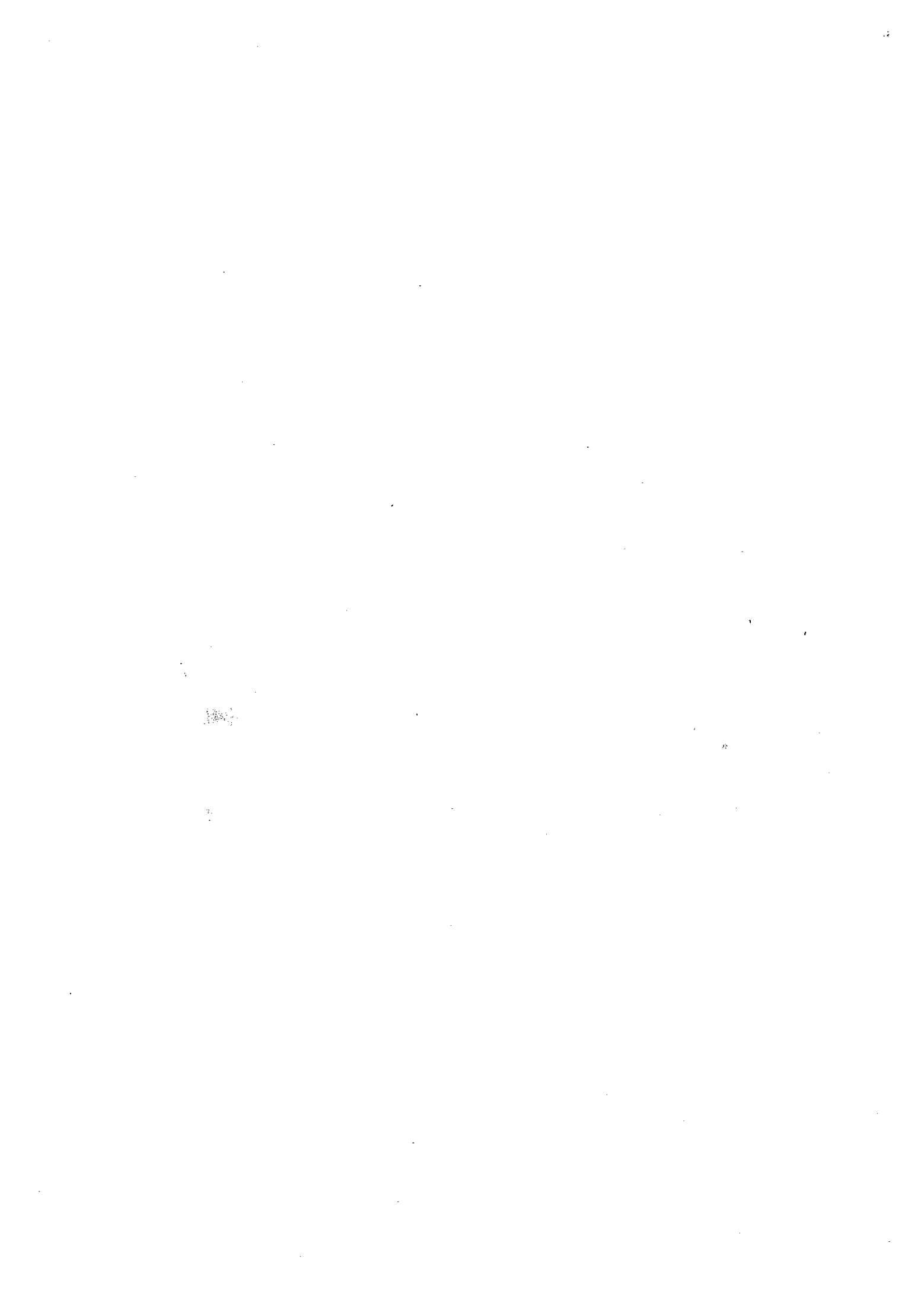


**Prepared by Bower Bush Works.
June 1999.**

for the

Big Scrub Rainforest Landcare Group.

Funded by a National Heritage Trust Grant.



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Executive Summary.

Dalwood Scrub is an isolated remnant of the once vast Big Scrub subtropical lowland rainforest, which covered over 75, 000 hectares on the North coast of NSW. Less than 1% of the Big Scrub remains as fragmented remnants. These remnants are important regardless of their size as refuge for the original flora and fauna, for the role they play in providing corridors and/or stepping stones amongst a fragmented ecosystem and as a seed source for regrowth areas. Dalwood is one of 34 Big Scrub remnants of heritage and conservation significance that has been listed on the register of the National Estate.

Dalwood Scrub is about 1.5 hectares in size and is situated on the Alstonville plateau. The remnant is located on crown land on the north side of Dalwood Rd. within the Ballina Shire. Dalwood Scrub contains up to 130 native plant species of which eight are listed as Rare or Threatened Australian Plants (R.O.T.A.P.) and of these four are listed as Threatened under the N.S.W. Threatened Species Conservation Act 1995.

The remnant contains patches of healthy "intact" forest, although the remnant has sustained large gaps (indicative of past logging) and the edges are degraded and dominated by weeds in areas. The main weeds posing long-term problems to the integrity of the remnant are Climbing Asparagus Fern, Lantana, Small-leaved Privet, Large-leaved Privet, Crocosma, Trad and Ochra. These weeds are inhibiting natural regeneration and compromising native plant species diversity. Shade tolerant weed species are also colonizing in less disturbed areas throughout the remnant.

Dalwood Scrub is highly vulnerable to further weed invasion and degradation owing to the small size of the remnant, edge effects, loss of natural forest ecofunctions, structural damage and high level of weed infestation. Subsequently, the resilience of Dalwood Scrub to naturally repair itself following future disturbances (eg. tree falls) has been altered and requires human assistance. Regardless of its small size and weed impacts Dalwood Scrub exhibits great regeneration potential having a diversity of seedlings and canopy recruits throughout the lower strata. The remnant also requires fencing to prevent encroachment of agricultural activities.

Immediate and long-term regeneration works are required to control the impacts of weeds and to restore the forest's structure and resilience to future disturbances. To ensure the long-term viability of floral and faunal communities in small, isolated rainforest remnants as Dalwood, extension of remnant size is necessary to help buffer harsh edge effects, and to create links between neighbouring remnants and/or areas of regrowth. However expansion of this remnant is restricted by agricultural and rural residential landuse. Effective weed control and maintenance will help to secure the viability of this remnant. This plan provides a range of relevant restoration techniques, recommendations and a work schedule to help bush regenerators, remnant managers to restore this remnant.



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1.0. INTRODUCTION.

1.1. *Purpose and Scope of the Report.*

This Management Plan was prepared by Hank and Sue Bower (Bower Bush Works) as part of the Big Scrub Rainforest Remnant Care Project which was funded by a National Heritage Trust grant. The project was developed to address the impacts of weed invasion, edge effects, livestock and human impacts that are currently affecting the long-term viability of privately owned, high conservation Big Scrub rainforest remnants. It is envisaged that initial on ground restoration works will be undertaken by a Greencorps team under the co-supervision of an EnviTE supervisor and a contracted private bush regenerator.

A long term commitment by the Big Scrub Rainforest Landcare Group (B.S.R.L.G.), relevant government agencies, the community and private landholders is required to sustain and increase the long term viability of these isolated remnants. For the effective long-term management of fragmented, weed impacted native vegetation communities a strategic, holistic, yet flexible range of management options need to be adopted including weed control and remnant extension.

This management plan lists regeneration aims, vegetation health and impacts, restoration recommendations, species lists and site map/s for use in future regeneration works. It provides a restoration strategy for prescribed areas to help rectify the problems that are affecting the regeneration capacity of Dalwood Scrub.

2.0. AIMS and OBJECTIVES.

The long term aim of the Big Scrub Remnant Care Project is to restore, protect, maintain and where possible expand Big Scrub remnants so that their natural resilience and habitat values are enhanced. **The aim** of this report is to provide appropriate regeneration strategies and recommendations that will help guide the process of weed control and help to restore the processes that favour natural regeneration and repair of the forest structure at Dalwood Scrub.

The objectives of this study are to:

- 1) identify and assess impacts that are or potentially could degrade the viability of plant and animal communities at Dalwood Scrub
- 2) identify the weed species present at the remnant
- 3) locate and map the locations of major weed infestations, canopy gaps and areas subject to adverse impacts
- 4) assess the resilience and regeneration potential in and around the remnant
- 5) provide information on weed species, weed control and restoration techniques

- 6) develop appropriate strategies and recommendations for the effective long-term restoration and regeneration of the native vegetation and forest processes at Dalwood Scrub
- 7) identify flora species, particularly those listed on Schedule 1 or 2 on the N.S.W. Threatened Species Conservation Act. 1995 (TSC Act) and those listed by Briggs and Leigh (1996) as Rare or Threatened Australian Plants (ROTAP)
- 8) raise community, landholder and government agency awareness of the importance of adopting ecologically sound and long-term restoration strategies for the effective management of Big Scrub remnants

3.0. METHODOLOGY.

3.1. *Site Assessment.*

This management plan has been developed by liaison with Ballina Council, reviewing relevant literature (published and unpublished) and by undertaking field assessments to identify impacts and management problems.

On ground field assessment involved:

- Identification of weed species and infestations (see Tables 4a-d).
- Reviewing remnant health and regeneration capacity by assessing successional development, native species composition and condition of the forest structure.
- Mapping the location threatened species, of weed infestations, gaps, healthy sections of forest, landmarks and the remnant boundary (Figure 2).
- Compilation of a vegetation species list and incorporation of species lists from previous reports (Appendix 1).
- Taking photos to assist in the explanation of pertinent management points.

The remnant has been divided into four general management areas (in relation to remnant edge) to help identify particular regeneration problems and to assist in the development of appropriate recommendations for restoration work (refer to Management Areas & Recommendations and the Prioritised Work Schedule). The management areas tend to overlap due to the small size and rectangular shape of the remnant. NB. Not all of the threatened plants known from Dalwood Scrub were located during this survey.

4.0. BACKGROUND.

4.1. *Regional Context of the Big Scrub.*

Dalwood Scrub is an isolated remnant of the once vast Big Scrub, which was approximately 75,000 hectares of subtropical rainforest associated with the Mount Warning Volcanics. The Big Scrub is approximately located between east Lismore, Alstonville, St. Helena and Dunoon (Holmes 1987; Floyd 1990a; Mezzatesta 1992; Lott & Duggin 1993) (Figure 1). By the early 1900's much of the Big Scrub had been reduced to a series of isolated remnants that comprise less than 1% (or 300 ha.) of the original vegetation (Frith 1976; Floyd 1990a; Lott & Duggin 1993; Adam 1994).

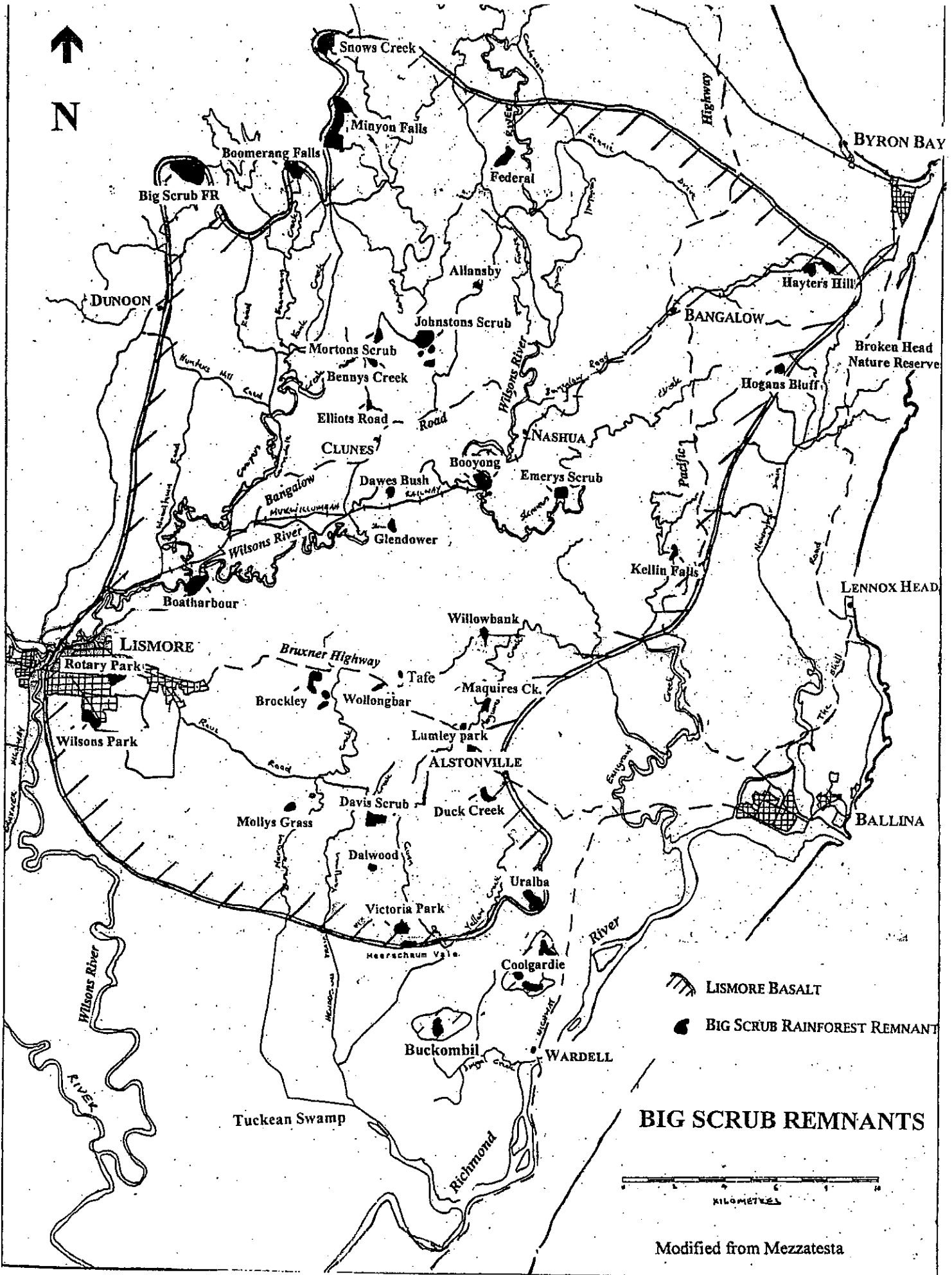


Figure 1. Big Scrub Remnants

4.2. Remnant Tenure, Location and Size.

Dalwood Scrub is 1.5 hectares in size, is rectangular in shape and occurs on crown land within the Shire of Ballina (Lot 11, DP 2248855). Dalwood is under the jurisdiction of Ballina Shire Council. The remnant is located about 6 km south-west of Alstonville and 2.5 km south-east of Rous Mill on the Far North Coast of N.S.W. (Wardell mapsheet 9540-2-S. 5,39,000 - 68, 04,600), being situated on the north side of Dalwood Road about 500m west of the intersection with Cook Lane. Zoning is 7(1) – Environmental Protection (Habitat) Zone, which requires development consent for all activities.

4.3. Climate, Soils, Topography and Hydrology.

North eastern N.S.W. experiences a warm temperate to subtropical climatic regime that is generally characterised by a warm, moist summer and autumn (Dec.-May) to a mild dry winter (June-Aug.) and a warm dry spring (Sept.-Nov.). Annual rainfall in the Big Scrub area ranges from between 1300-2000 mm/yr. (Holmes 1987, Lott & Duggin 1993, Morand 1994).

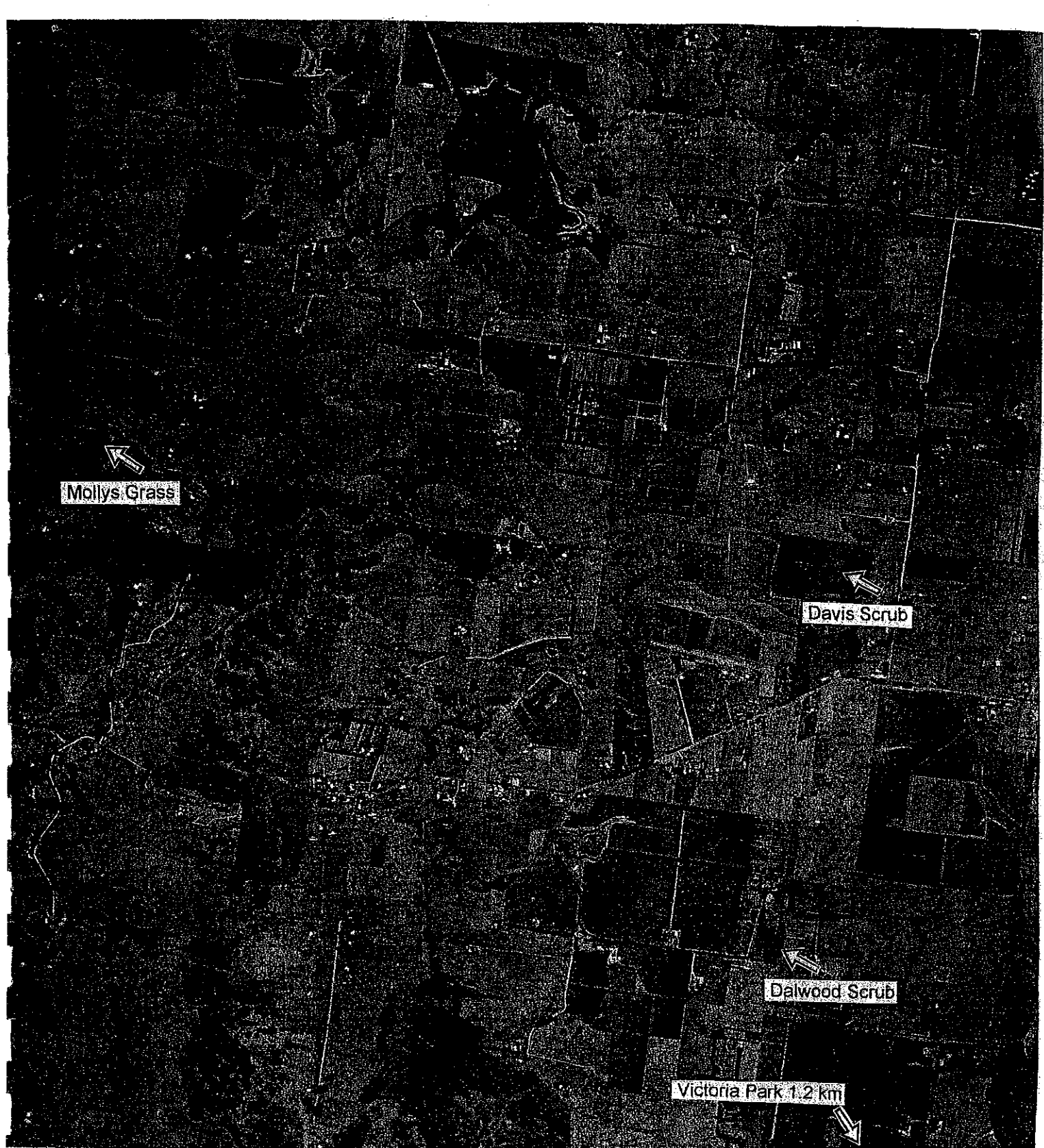
Dalwood Scrub displays the characteristic free draining, deep and well-structured kraznozem soils that cover most of the Big Scrub. The parent material is Tertiary Lismore basalt that derived from the Mount Warning Volcanics and weathered to acidic clay loam's of variable depths with potentially high fertility in the organic layer. Kraznozems mainly occur in areas that have high rainfall (> 1300) and warm temperatures and grow lush, subtropical rainforests in the Big Scrub region (Floyd 1990a, Lott & Duggin 1993).

Dalwood Scrub occurs on relatively flat topography having a slight southerly aspect. The south-east road edge of the remnant tends to pool with water following heavy rain due to surface drainage from this area being restricted by the built up road. The remnant is exposed to winds from all directions and is susceptible to occasional frosts beyond its boundaries. The remnant does not contain any watercourses but is situated above the headwaters of a tributary that drains southward into Tuckean Swamp. Altitude is 180 metres above sea level.

4.4. Landscape Context.

Dalwood Scrub is situated towards the southern periphery of the Alstonville plateau in a predominantly cleared and agricultural landscape. Aerial photos of the site (Plate 2,3) highlight the poor representation of pre-1800's native vegetation within the local landscape. This exemplifies the ecological significance and biodiversity values of Dalwood Scrub. Dalwood Scrub is one of about five disjunct but significant Big Scrub remnants within this area (Figure 1, Plate 1). Other remnants in close proximity to Dalwood Scrub include: Davis Scrub (2km to the north), Victoria Park (3km to the south), Mollys Grass (4.2km south-west) and Duck Creek (5km north-east). Dalwood is sited between the NPWS managed remnants, Davis Scrub and Victoria Park. Patches of regrowth (mixed rainforest and woody weeds) is evident, to south of Dalwood, particularly along Youngmans and Gum Creek (Dalwood Falls) and toward the Rous Mill area.

Neighbouring landuse consists of intensive orchards and cropping, rural residential and grazing land. A few regrowth trees also occur on the property adjoining the north side of the remnant.



▲
N

Plate 1. Landscape of the Rous Mill area (the southern periphery of the Alstonville plateau) and Big Scrub Rainforest Remnants. Source: DLWC (1997)

Davis Scrub



Dalwood Scrub



Plate 2. Dalwood Scrub and local environs. Source DLWC (1997)

Dalwood Scrub

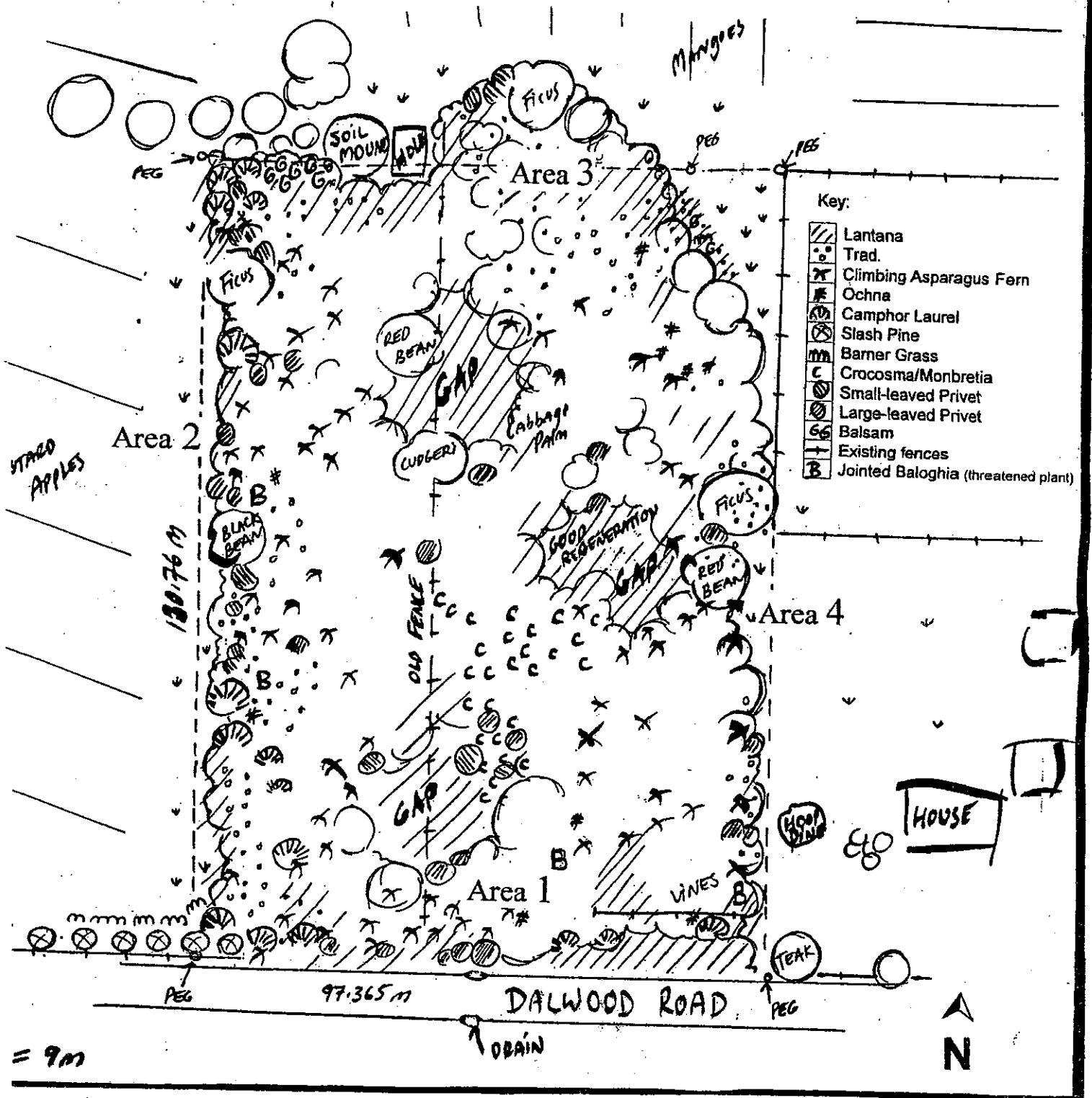


Figure 2. Plan of Dalwood Scrub, showing general weed distribution, gaps and site features.



4.5 Proposed Future Management.

It is recommended that the remnant should not be used for recreation purposes, due to its limited size, isolation and infrequent management. Excessive human visitation to this small remnant may disturb wildlife and encourage the pilfering of ferns and threatened plants. As an alternative, the NPWS remnant at Victoria Park provides walking tracks and an impressive rainforest experience. Victoria Park is only 3 km to the south of Dalwood Scrub. Visitation to Dalwood should be limited to restoration workers and for occasional scientific research. Ballina Shire Council parks and gardens officer, Ron Baird must be contacted to grant approval of activities.

4.6. Previous Restoration Works.

Restoration works have not been undertaken in the remnant.

5.0 VEGETATION DESCRIPTION.

5.1 Floristics

Floyd (1990a) recognises four major floristic suballiances within the 'true' Big Scrub. Three of these are within the *Heritiera* (Booyong) alliance; (previously *Argyrodendron*):

- *Heritiera trifoliolata* suballiance No. 1.
 - *Cryptocarya obovata-Dendrocnide excelsa-Ficus* spp.-*Araucaria* suballiance No. 3.
 - *Castanospermum australe-Dysoxylum mollissimum (muelleri)* suballiance No. 5.
- The other is within the *Drypetes-Araucaria* alliance;
- *Araucaria* suballiance No 21.

Dalwood Scrub belongs to the White Booyong *Heritiera trifoliolata* alliance which is characteristic of lowland subtropical, complex notophyll vine forest throughout the Big Scrub. Floyd (1990b) describes this alliance as the most structurally complex rainforest alliance in N.S.W. It requires protection from salt laden winds, cold or hot drying winds and often occurs on some of the best agricultural land. It has been virtually destroyed in the Big Scrub area, except for small remnants which were either flood prone, inadequately drained, rather stony or left due to surveying errors.

The White Booyong alliance can be further classified into a suballiance that is determined by the abundance of canopy species and forest structure. Dalwood Scrub displays many affinities to the White Booyong *Heritiera trifoliolata* suballiance No. 1, due to having an abundance of this species in the canopy, although it also displays attributes that are indicative of another suballiance, Black Bean *Castanospermum australe* and Red Bean *Dysoxylum mollissimum* suballiance No.5. The closest remnants to Dalwood which include, Victoria Park belongs to suballiance No.1 and Davis Scrub to suballiance No. 5 (Floyd 1990b). Dalwood is sited between these two remnants and possess similarities to both. The determination of the remnant's true forest type is difficult to ascertain due to prior selective logging and its limited size.

Common canopy species in Dalwood include; White Booyong *Heritiera trifoliolata*, Cudgeri *Flindersia schottiana*, Firewheel *Stenocarpus sinuatus*, Red Bean *Dysoxylum mollissimum*, Blackbean *Castanospermum australe*, Pepperberry *Cryptocarya*

obovata, Red Ash *Alphitonia excelsa*, Guioa *Guioa semiglauca*, Strangler Fig *Ficus watkinsiana* and Red Apple *Acmena ingens*.

Refer to Appendix 1 for a list of native plant species.

5.2 Vegetation Condition

Dalwood Scrub supports a high diversity of native plant species and contains sections of healthy forest except on edges and areas of prior disturbance. It is a structurally complex remnant, consisting of a tall dense canopy that is largely comprised of mature and secondary phase species, a multi layered midstorey and a dense understorey supporting vine thickets, a diversity of shrubs, herbs/ferns and suppressed canopy species. Areas of prior disturbance are evident by simplified forest structure lacking either in the canopy and or the midstorey. The remnant displays considerable regeneration potential, evident by the high diversity and density of suppressed native recruits under weed dominated vegetation.

Dalwood Scrub has a high regeneration capacity but requires human intervention to successfully restore, protect and enhance the remnants ecofunctions. A systematic regeneration program with regular follow-up weed control is essential to release and promote the establishment and domination of native species in the lower strata to provide recruits for the upper strata.

A single mature Bolly Gum (*Litsea reticulata*) is situated on the northern edge of the remnant. No other specimens were located during the survey. Bolly Gum is dioecious, therefore a single individual is reproductively defunct. The sex of the Bolly Gum needs to be determined. The long term viability of this species as part of the remnant's flora may be compromised and human intervention may be required to secure its future. A few specimens sourced from the local area could be planted in the adjacent grassy patch, which should be regenerated into rainforest (Figure 10,11). Isolated plant species that have a low population number are vulnerable to change and may also be prone to genetic drift due to in-effective population size (Given 1994). In some cases the introduction and planting of specimens from local sources may be necessary to help maintain the genetic vigour and reproductive status of the species in perpetuity, within small remnants.

The minimum number of individuals required to maintain a genetically viable population of plants will vary between species lifeform and phenology (Cropper 1993) and between rare or common species. Maintenance of the viability of common and less common, but disjunct sub-populations of plant species within remnants should be considered in remnant management. Further investigation is required to determine species that may be inadequately represented in the remnant and those that require strengthening of numbers.

6.0. CONSERVATION SIGNIFICANCE.

6.1. *Regional Significance/Biogeography of Big Scrub remnants.*

Big Scrub remnants are of high conservation value to the local region and nationally owing to the poor conservation of lowland subtropical rainforest in Australia. The ecological significance of the Big Scrub remnants is recognised with thirty-four of the major remnants being listing on The Register of the National Estate (Mezzatesta 1992). Brockley 2 is listed on the National Estate Register.

There has been extensive review into the importance of Big Scrub rainforest remnants as habitat for both flora and fauna and their need for restoration (Lott & Duggin 1993; Gosper 1994; Recher *et al.* 1995; Date *et al.* 1996; Kooyman 1996; Floyd 1990a; 1990b; Adam 1994; Date *et al.* 1988; Eby & Palmer 1991). The region exhibits a wide range of floristic and structural variation whilst potentially providing habitat for over 40 threatened fauna and 35 flora species listed under the NSW Threatened Species Conservation Act, 1995 (TSC Act 1995).

Big Scrub remnants are important regardless of their size as they provide refuge for the original flora and fauna, for the role they play in providing corridors and/or stepping stones amongst a fragmented ecosystem and as a genetic pool and seed source for regrowth areas. Additionally, all lowland remnant vegetation has been recognised as being seasonally important for migratory and nomadic species of birds (Holmes 1987, Gilmore pers. comm.). The remnants contain important ecological information regarding the original species mixes throughout the region and are invaluable for scientific research.

The Big Scrub lies within the McPherson-Macleay biogeographical overlap zone (NPWS 1995). This zone is a convergence area for northern and southern biota, so that many species reach their southern or northern limits in the region. The region is ecologically significant in that three of Australia's five land biotas mingle: Tumbunan (subtropical); Bassian (temperate) and Torresian (tropical) (CSIRO 1995). The Big Scrub rainforest remnants largely favour Tumbunan biota but also display Bassian and Torresian elements, particularly since clearing and during summer months.

The north eastern region of NSW supports the highest number of rare or threatened plant species in Australia (NPWS 1998) and is equal to the wet tropics for faunal diversity (NPWS 1995). Subsequently the area is recognised for its outstanding biodiversity at both the national and international level with significant areas listed on the World Heritage register.

6.2. *Threatened, ROTAP and Significant Plant Species.*

Over 130 native plant species have been recorded from Dalwood Scrub, of these one is listed as Endangered under Schedule 1, and three listed as Vulnerable under Schedule 2 (S2) of the NSW TSC Act 1995. These four plants and an additional four species are listed by Briggs and Leigh (1996) as being Rare Or Threatened Australian Plants (ROTAP) (see Appendix 4. for ROTAP codes), (Table 1).

Table 1. Threatened and ROTAP species recorded from Dalwood Scrub.

Common Name	Latin Name	TSC Act 1995	ROTAP
Veiny Laceflower	<i>Archidendron muellerianum</i>	-	3RCa
Byron Bay Acronychia	<i>Acronychia baeuerlenii</i>	-	3RC-
Jointed Baloghia	<i>Baloghia mamorata</i>	Schedule 2	3VC-
Southern Ochrosia	<i>Ochrosia moorei</i>	Schedule 1	2RC
Macadamia Nut	<i>Macadamia tetraphylla</i>	Schedule 2	2VC-
Quassia	<i>Quassia sp.A</i>	-	3RC-
Smooth Scrub Turpentine	<i>Rhodammia maideniana</i>	-	2RC-
Arrow-head Vine	<i>Tinospora tinosporoides</i>	Schedule 2	3RC-

6.3. Threatened Fauna.

Systematic fauna surveys were not undertaken at Dalwood Scrub due to the limited resources available through this project. Instead, lists of threatened fauna species that potentially could occur at Dalwood Scrub were compiled by investigating historical records, the mobility of potential species and by assessing the faunal habitats present within the local area. It is considered that Dalwood Scrub could potentially provide habitat for up to 17 threatened fauna species. However, due to the remnants isolation and loss of habitat resources, the majority of threatened fauna that potentially could occur at Dalwood Scrub are species that are highly mobile and are typically nomadic or seasonal migrants (Table 3). Fauna surveys should be undertaken to provide benchmark data on the existing faunal diversity and to monitor changes in fauna species and populations following restoration activities.

Table 3. Threatened fauna species that potentially occur at Dalwood Scrub.

Common Name	Scientific Name	Likelihood of Occurrence
Bush Hen	<i>Amaurornis olivaceus</i>	Moderate - Low
Wompoo Fruit-dove	<i>Ptilinopus magnificus</i>	Moderate
Superb Fruit-dove	<i>Ptilinopus superba</i>	Moderate
Rose-crowned Fruit-dove	<i>Ptilinopus regina</i>	Very High
Coxen's Fig Parrot	<i>Cyclopsitta diophthalma coxeni</i>	Very Low
Barred Cuckoo-shrike	<i>Coracina lineata</i>	Moderate
White-eared Monarch	<i>Monarcha leucotis</i>	Moderate
Common Planigale	<i>Planigale maculata</i>	Low
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Moderate
Common Blossom Bat	<i>Syconycteris australis</i>	Moderate - High
Eastern Tube-nosed Bat	<i>Nyctomine robinsoni</i>	Low
Black Flying Fox	<i>Pteropus alecto</i>	High - Very High
Little Bent-wing Bat	<i>Miniopterus australis</i>	Moderate-High
Common Bent-wing Bat	<i>Miniopterus schreibersii</i>	Moderate
Qld Long-eared Bat	<i>Nyctophilus bifax</i>	Moderate
Greater Broad-nosed Bat	<i>Scoteanax ruepellii</i>	Low
Three-toed Snake Tooth Skink	<i>Coeranoscincus reticulatus</i>	Low

All of the above species except the Coxen's Fig Parrot are listed as Vulnerable under Schedule 2 (S2) of the NSW TSC Act 1995. The Coxen's Fig Parrot is listed as Endangered (S1).

The habitat requirements and general biology description for one of the main threatened species that is likely to occur in Dalwood Scrub is given below.

Rose-crowned Fruit-dove.

In N.S.W. the Rose-crowned Fruit-dove is a nomadic frugivorous bird dependent on closed rainforest communities for its habitat. It is most commonly found below 600m in subtropical or dry rainforest and in wet sclerophyll forest with a rainforest understorey. Due to a lack of lowland rainforest habitat it is increasingly being found to seasonally utilise regrowth forests dominated by fruiting Camphor Laurel (autumn-winter). During their breeding season (spring-summer) they favour dense rainforest areas with abundant fruiting figs. They nest amongst dense vines in the upper strata. They have been observed by the author to nest in the Big Scrub area during autumn-winter when camphor, native laurels and ebony's are in heavy fruit. Recher *et. al.* (1996) suggest that rainforest pigeons are easily disturbed from their feeding, roosting and nesting sites during breeding season. Care needs to be taken not to disturb nesting, feeding or roosting pigeons.

7.0. FAUNA.

7.1. *Fauna occurring at Dalwood Scrub*

Dalwood Scrub provides important habitat for a range of sedentary and nomadic fauna. Sedentary species rely on the site all year round whilst migratory and nomadic species opportunistically or seasonally use the site for feeding and breeding, particularly when suitable resources are available or favourable conditions prevail. Being an isolated rainforest remnant, this site is an important stepping stone for nomadic nectivorous and frugivorous fauna that effectively disperse seeds and pollen through the surrounding landscape. The fauna of the site is largely impacted by the fragmented nature of the surrounding landscape. Much of the fauna that utilise the site are open habitat generalist species. These species use the site for refuge and as breeding habitat. Specialist species dependent on rainforests or contiguous forest are disadvantaged by the remnant's isolation from surrounding vegetation, edge effects, its limited size and competition by aggressive generalist species.

7.2. *Habitat Types.*

Dalwood Scrub and neighbouring regrowth patches displays several habitat types, which provide a variety of environments/niches for fauna typical to certain habitats.

★ **The rainforest habitat** is important for rainforest specialist species whilst also providing important foraging and breeding habitat for many open habitat species. This vegetation community provides high quality habitat for the threatened species listed in Table 3.

★ **The open agricultural habitat** favours generalist species that are common throughout disturbed environments in eastern Australia. These include species such as the Magpie *Gymnorhina tibicen*, Pied Butcherbird *Cracticus nigrogularis*, Noisy Miner *Manorina melanocephala*, Torresian Crow *Corvus orru*, Eastern Brown Snake *Pseudonaja textilis*, Lace Monitor *Varanus varius* and feral animals such as the Rabbit *Oryctolagus cuniculus*, Black Rat *Rattus rattus*, Fox *Vulpes vulpes*, Cat, *Felis catus*, Cane Toad *Bufo marinus* and ranging domestic animals such as Cats and Dogs *Canis familiaris*.

★ **Secondary regrowth edges/forest** dominated by woody weeds (Camphor Laurel) in the surrounding landscape are similar to regrowth rainforest in canopy structure but lack structural and species diversity in the lower stratum. Such forests are useful as corridors/stepping stones and habitat for species that favour closed forests, including many of the threatened species listed in Table 3. These regrowth areas are providing an important seasonal food source for frugivorous birds and have been attributed to an increase in the numbers of several species. Incremental habitat removal/replacement and strategic natural regeneration from the understorey upward should maintain the existing habitat values in these regrowth patches.

7.3. Habitat Requirements.

The habitat requirements for all native species found or suspected to occur on site needs consideration prior to undertaking regeneration works. Where a potential significant impact is likely on any species it is suggested that the animals life-cycle requirements be thoroughly investigated to determine likely impacts and ameliorative measures. This may include incremental and/or strategic weed removal, monitoring of existing populations, creation of alternative habitat prior to removal of existing weed habitat and undertaking work when animals are not breeding, feeding or active (e.g. spray when frogs are not active). When deciding if there is a significant impact to the habitat of any threatened fauna species it is recommended to refer to the guidelines set out in the NSW NPWS Threatened Species Management Information Circular No. 2. (1996). Potential impacts should also be assessed in accordance to the project aims and objectives.

7.4. Importance of Small Remnants for Fauna.

Although Dalwood Scrub is a small fragmented remnant which has suffered loss of biodiversity and ecofunctions, fragmented remnants whatever their size are of extreme importance to the remaining fauna and for enhancing the regeneration potential of the site (Barrett *et al.* 1994). However, the limited size and disturbed nature of this rainforest remnant decreases its ability to sustain a viable population for certain species to exist in perpetuity (Lott & Duggin 1993). This is particularly the case for species dependent on large territories, those that require large foraging ranges or those that have specific breeding or habitat requirements.

A range of factors are implicated in affecting the ability of a remnant to sustain a viable population of a particular species in the long term. These include remnant shape and size, time since isolation, distance between remnants, their connectivity, degree of habitat alteration and disturbance, competition for resources and exposure to edge effects (Bennett 1987, Leach & Recher 1993, Saunders & Hobbs 1995, Sivertsen 1995). These changes can often promote localised extinction's for specialist species or species that require large territories. This problem is exacerbated by increased competition with open habitat and generalist species (including ferals, domestic pets and livestock), loss of pollinators and an increase in desiccation from harsh edge effects. Consequently, when managing fragmented units of vegetation for the conservation of an ecosystems ecofunctions it is necessary to retain or reconstruct larger areas of habitat. This is because smaller remnants are subject to edge effects, which lead to the degradation of a range of environmental conditions that can promote species declines.

8.0. ASSESSMENT OF MAIN IMPACTS

8.1. *Structural damage*

The main impacts associated with Dalwood Scrub are a result of previous land clearing and landuse which has damaged the forest structure and fragmented the remnant from continuous tracts of forest. Impacts associated with edge effects and future disturbances are exacerbated by the remnant's limited size, narrow elongated shape, high edge to area ratio, arrested regeneration in areas of previous disturbance and high levels of weed invasion, particularly around the edges and in gaps. Future disturbances such as the incidence of tree fall (due to senescence of mature canopy trees) and storm damage will create new gaps in the canopy allowing light to the lower strata, thus increasing the potential for release of suppressed weeds from these strata. The combination of edge effects and future disturbances exerts further impacts on an already degraded forest structure, thereby reducing the remnant's ability to resist further weed invasion without human assistance.

To minimise edge effects it is necessary to systematically control weed infestations to promote the regeneration of a dense edge and canopy and to increase the structural complexity of the forest. Dalwood is small in size, occurs within a heavily modified landscape and provides important habitat. To prevent localised extinction's of fauna restoration works should be undertaken with consideration for all fauna that rely on the site. Expansion of the remnant will further reduce edge effects by buffering the core areas of the remnant, whilst increasing the area of available rainforest habitat.

★ Gaps

The remnant contains three distinct large gaps that appear indicative of prior selective logging activities (Figure 2, plate 8), which have accelerated the establishment of weeds throughout the remnant. The gaps are in various stages of regeneration. In some areas canopy and upper storey trees have extended and filled in the gaps yet midstorey development is patchy. In other areas breaks in the canopy remain and natural regeneration within the gaps is being suppressed and dominated by weeds.

On the edges of some gaps native vines are restricting extension of canopy trees. The cutting of vines is necessary to free up canopy trees but should be undertaken incrementally, following nesting and fruiting (for species that provide a food source for fauna), and within a mosaic to avoid impacting local fauna particularly birds and reptiles. Over zealous vine cutting within the lower storey should also be avoided to reduce feral animal access and to maintain habitat structure.

Shade tolerant weed species occur sporadically throughout Dalwood, increasing the vulnerability of the remnant to future disturbances and impacts from edge effects. Monitoring of regeneration in gaps (old and new) and beneath senescing trees is necessary to control weed infestations before they become well established.

★ Edges

All the edges exhibit some form of disturbance and weed infestation. Dalwood Scrub, crown land remnant is not fenced and the boundaries are unclear, particularly the northern edge which has enabled unsuitable landuses to encroach into the remnant. Edges have also been mown along. The northern part of the remnant is the most impacted from neighbouring landuse. Farm and household refuse and plants are

dispersed through the north-western edge of the remnant. A large trench /garbage pit and its burden incurs into the remnant boundary (Figure 2, plate 9). It is recommended that the trench should be filled in. Garbage pits on private land are considered as a development that requires consent from council. Furthermore, Ballina Local Environment Plan (LEP) states that no development can be undertaken on land zoned 7(1) Environmental Protection without a development application, which also includes regeneration activities.

Recent boundary surveys undertaken by Ballina Council indicates that the tree line on the northern edge does not represent the reserve boundary but shows that regrowth also occurs on the neighbouring property. The Landcare group should liaise with Council and the neighbouring landholders to develop a positive working relationship and conservation outcome. A fence will help define land tenure and reduce any likely conflict. Management of the rainforest regrowth on the neighbouring land should be encouraged.

8.2. Weeds.

Up to 31 weed species have been identified at Dalwood Scrub (excluding common paddock weeds). Of these fourteen are listed as serious weeds in the Common Weeds of Northern NSW Rainforests (1998). At present only eight of these appear to be seriously impacting the regeneration capacity and ecosystem integrity of the remnant. A serious weed is considered as a plant that can cause a major modification to the species richness, abundance or ecosystems function (Fox & Adamson 1990). The high diversity and density of serious to less serious environmental weeds throughout the remnant collectively pose a significant threat to the integrity of the remnant, due to the weed species being able to occupy all niches/strata within the forest ecosystem (ground and shrub layer, midstorey and canopy).

Weeds effectively out-compete and deflect natural succession, dominate the native vegetation thus degrading the species diversity, abundance and remnant ecofunctions (see Tables 4a-d for weed species list, strata they occur in, and dispersal mechanisms). Up to fourteen of the weed species that occur in the remnant are bird dispersed.

Dalwood Scrub contains dense weed infestations along some edges and within the vicinity of gaps. Weeds predominate in areas that have been structurally damaged and/or have sparse foliage cover in the canopy. In such areas extra light penetrates to the lower strata creating favourable conditions for further weed establishment and domination. Shade tolerant weed species also occur sporadically throughout healthy sections of Dalwood Scrub. Woody weeds, as well as native and exotic vine infestations have impeded the establishment of native edge recruits and reduced effective canopy expansion in areas.

The main weeds of concern in Dalwood Scrub are; Climbing Asparagus Fern (*Protasparagus plumosus*), Camphor Laurel, Crocosma (*Crocosma crocosmiiflora*), Large-leaved Privet (*Ligustrum sinense*), Small-leaved Privet (*Ligustrum lucidum*), Ochna (*Ochna serrulata*), Lantana (*Lantana camara*) and Trad. (*Tradescantia fluminensis*).

The potential for these main weed species to spread is very high. Re-infestation of weeds will also remain an on going problem in areas with poor canopy development. Promotion of conditions that favour the development of a dense canopy will reduce the impact of weed establishment, although shade tolerant weed species are expected to persist. Infestations of serious weeds that occur within the vicinity of Dalwood Scrub provide a constant source of weed seeds that are dispersed by birds. Local and catchment based management of serious weeds is necessary.

Tables 4a-d. Weeds of Brockley 2.

4a. Trees.

Common Name	Species Name	Family	Growth Strata	Level of Infestation	Dispersal Mechanism
Custard Apple	* <i>Annona reticulata</i>	Annonaceae	4	L	(a,b,k)
Camphor Laurel ~	* <i>Cinnamomum camphora</i>	Lauraceae	2 3 4	M	(a)
Rough Lemon ~	* <i>Citrus limonia</i>	Rutaceae	2 3	L	(h,k)
Loquat ~	* <i>Eriobotria japonica</i>	Malaceae	2	L	(a,b,k)
Large-leaved Privet ~	* <i>Ligustrum lucidum</i>	Oleaceae	1 2 3 4	M	(a,b,d)
Small-leaved Privet ~	* <i>Ligustrum sinense</i>	Oleaceae	2 3 4	M	(a,b,d)
Avocado	* <i>Persea americana</i>	Lauraceae	4	L	(r)
Slash Pine	* <i>Pinus elliotii</i>	Pinaceae	4	L	(a,c)

4b. Shrubs.

Common Name	Species Name	Family	Growth Strata	Level of Infestation	Dispersal Mechanism
Cedar Wattle	* <i>Acacia elata</i>	Mimosaceae	4	L	(a)
Lantana ~	* <i>Lantana camara</i>	Verbenaceae	2 3 4	E	(a,d)
Garden Shrub	* ?	Rosaceae	4	L	(j)
Ochna ~	* <i>Ochna serrulata</i>	Ochnaceae	3 4	M	(a)
Barner Grass	* <i>Pennisetum purpureum</i>	Poaceae	4	L	(d)
Smooth Senna ~	* <i>Senna X floribunda</i>	Caesalpinioidea e	4	L	(a,g)
Wild Tobacco ~	* <i>Solanum mauritianum</i>	Solanaceae	3 4	L	(a,b)

4c. Vines & Climbers.

Common Name	Species Name	Family	Growth Strata	Level of Infestation	Dispersal Mechanism
Fabaceae Vine	-	Fabaceae	4	L	(j)
Silver-leaf Desmodium ~	* <i>Desmodium uncinatum</i>	Fabaceae	4	L	(e)
Swiss Chees Plant	* <i>Monstera deliciosa</i>	Araceae	4	L	(g,d)
Edible Passionfruit ~	* <i>Passiflora edulis</i>	Passifloraceae	4	L	(a,h)
White Passionfruit ~	* <i>Passiflora subpeltata</i>	Passifloraceae	2 3 4	L	(a,b)
Asparagus Fern ~	* <i>Protasparagus plumosus</i>	Asparagaceae	2 3 4	E	(a)
Climbing Nightshade	* <i>Solanum seaforthianum</i>	Solanaceae	3	L	(a)
Succulent Vine	* <i>Syngonium sp</i>	Araceae	4	L	(d)

4d. Herbs & Groundcovers.

Common Name	Species Name	Family	Growth Strata	Degree of Infestation	Dispersal Mechanism
Ribbon Plant ~	* <i>Chlorophytum comosum</i>	Anthericaceae	3 4	L	(g,h)
Crocospa ~	* <i>Crocospa crocosmiiflora</i>	Iridaceae	3	E	(g,h)
Tropical Chickweed ~	* <i>Drymaria cordata</i>	Caryophyllaceae	3 4	L	(e)
Busy Lizzie ~	* <i>Impatiens alleriana</i>	Balsaminaceae	3 4	L	(g,h)
Fishbone Fern	* <i>Nephrolepis cordifolia</i>	Davalliaceae	4	L	(g)
Mother -in-law's Tongue ~	* <i>Sanservieria trifasciata</i>	Dracaenaceae	3 4	L	(d)
Setaria ~	* <i>Setaria</i> sp.	Poaceae	4	L	(e)
Trad ~	* <i>Tradescantia fluminensis</i>	Commeliaceae	3 4	M	(d,f,h)

Key to Table 4.

~ common weed according to weed manual (1998).
* = exotic species.
X = listed noxious weed.

Growth Strata
1 = canopy
2 = midstorey
3 = understorey
4 = edge

Degree of Infestation
L = low
M = moderate
E = extensive

Dispersal Mechanism
a = bird
b = fruitbat
c = wind
d = vegetative
e = attachment
f = water
g = explosive capsule
h = human
i = livestock
j = unsure
K = rodent

8.4 Edge Effects.

Edge effects are the external impacts imposed upon an exposed edge of remnant habitat. The distance that external factors penetrate in from a remnant edge is the area impacted by edge effects (Sisk & Margules 1993). The area of forest that is not adversely affected by edge effects is for this report termed as core forest. Remnants that display high edge to area ratios may be too small to have an area of core forest as edge effects may prevail throughout (Lott & Duggin 1993).

Altered climatic regimes can dramatically alter micro-climate, hydrology, vegetation succession and available habitat/food resources. This can disadvantage certain species dependent upon specific conditions. An increase in the incidence of fire, wind, agricultural spraying, weeds, feral animals, livestock and people causes either direct loss or disturbance to habitat or displacement via disturbance, competition and/or predation (Sivertsen 1995, Friend 1987, Sisk & Margules 1993).

Landscape fragmentation results in alteration of the previous environment.

Changes can include;

- Microclimate change.
- Increase in wind penetration and turbulence.
- Increased solar radiation, temperature and light.
- Alter the hydrology and water quality.
- Alter soil stability and nutrient balance.
- Change in vegetation structure/composition and faunal communities.
- Food and habitat resources are removed or altered.
- Altered predator/prey relationships.

(Start 1991, Scougall *et al.* 1993).

Summary of impacts

Edge effects

Narrow shape, small size, isolation from contiguous forest

High level of weed infestation around edges

Structural damage (around edges, large gaps and in weed dominated areas)

Extensive infestations of bird dispersed weeds in the local area

Shade tolerant weed species

Senescing canopy trees (tree fall - natural succession most likely to be invaded by weeds)

Vine infestations smothering canopy trees

Potential loss of ecofunctions (eg. specialist pollinators, seed dispersers, predators etc)

Impacts of pesticides on pollinators.

In-effective plant population size (limited genetic base, low -nil reproductive capability)

9.0. REMNANT MANAGEMENT – THEORY AND PRACTICE.

For effective long-term management of fragmented, weed impacted native vegetation communities a strategic, holistic, yet flexible range of management options needs to be adopted. Remnants need to be managed on a whole system basis (Dunphy 1992), utilising management options that are ecologically relevant to the landscape context (Hobbs 1995). Management should follow an integrated approach that takes into account all ecological factors and uses a variety of practical measures (Joseph 1995). Techniques used should be those that are most effective and efficient based on available resources and funding. The control of weeds alone should not be the basis for a regeneration program, although it is a very important aspect of it. Instead, the restoration of the natural processes of regeneration and succession to resist and replace weeds to improve the long-term viability for native flora and fauna (Joseph 1995).

Weed control should not target certain weeds unless early control of a minor infestation of a serious weed (e.g. Madeira Vine, Cat's Claw Vine, Asparagus Ferns *Protasparagus* spp. and Trad etc.) will prevent further or more serious infestations (Joseph 1995). Regeneration work should focus on systematically working an area to promote the conditions that favour the re-establishment of native species whilst disadvantaging the establishment of exotic species. No preconceived or inflexible principles should be followed, rather weed control should be considered on a species

by species, site by site basis incorporating faunal, micro-climatic and seasonal requirements (Dunphy 1992).

Webb *et. al.* (1985) and Kooyman (1996) consider small, fragmented/isolated remnants unlikely to be able to be self-sustaining and viable in the long-term due to a regression towards secondary successional species. Saunders *et. al.* (1991) indicate that the degree of alteration together with remnant size, shape and degree of isolation greatly influences species survival in native habitat remnants. In the Big Scrub, successional regression or 'stagnation' (Lovejoy 1985) is exacerbated by harsh edge effects, fragmentation (limiting movement of genetic material), impacts associated with agricultural activities, browsing from livestock, deflection by exotic weed species and domination by native woody vines. The altered conditions associated with fragmentation has disrupted the natural successional pathways and reduced the effectiveness of faunal distribution of some mature phase species throughout the isolated Big Scrub remnants. This often results in a lower recruitment of mature phase species than in areas of contiguous forest (Dunphy 1992, Hopkins 1990 and Adam 1994). However the use of Big Scrub remnants and regrowth areas as "stepping stones" for frugivorous avifauna and flying-foxes and the role they play in seed and pollen dispersal is fundamental to the long-term viability to any remnant (Date *et. al.* 1991).

To ensure the long-term viability of floral and faunal communities in the small, fragmented Big Scrub remnants it necessary to increase their size to buffer harsh edge effects and to create links between neighbouring remnants and/or areas of regrowth by stimulating natural regeneration and/or by undertaking extension plantings. Plantings should only utilise locally sourced (Big Scrub) seed grown native trees from variable parentage to maintain genetic diversity. Species to be considered for planting around a remnant should only include those that are currently or were historically known to occur from the site. Planting composition and design should follow the Kooyman model of accelerated succession (Kooyman 1991; 1996). This model utilises a high diversity of pioneer, secondary and mature phase species, with a preference towards the late secondary and mature phases (especially when disjunct from a local mature phase seed source forest). However, where sites experience heavy frost or flooding it is often necessary to alter the planting composition to suit the site conditions.

A team supervised by a qualified rainforest regenerator with skills in plant identification, vegetation management and weed control should undertake all regeneration works. Where threatened species are present specialist advice should be sought on appropriate management strategies. Team members should be adequately trained or be undergoing training. Regular, follow-up maintenance work and monitoring and is required for all previous restoration works to control the re-establishment of weeds and to promote natural regeneration.

3



Plate 3. Dalwood Road runs along the southern edge of the remnant.

Plate 4. South-east edge of remnant, road has been raised above ground level.

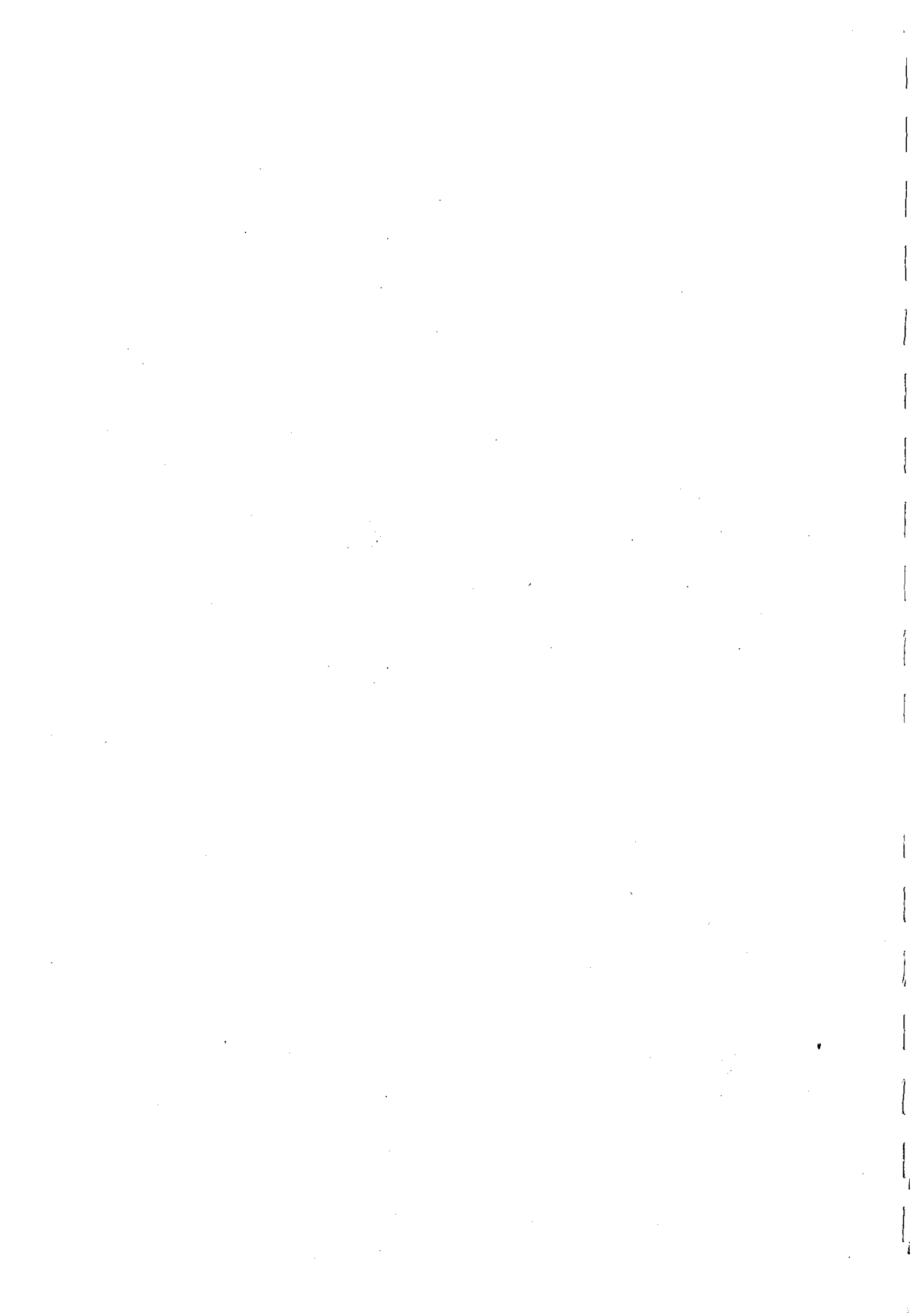
Plate 5. South-west edge of remnant. Pines and Barner Grass impinge on crown land/remnant. Survey peg indicates crown land boundary.

5



4





10.0. DESCRIPTION OF MANAGEMENT AREAS.

Area 1. Southern edge near Dalwood Road

The southern edge of the remnant fronts onto Dalwood Road (Plate 3-5). This is the main access point to the remnant. The southern edge is comprised predominantly of secondary rainforest species and woody weed tree and shrub species. The road has been raised above the ground level toward the south-eastern edge of the remnant, which reduces surface runoff. This area should be monitored to assess the impact of restricted drainage on regeneration and vegetation health. Slash Pine (*Pinus elliottii*) trees and Barner Grass (*Pennisetum purpureum*) occur on the south-west edge of the remnant within the crown reserve boundary (Plate 5). The crown land remnant should be fenced to define the boundary between adjoining properties and to assist in the appropriate management of the remnant. Survey pegs demark the reserve boundary (Plate 5).

The inner edge is well developed, contains large patches of ferns, vine tangles and an array of native recruits in the understorey. Weed cover tends to be denser towards the edges and in the vicinity of gaps, although shade tolerant weed species are sporadically distributed throughout the remnant (Figure 2). A large patch of the bulbiferous garden plant, *Crococma* is located near the large canopy gap in this area (Figure 2).

The main weeds occurring in the Southern Area include:

Barner Grass, Camphor Laurel, Climbing Asparagus Fern, *Crococma*, Lantana, Large-leaved Privet, Small-leaved Privet, *Ochna*, Slash Pine and Trad.

Ameliorative measures/recommendations for Area 1.

Refer to Appendix 2 & 3 for weed control

- Define boundary between crown land and neighbouring property and construct fence.
- Control weeds systematically and carry out follow-up maintenance on a regular basis. Avoid creating conditions that may create a new weed problem.
- Promote canopy, midstorey, understorey and edge development to repair forest structure and to create shaded conditions that will disadvantage shade intolerant weed species.
- Take care when controlling weeds around rare plants (refer to Appendix 5, Guidelines for weeding near threatened plants).
- Start from the southern edge, working toward the northern edge. Work back and forth along the southern edge from west to east or work one side at a time.
- Inject Slash Pines occurring on the crown land and cut back Barner Grass. Spray Barner Grass regrowth with herbicide.

- When treating Climbing Asparagus Fern in shaded areas cut foliage at head height and loosely roll up. This will make follow-up spray work easier. Asparagus Fern that has been cut near ground level in shaded situations often re-shoots into long tendrils prior to producing foliage and is difficult to spray, requiring further handwork.
- Crown out (hand weed) any isolated patches/plants of Climbing Asparagus Fern.
- Knife out Crocosma bulbs and collect for suitable disposal, composting &/or trial spraying plant with herbicide after flowering.
- Systematically control dense understorey weed infestations prior to controlling weeds from upper strata's.
- Following the control of understorey weeds strategically inject woody weeds from the upper strata's, particularly where sub-canopy and understorey development and/or native recruitment is expected to be high.
- Hand weed and bottom prune around existing natives in preparation for spraying.
- Incrementally control native vines that are deflecting canopy development. Do not poison native vines, only cut them back to promote canopy expansion Retain a mosaic of native vine-dominated areas for habitat values and structural complexity. Avoid over zealous vine cutting within the lower storey.
- Assess habitat value of vine thickets (eg. nest, roost and food resources) prior to cutting vines back. If vines provide important habitat resources undertake vine control following period of peak habitat use or incrementally control vine thicket.
- Hand weed, weeds from fern beds or cut back ferns prior to spraying.
- Strategically control or retain less serious weeds that may reduce light penetration, provide a temporary buffer against adverse weather conditions and help to reduce growth of more serious weeds. Remove weed buffer later.
- Undertake thorough and regular follow-up for all previous restoration works to reduce/prevent re-establishment of weeds and to promote natural regeneration.
- Following primary weed control along existing edges, spray exotic grasses out from remnant edge up to fenceline.
- Monitor regeneration, successional trends and weed infestations.
- Remove barbed wire from old fence through centre of remnant.

Plate 6. Western edge of the remnant,
and Custard Apple orchard.

Plate 7. Eastern edge of remnant with
adjoining mown lawns. The edge of the
crown land boundary needs to be defined.

Plate 8. A canopy gap in Dalwood Scrub.



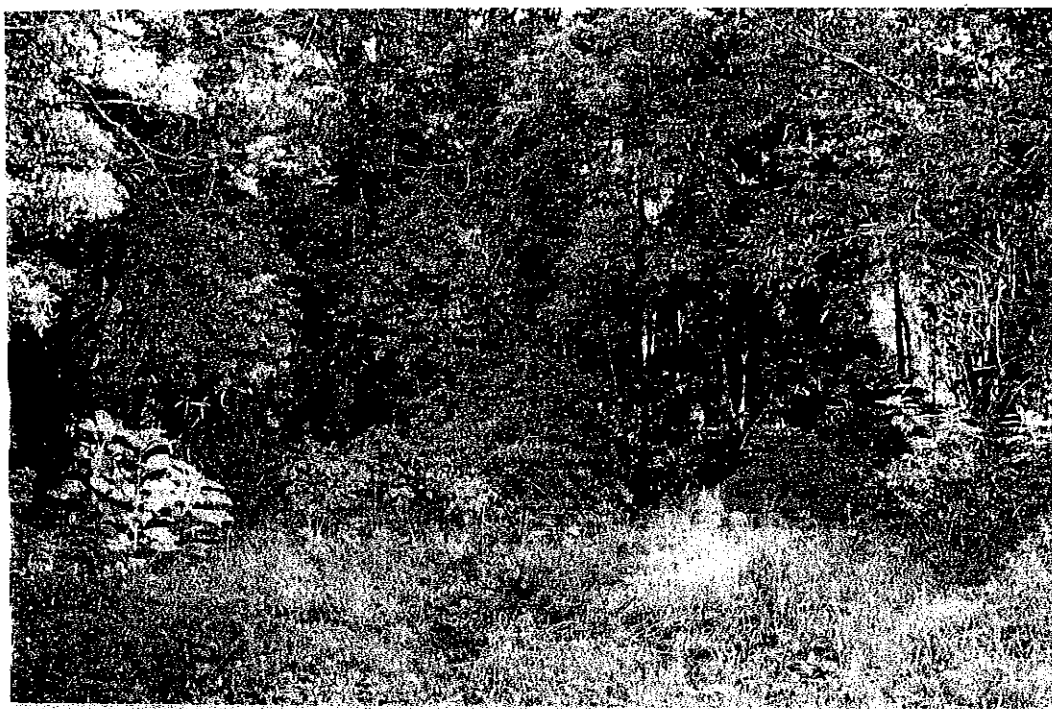
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11



Plate 9. View of the overburden from trench dug on the northern edge.

Plate 10. The north-east Corner. Boundary runs near to the fence. The grass patch should be regenerated. *Litsea reticulata* on edge.

Plate 11. Another view of north-east edge. Soil and garden refuse has been mounded on this edge. A survey peg is located in the grass.

Area 2. Western Area

The western edge of the remnant adjoins a Custard Apple orchard. A strip of grass lies between the remnant and the orchard (Plate 6). Some of the rainforest trees along the remnant edge have been mown underneath thereby limiting edge development. The reserve boundary needs to be clearly defined to enable appropriate management.

A few canopy sized Camphor Laurels occur on the western edge and become more common toward the north-west section of the remnant. Other weeds along this edge include; Privet, Lantana, Trad. and Climbing Asparagus Fern. Climbing Asparagus fern is getting up into the midstorey in places within the inner edge. The remnant should be extended to the edge of the crown reserve boundary (once it is defined) to further buffer the remnant edge.

The main weeds occurring in the Western Area include:

Camphor Laurel, Climbing Asparagus Fern, Large-leaved Privet, Small-leaved Privet Lantana, Trad., Custard Apple and a small patch of Spider Plant (*Chlorophytum comosum*).

Ameliorative measures/recommendations for Area 2

For appropriate weed control techniques refer to Appendix 2 and 3

- Refer to recommendations for Area 1
- Define crown land boundary.
- Control weeds systematically to avoid creating a new weed problem.
- Maintain all previous restoration works.
- Promote the establishment of a dense edge and extend remnant to fenceline (crown land boundary).
- Spray exotic grasses on edge after primary work has been undertaken throughout existing remnant edges.
- Strategically control or retain less serious weeds that may reduce light penetration, provide microclimate and help to reduce growth of more serious weeds. Remove weed buffer later.
- Monitor and regularly maintain regeneration works.

Area 3. Northern Edge

The forest edge at the north side of the remnant does not define the crown land boundary. Regrowth rainforest occurs on the adjoining property (Figure 1). The crown land boundary is rectangular in shape. Survey pegs are located near the northern edge of the remnant (Plate 11). Fencing will help to indicate tenure boundaries.

The northern edge appears to have been substantially disturbed, having a simplified structure in areas, high weed density and an array of farm junk. A large trench /garbage pit about 7m long X 4m wide X 3m deep and its burden incurs into the remnant boundary (Plate 9). This trench should be filled in so that the fence can be

erected. The regrowth on adjoining property requires regeneration works to prevent re-infestation of weeds into the remnant.

A grassy patch occurs on the north-east remnant edge (about 15m X 15m). The remnant should be expanded into this area. Trial stimulating natural regeneration, if regeneration is poor undertake strategic planting of locally sourced trees. The grassy edges should be revegetated to reduce potential impacts of pesticide sprays from adjoining orchards and to further buffer the edge. A single specimen of *Litsea reticulata* is located on the edge. This species is dioecious and will require bolstering of numbers to enable reproduction and to maintain this species in perpetuity within the remnant.

The main weeds occurring in the Northern Area include:

Camphor Laurel, Climbing Asparagus Fern, Balsam, Lantana, Large-leaved Privet, Small-leaved Privet, Trad., Avocado, Tropical Chickweed (*Drymaria cordata*), Fishbone Fern (*Nephrolepis cordifolia*) Mother-in-laws Tongue (*Sanservieria trifasciata*) and the foliage plant (*Syngonium sp.*).

Ameliorative measures/recommendations for Area 3

- Liaise with Ballina Council and neighbours to get the garbage pit filled in.
- Systematically control weeds throughout the northern area (refer to recommendations in Area 1).
- Spray out grass edges following primary work along remnant edge.
- Spray out grassy patch at northeast edge and allow natural regeneration. Assess need for planting if regeneration is low.
- If planting is required:
 - Seed should be sourced from the Alstonville plateau.
 - Plant trees out from edge of forest.
 - Plant a few species from differing developmental stages pioneer to mature phase in a configuration to assist natural regeneration.
- Determine sex of the *Litsea reticulata*. Plant out a few specimens from local sources in order to develop a reproductively active population of this species.
- Monitor regeneration and regularly follow-up weed regrowth.
- Determine whether farm refuse should be gathered and disposed or left as habitat for terrestrial fauna.

Area 4. Eastern edge

The eastern edge is undefined and adjoins a mown yard area and a fenced horse paddock. The eastern edge is comprised of a diversity of rainforest plant species, is fairly dense and provides a good buffer and microclimate. Trees along this edge have been mown underneath which has restricted further development of edge recruits. Following the construction of a fence the grassy areas should be sprayed with herbicide to extend the edge. A survey peg/marker, which indicates the position of eastern edge, is located near the fence at the north-east edge of the remnant.

A large gap occurs toward the centre of the remnant immediately behind the edge. The majority of weeds along this edge tend to occur in the lower storey and

understorey although Lantana and Climbing Asparagus Fern is getting up into the midstorey near the gaps.

The main weeds occurring within the Eastern Area include: These include: Climbing Asparagus Fern, Trad, Tropical Chickweed occasional Lantana, Ochna, Privet and Camphor Laurel.

Ameliorative measures/recommendations for Area 4

For appropriate weed control techniques refer to Appendix 2 and 3

- Systematically control weeds in Area 4.
- Carefully regenerate and control weeds around rare plants (refer to Appendix 5 for guidelines).
- Promote the establishment of a dense edge and spray grass edges after primary work has been undertaken.
- Monitor and maintain natural regeneration.

11.0. PRIORITISED WORK SCHEDULE.

1. Define crown land boundary and erect a fence.
2. Identify, tag and label any plant species that are listed as threatened or ROTAP or those that may be mistaken as a weed species.
3. Undertake systematic regeneration works. Commence regeneration work from the southern edge, working toward the north.
4. Carefully control weeds around rare plants (refer to Appendix 5 for guidelines).
5. Extend remnant to edge of crown land boundary. Spray exotic grass edge after a fence has been constructed and primary work has been undertaken throughout remnant edges.
6. Monitor rate of natural regeneration in larger grassy patch on north-east edge. If regeneration is poor assess need to plant to accelerate establishment of vegetation .
7. Determine sex of *Litsea reticulata*. Plan to establish specimens in adjoining grassy patch. Survey and research the reproductive and genetic viability of plant species that may be poorly represented in the remnant. Consider improving species viability.
8. Regularly undertake follow-up weed control and monitor rate of natural regeneration.

12.0. CONCLUSION.

Dalwood Scrub displays patches of intact and structurally complex forest, and areas that are disturbed and dominated by weeds. The remnant has sustained large gaps from prior selective logging. Due to its small size, narrow shape and structural damage Dalwood Scrub is vulnerable to further weed invasion and edge effects. The main impacts degrading the integrity of Dalwood Scrub are associated with past landuse and fragmentation.

Dalwood Scrub contains a high density and diversity of weed species. Weed densities are higher in the vicinity of gaps and edges. The weeds that are of most concern and are threatening the integrity of the forest include; Climbing Asparagus Fern, Camphor Laurel, Crocosma, Lantana, Large-leaved Privet, Small-leaved Privet, Camphor laurel and Trad. Despite being subject to a range of impacts and having an extensive cover of weeds Dalwood Scrub exhibits great regeneration potential if appropriately managed. Furthermore, the boundary of the crown land is undefined and at present neighbouring landuse is encroaching into the edge of the remnant. Fencing is required to define land tenure.

It is imperative that a long-term regeneration program is implemented as following the recommendations in this plan, to effectively control degrading processes and to promote natural regeneration. To achieve success in a restoration project regular follow-up weed control and monitoring is required. Regeneration of rainforest remnants is an ongoing and long-term process, which requires commitment and substantial financial support. Due to the poor reservation of rainforest throughout this region the importance of actively managing these remnants to secure their viability for the future is indisputable. It is important that Local Councils, Landcare groups and landholders recognize the significance of rainforest remnants and assist in their management.

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APPENDIX 1

Native Vegetation Species List for Dalwood Scrub. DP - 248855

LISTING	SCIENTIFIC NAME	COMMON NAME	HABIT
FILICOPSIDA			
	ADIANTACEAE <i>Adiantum hispidum</i>	Rough Maidenhair	fern
	ASPLENIACEAE <i>Asplenium australasicum</i>	Birds Nest Fern	fern
	BLECHNACEAE <i>Doodia caudata</i>	Rasp fern	fern
	DRYOPTERACEAE <i>Christella dentata</i>	Binung	fern
	<i>Lastreopsis marginans</i>	Bordered Shield Fern	fern
	<i>Lastreopsis munita</i>	Naked Sheild Fern	fern
	POLYPODIACEAE <i>Pyrossia rupestris</i>	Rock Felt Fern	climbing fern
MONOCOTYLEDONS			
	AGAVACEAE <i>Cordyline rubra</i>	Red-fruited Palm Lily	palm
	ARACEAE <i>Alocasia brisbanensis</i>	Cunjevoi	herb
	<i>Gymnostachys anceps</i>	Setterls Flax	herb
	<i>Pothos longipes</i>	Pothos	climber
	ARECACEAE <i>Archontophoenix cunninghamiana</i>	Bangalow Palm	palm
	<i>Calamus muelleri</i>	Lawyer Vine	palm/vine
	<i>Livistona australis</i>	Cabbage Tree Palm	palm
	COMMELINACEAE <i>Commelina cyanea</i>	Commelina	herb
	DIOSCOREACEAE <i>Dioscorea transversa</i>	Native Yam	vine
	LILIACEAE <i>Dianella caerulea</i>	Blue Flax Lily	grass
	LOMANDRACEAE <i>Lomandra spicata</i>	Rainforest Mat-rush	rush
	LUZURIAGACEAE <i>Geitonoplesium cymosum</i>	Scrambling Lily	vine
	POACEAE <i>Oplismenus aemulus</i>	Basket Grass	grass
	<i>Oplismenus imbecilis</i>	Basket Grass	grass
	SMILACACEAE <i>Smilax australis</i>	Austral Sarsaparilla	vine
	RIPOGONACEAE <i>Ripogonium album</i>	White Supplejack	vine
DICOTYLEDONS			
	ACANTHACEAE <i>Psuederanthemum variabile</i>	Pastel Flower	herb
	ALANGIACEAE <i>Alangium villosum</i> subsp. <i>polyosmoides</i>	Muskwood	small tree
	ANNONACEAE <i>Rauwenhoffia leichardtii</i>	Zig -Zag Vine	vine
	APOCYNACEAE <i>Melodinus australia</i>	Southern Melodinus	vine
	<i>Parsonsia latifolia</i>	Silkpod	vine
	<i>Parsonsia straminea</i>	Common Silkpod	vine
	<i>Parsonsia velutina</i>	Hairy Silkpod	vine
	<i>Parsonsia ventricosa</i> H	Silkpod	vine
	<i>Ochrosia moorei</i> H	Southern Ochrosia	tree
	<i>Tabernaemontana pandacaqui</i>	Banana Bush	shrub

S2, ROTAP

LISTING	SCIENTIFIC NAME	COMMON NAME	HABIT
S2, ROTAP	ASCLEPIADACEAE		
	<i>Marsdenia rostrata</i>	Common Milk Vine	vine
	BIGNONIACEAE		
	<i>Pandorea pandorana</i>	Wonga Vine	vine
	CAESALPINIACEAE		
	<i>Caesalpinia subtropica</i>	Corky Prickle Vine	vine
	CAPPARACEAE		
	<i>Capparis arborea</i>	Brush Caper Berry	small tree
	CAPRIFOLIACEAE		
	<i>Sambucus australasica</i>	Native Elderberry	shrub
	CELASTRACEAE		
	<i>Celastrus subspicatus</i>	Large-leaf Staff Vine	vine
	<i>Denhamia celastroides</i>	Denhamia	small tree
	CUNONIACEAE		
	<i>Geissois benthamii</i> H	Red Carrabeen	tree
	EBONACEAE		
	<i>Diospyros pentamera</i>	Myrtle Ebony	tree
	ELAEOCARPACEAE		
	<i>Elaeocarpus obovatus</i>	Hard Quandong	tree
	ESCALLONIACEAE		
	<i>Polyosma cunninghamii</i>	Featherwood	small tree
	EUPHORBIACEAE		
	<i>Actephila lindleyi</i>	Actephila	shrub
	<i>Baloghia inophylla</i>	Brush Bloodwood	tree
	<i>Baloghia marmorata</i>	Jointed Baloghia	tree
	<i>Breynia oblongifolia</i>	Breynia	shrub
	<i>Bridelia exaltata</i>	Scrub Ironbark	tree
	<i>Claoxylon australe</i>	Brittlewood	shrub
	<i>Cleistanthus cunninghamii</i>	Cleistanthus	shrub
	<i>Croton verreauxii</i>	Native Cascarilla	shrub
	<i>Drypetes australasica</i>	Yellow Tulip	tree
	<i>Mallotus discolor</i>	White Kamala	tree
	<i>Mallotus philippensis</i>	Red Kamala	tree
	<i>Omalanthus populifolius</i>	Bleeding Heart	tree
	EUPOMATIACEAE		
	<i>Eupomatia bennettii</i>	Small Bolwarra	shrub
	FABOIDEAE		
	<i>Austrosteenisia blackii</i>	Blood Vine	vine
	<i>Castanoperмум australe</i>	Black Bean	tree
	<i>Derris involuta</i>	Native Derris	vine
	<i>Milletia megasperma</i>	Native Wisteria	vine
	FLAGELLARIACEAE		
	<i>Flagellaria indica</i>	Whip Vine	vine
	GERANIACEAE		
	<i>Geranium solanderi</i>	Native Geranium	trailing herb
	LAURACEAE		
	<i>Cinnamomum oliveri</i> H	Oliver's Sassafras	tree
	<i>Cinnamomum virens</i>	Red-barked Sassafras	tree
	<i>Cryptocarya glaucescens</i>	Jackwood	tree
	<i>Cryptocarya obovata</i>	Pepperberry	tree
	<i>Cryptocarya triplinervis</i> var. <i>pubescens</i>	Hairy Three -veined Laurel	tree
	<i>Endiandra pubens</i>	Hairy Walnut	tree
<i>Litsea reticulata</i>	Bolly Gum	tree	
<i>Neolitsea dealbata</i>	White Bolly gum	small tree	
MELIACEAE			
<i>Dysoxylum fraserianum</i>	Rosewood	tree	
<i>Dysoxylum mollissimum</i>	Red Bean	tree	
<i>Dysoxylum rufum</i>	Hairy Rosewood	tree	
<i>Toona ciliata</i>	Red Cedar	tree	
MENISPERMACEAE			
<i>Carronia multisejala</i>	Carronia	vine	
<i>Sarcopetalum harveyanum</i> H	Pearl Vine	vine	

LISTING	SCIENTIFIC NAME	COMMON NAME	HABIT
S2, ROTAP	<i>Tinospora tinosporoides</i>	Arrow-head Vine	vine
	MIMOSOIDEAE		
	<i>Acacia melanoxylon</i>	Sally Wattle / Blackwood	tree
ROTAP	<i>Archidendron muellerianum</i>	Veiny Laceflower	tree
	<i>Pararchidendron pruinatum</i> var. <i>pruinatum</i>	Snowwood	tree
	MONIMIACEAE		
	<i>Doryphora sassafras</i> H	Sassafras	tree
	<i>Wilkiea austroqueenslandica</i>	Smooth Wilkiea	shrub
	<i>Wilkiea huegeliana</i>	Veiny Wilkiea	shrub
	MORACEAE		
	<i>Ficus fraseri</i>	Sandpaper Fig	tree
	<i>Ficus obliqua</i>	Small-leaved Fig	tree
	<i>Maclura cochinchinensis</i>	Cockspur Thorn	vine
	<i>Ficus watkinsiana</i>	Strangler Fig	tree
	MYRSINACEAE		
	<i>Embelia australiana</i>	Embelia	vine
	MYRTACEAE		
	<i>Acmena ingens</i>	Red Apple	tree
	<i>Acmena hemilampra</i> subsp. <i>hemilampra</i>	Broad-leaved Lillypilly	tree
	<i>Acmena smithii</i>	Common Lilly Pilly	tree
	<i>Austromyrtus bidwillii</i>	Python Tree	tree
ROTAP	<i>Rhodamnia maideniana</i>	Smooth Scrub Turpentine	small tree
	OLEACEAE		
	<i>Jasminum singuliflorum</i>	Soft Jasmine	vine
	<i>Notalaea johnstonii</i>	Veinless Mock Olive	shrub
	PITOSPORACEAE		
	<i>Citriobatus pauciflorus</i>	Orange Thorn	shrub
	<i>Pittosporum revolutum</i>	Hairy Pittosporum	shrub
	<i>Pittosporum undulatum</i>	Sweet Pittosporum	tree
	PROTEACEAE		
	<i>Helicia glabriflora</i>	Smooth Helicia	small tree
S2, ROTAP	<i>Macadamia tetraphylla</i>	Macadamia Nut	tree
	<i>Stenocarpus salignus</i> H	Beefwood	small tree
	<i>Stenocarpus sinuatus</i>	Firewheel Tree	tree
	<i>Truinia youngiana</i>	Honeysuckle Bush	shrub
	RHAMNACEAE		
	<i>Alphitonia excelsa</i>	Red Ash	tree
	ROSACEAE		
	<i>Rubus rosifolius</i>	Native Raspberry	rambler
	RUBIACEAE		
	<i>Canthium coprosmoides</i>	Coast Canthium	small tree
	<i>Morinda jasminoides</i>	Morinda	vine
	<i>Randia chartacea</i>	Narrow-leaved Gardenia	shrub
	RUTACEAE		
ROTAP	<i>Acronychia baeuerlenii</i> H	Byron Bay Acronychia	small tree
	<i>Acronychia pubescens</i>	Hairy Acronychia	small tree
	<i>Bosistoa pentacocca</i> H	Large-leaved Bosistoa	small tree
	<i>Flindersia schottiana</i>	Cudgerie	tree
	<i>Flindersia xanthoxyla</i> F	Yellowwood	tree
	<i>Melicope micrococca</i>	White Euodia	tree
	<i>Microcitrus australasica</i> var. <i>australasica</i>	Finger Lime	tree
	<i>Pentaceras australis</i>	Crow's Ash	tree
	<i>Sarcomelicope simplicifolia</i> subsp. <i>simplicifolia</i>	Bauerella	small tree
	SAPINDACEAE		
	<i>Arytera distylis</i>	Twin-leaved Coogera	tree
	<i>Cupaniopsis flagelliformis</i> var. <i>australis</i>	Brown Tuckeroo	tree
	<i>Diploglottis australis</i>	Native Tamarind	tree
	<i>Elattostachys nervosa</i>	Green Tamarind	tree
	<i>Guioa semiglauca</i>	Guioa	tree
	<i>Jagera pseudorhus</i> var. <i>pseudorhus</i>	Foambark Tree	tree
	<i>Mischocarpus pyriformis</i>	Yellow Pear-fruit	tree
	<i>Sarcopteryx stipata</i>	Steelwood	tree
	<i>Toechima dasyrrache</i>	Blunt-leaved Steelwood	small tree

LISTING	SCIENTIFIC NAME	COMMON NAME	HABIT
ROTAP	SOLANACEAE		
	<i>Solanum corifolium</i>	Straggling Nightshade	shrub
	SAPOTACEAE		
	<i>Planchonella australis</i>	Black Apple	tree
	SIMAROUBACEAE		
	<i>Albanthus triphysa</i> H	White Bean	medium tree
	<i>Quassia</i> sp. A	Quassia	shrub
	SYMPLOCACEAE		
	<i>Symplocos thwaitesii</i>	Buff Hazelwood	tree
	STERCULIACEAE		
	<i>Commersonia bartramia</i>	Brown Kurrajong	tree
	<i>Heritiera trifoliolata</i>	White Booyong	tree
	THYMELAEACEAE		
	<i>Wikstroemia indica</i>	Wikstroemia	shrub
	ULMACEAE		
	<i>Aphananthe philippinensis</i>	Native Elm	tree
VERBENACEAE			
<i>Clerodendron floribundum</i>	Smooth Clerodendron	shrub/tree	
VITACEAE			
<i>Cayratia clematidea</i>	Slender Grape	vine	
<i>Cissus antarctica</i>	Water Vine	vine	

Sue Bower 1999

H = Holmes 1987, F = Floyd from Holmes 1987

S1 = Schedule 1, S2 = Schedule 2 of the Threatened Species Conservation Act

ROTAP = Rare or Threatened Australian Plant

APPENDIX 2

Techniques for controlling weeds.

Cut & Paint.

Use on saplings, shrubs and tree weeds.

* Cut stem down low, near the ground and immediately paint with mix of glyphosate and water (1:1.5). Failure to apply herbicide ASAP will reduce its effectiveness. For Camphor Laurels also apply cuts to buttresses & inject (1:1.5).

Weed Species – Camphor Laurel, Groundsel.

Equipment - Secateurs/ loppers/knife / hand saw / chainsaw /poison pot & paint brush.

Cut / Scrape & Paint.

Similar to cut and paint but includes a scrape along the side of the stem to increase the uptake of herbicide. Failure to scrape the stem will enable the plant to re-shoot (particularly Privets and Lantana). Use on saplings and shrubs.

* Cut stem low, near the ground and immediately paint with mix of glyphosate and water (1:1.5)

* Lightly scrape side of stem to green inner and immediately paint with glyphosate (1:1.5)

Weed Species – Brazilian Cherry, Camphor Laurel, Cat's Claw Vine, Coffee, Corky Passionfruit Vine, Guava, Lantana, Loquat, Privet (small & large leaved), Ochna, *Senna* spp (formerly *Cassia*), Tobacco.

Equipment - Secateurs/ loppers/ knife / hand saw / chainsaw /poison pot & paint brush.

Scrape and Paint

For aggressive vine species e.g. **Madeira Vine**, Cape Ivy and Morning Glory. It is imperative that *Madeira Vine should not be pulled out of the canopy* as this will spread aerial tubers.

* Scrape one side of the vine stem at 30cm lengths (to inner part of vine) with knife.

* Paint immediately with **100%** (neat) glyphosate.

* Gouge large Madeira Vine tubers (eye out) and fill with herbicide.

Scrape & paint as many parts of the vine as feasible. This technique effectively translocates herbicide to Madeira Vine aerial tubers and will kill them within a few months depending on the season. Smaller infestations of Madeira Vine and Cape Ivy can be untwined and bagged.

Weeds - **Madeira Vine, Cape Ivy and Morning Glory.**

Equipment - Knife/ poison pot & paint brush

Cutting exotic Vines & Follow-up Spray

For treating dense infestations of **Asparagus Fern**. Cut vines at head height and roll up foliage or cut vines at head height and cut low to ground. Spray regrowth. If the area is shaded do not cut foliage down low as the cut vines will produce long tendrils opposed to leaves, rather cut vines at head height and roll up. In higher light conditions cut vines will produce adequate foliage for spraying, (see spray ratios).

Weed Species - **Climbing Asparagus Fern, Cats Claw, Morning Glory**

Equipment - Secateurs/ loppers/ hedge clippers/poison pot & paint brush.

Knifing-out / Crowning-out

For prising up weeds with shallow root systems and for crowning-out plants with growing points below the soil surface eg. Asparagus Fern.

* For Asparagus Fern hold back leaves or stems, insert knife beside growing point and cut around base of plant to remove growing point. Exhumed part will regrow from growing point; hang up or pile up plant.

* For White Passionfruit (that has a two-way lateral root) locate main stem and prise up lateral roots. Severed roots will regrow.

Weed Species – Asparagus Ferns, Pointed Passionfruit, White Passionfruit, Bulbs.

Equipment - Knife

Handpull

Good for removing weeds amongst patches of native seedlings, ferns and isolated weed infestations. Carefully pull up plant including entire root system. Cut up weed stems into small pieces to increase decomposition and reduce re-shooting. Many weed species will re-shoot from severed roots and lengths of stem (in wet season) eg. Lantana, Privet and Ochna.

Weed Species - Succulents, soft herbs, Lantana, young weeds.

Equipment – Hands, gloves and a strong back

Cutting Up Weed Biomass.

Cut up weed biomass (Lantana, Camphor Laurel, and Privet) into small lengths with loppers / chainsaws to aid decomposition and to reduce re-shooting of cut stems. Cutting up weed biomass also makes the work site safe to prevent tripping over long sticks.

Weed Species - Camphor Laurel, Lantana, Tobacco Bush etc.

Equipment - Loppers, chainsaws etc.

Tree Injection /Frilling

For killing large weed shrubs and trees such as Camphor Laurel, Privet and Coral Tree. Using tomahawk cut a double row of overlapping cuts (brick-layer effect) around entire base of the tree (at 30 cm above the ground). Inject glyphosate mix of 1 : 1.5 immediately into each cut with tree injector kit. Cut and inject buttresses and roots.

Weed Species - Camphor Laurel, Loquat, Guava, Privet and Coral Tree

* Use Tordon ® or Maverick ® to kill Coral Tree

Equipment - Tomahawk / injector kit

Spearing - Tree Spear

The tree spear is specifically designed for injecting trees – Hollow spear which can be filled with herbicide mix, has a lever handle to release herbicide. Thrust chisel-like end into tree and lift handle to expose herbicide. Overlap cuts. The spear reduces handling of herbicide. Spear should be rinsed following use otherwise it will corrode.

Weed Species - Camphor Laurel, Loquat, Guava, Privet.

Equipment - The tree spear.

Brush-hooking

Brush-hook / lopper down thickets of Lantana, Crofton etc. Spray weed regrowth with herbicide. Brushhooking can help stimulate natural regeneration with the action of the blade hitting the soil.

Weed Species – Lantana, Crofton.

Equipment - Brushhook/loppers.

Herbicide Spray – Overspray, blanket spray, spot spray

Used for following up / controlling weed regrowth in a regeneration site (spot spraying) and for over-spraying dense weed thickets e.g. Lantana, Madeira Vine and for preparing for planting. Ratios differ for some weed species (refer to Herbicide ratios).

Weeds Species – most species. Bitou Bush, Lantana, Madeira Vine.

Equipment - Spray pack & protective spray gear.

Mechanical – Bulldozer, excavator, tractor.

Machinery can be useful for large-scale clearing of Lantana and Camphor Laurel being able to selectively work around natives and clear large areas quickly. Tractors are effective at pushing, slashing Lantana. Problems with machinery is that they may compact the soil, will create a lot of biomass (which is generally burnt, buried or chipped), may encourage over clearing and erosion. Weed regrowth from severed roots, seeds etc will require follow-up.

Weed Species – Camphor Laurel, Lantana etc

Equipment - Machinery

Herbicide additives.

* **Li-700 a penetrant**, is required for species that have hairy or waxy cuticles and do not respond well to herbicide eg; Madeira Vine, Camphor Laurel, Privet, Asparagus Fern, Wandering Jew, Ochna, Guava, Mistweed and Crofton (Lantana –optional)...

* **Marker dye** is recommended to guide progress of spray & to identify native plants that have been accidentally sprayed. **White Lightning** (white colour) & **Spraymate Marker Dye** is a red dye.

* **Stickers** – increases adherence of herbicide to leaf surface, good for inclement weather and can help reduce spray drift. Products: Codicide Oil.

Herbicide Ratios

Cut and Paint ratio.

1:1.5 = 1 part herbicide to 1 ½ parts water eg; 100ml herbicide to 150mls water.

100% for ... scrape & paint technique used for vines of Madeira Vine, Morning Glory etc.

Spray ratios.

1:100 (100mls of glyphosate in 10 litres of water)

for.....Annuals, Grasses & Lantana .

1:100 + 0.5 % of Li 700 (100mls of glyphosate in 10 litres of water + 50ml of Li-700) for ...

Crofton, Mistweed.

1: 50 + 0.5 % of Li 700 (200ml of glyphosate in 10 litres of water + 50ml of Li-700) for ...Asparagus Fern, Camphor Laurel, Guava, Madeira Vine, Morning Glory, Passionfruit spp, Privet, Silver-leaved Desmodium, Wandering Jew. (increase herbicide ratio for Mistweed & Crofton when plants are stressed).

Summary of weed control techniques

Cut & paint.

Cut / scrape & paint.

Scrape and paint

Cutting exotic vines & follow-up spray

Knifing, crowning out

Handpull

Cutting up weed biomass.

Tree Injection / frilling

Spearing - tree spear

Brush-hooking

Herbicide Spray – Overspray, blanket spray, spot spray

Mechanical – Bulldozer, excavator, tractor

APPENDIX 3

Weed control techniques for weed species occurring in Dalwood Scrub and the local environs.

KEY

G = glyphosate herbicide (Round Up®, Glyphosate 360®) has been recommended unless stated otherwise.

LI700= A penetrant added to spray to increase effectiveness of herbicide.

C&P= cut and paint.

S&P= scrape and paint.

C, S & P= cut, scrap and paint.

Crown= knife out plants subterranean growth structures.

HW= hand weed.

?= removal technique not adequately known at present.

Family	Scientific Name	Common Name	Removal techniques
VINES			
Aristolochiaceae	* <i>Aristolochia elegans</i>	Dutchman's Pipe ***	CS&P(1:1). Trial spray ratios on seedlings using G at 1:50+LI700.
Asparagaceae	* <i>Protasparagus plumosus</i>	Climbing Asparagus Fern ***	Vines- if dense-cut at head height and at ground, wait for regrowth, Regrowth-spray(1:50+LI700), if sparse-crown
Asparagaceae	* <i>Protasparagus africanus</i>	Climbing Asparagus Fern ***	If dense -cut head height & at ground. Spray regrowth as above(mixed success). Gouge, scrape rhizome and paint with G at (1:1.5)
Asteraceae	* <i>Delairea odorata</i>	Cape Ivy ***	Roll/rake ground infestations, S&P vines with G at (1:2.5), Spray regrowth(1:50 + LI700) Don't cut!
Basellaceae	* <i>Anredera cordifolia</i>	Madeira Vine ***	S&P ascending vines (neat/100% G), Spray (1:50 +LI700), bag & compost. Don't cut!
Convolvulaceae	* <i>Ipomea purpurea</i>	Morning Glory ***	Roll up: scrape & paint stems with G at 1:1.5 (trial 100%). Spray with G at (1:100 + LI700)
Faboideae	* <i>Desmodium uncinatum</i>	Silver *** Desmodium	Spray G at (1:50+LI700). + bag seed heads.
Passifloraceae	* <i>Passiflora suberosa</i>	Corky *** Passionfruit	Vines-CS&P(1:1.5), Regrowth-spray (1:50+LI700)
Passifloraceae	* <i>Passiflora subpeltata</i>	White*** Passionfruit	Vines-CS&P(1:1.5), spray regrowth (1:50+LI700). HP carefully & bag seeds
Polygonaceae	* <i>Acetosa sagittata</i>	Turkey Rhubarb ***	Dig up tubers. Glyphosate not very effective. Trial differing techniques.
Sapindaceae	* <i>Cardiospermum grandiflorum</i>	Balloon Vine ***	Seedlings-handpull, Vines-CS&P(1:1), Spray regrowth (1:50+LI700)
Solanaceae	* <i>Solanum seaforthianum</i>	Climbing Nightshade***	Seedlings-handpull, Vines-C,S&P(1:1.5), Spray regrowth (1:100+LI700)

TREES			
Anacardiaceae	* <i>Schinus terebinthifolia</i>	Broad-leaved Pepper Tree ***	Spray seedlings (1:50+LI700), Saplings CS&P(1:1.5), Trees frill/inject/spear (1:1.5).
Anacardiaceae	* <i>Toxicodendron succedaneum</i>	Rhus ***	Spray seedlings (1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear (1:1.5).
Oleaceae	* <i>Olea europaea</i> subsp. <i>africana</i>	African olive ***	Spray seedlings (1:50+LI700) Saplings HW or CS&P(1:1.5), Trees frill/inject/spear (1:1.5).
Pinaceae	* <i>Pinus elliottii</i>	Slash Pine***	Seedlings-handpull, spray (1:100+LI700), Saplings CS&P (1:1.5), Trees- inject(1:1.5)
Faboideae	* <i>Erythrina crista galli</i>	Indian Coral Tree ***	Inject with Tordon or Maverik at (1:1.5)

Lauraceae	* <i>Cinnamomum camphora</i>	Camphor Laurel ***	Seedlings-handpull or spray G at (1:25 + LI700), saplings-CS&P(1:1.5), Trees-frill/inject/spear (1:1.5)
Malaceae	* <i>Eriobotrya japonica</i>	Loquat	Seedlings-HW, spray (1:100+LI700) Saplings-CS&P(1:1), Trees-frill/inject/spear(1:1.5)
Oleaceae	* <i>Ligustrum lucidum</i>	Large-leaved Privet ***	Spray seedlings with G at (1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear with G at (1:1.5). Dense infestations cut back to 30cm, wait for dense regrowth and spray with G at (1:50=LI700). Hand weed around existing natives.
Oleaceae	* <i>Ligustrum sinense</i>	Small-leaved Privet ***	" "
Ulmaceae	* <i>Celtis sinensis</i>	Hackberry*** Chinese Elm	Seedlings-handpull, S&P(1:1.5), Trees-frill/inject with G at (1:1.5), spray G at (1:100+LI700)

SHRUBS			
Asteraceae	* <i>Baccharis halimifolia</i>	Groundsel ***	CS&P(1:1.5). Spray (1:50) time well before flowering.
Bignoniaceae	* <i>Tecoma capensis</i>	Cape Honeysuckle	Cut & spray with G at (1:50+LI700), CS&P stems(1:1.5)
Caesalpinoideae	* <i>Senna pendula</i> var. <i>glabrata</i>	Winter Senna	Bag seedheads, Seedlings-handpull, Shrubs-CS&P(1:1) or frill/inject with G at (1:1.5)
Caesalpinoideae	* <i>Senna X floribunda</i>	Smooth Senna	Bag seedheads, Seedlings-handpull, Shrubs-CS&P(1:1) or frill/inject (1:1.5)
Ochnaceae	* <i>Ochna serrulata</i>	Ochna ***	CS&P or frill/inject/spear(1:1.5), spray(1:50+LI700)
Poaceae	* <i>Arundinaria</i> spp.	Creeping Bamboo ***	C&P and fill stems with G at (1:1.5), Spray regrowth with G at (1:50 +L.I 700)
Verbenaceae	* <i>Lantana camara</i>	Lantana ***	CS&P(1:1.5), brush hook & spray regrowth(1:100), Handpull.
Solanaceae	* <i>Cestrum parqui</i>	Green Cestrum ***	CS&P(1:1.5), hand pull, spray with G at (1:100+LI700)

GROUNDCOVERS & HERBS ETC.			
Anthericaceae	* <i>Chlorophytum comosum</i>	Spider Plant	HW and compost, G spray not so effective, trial Brushoff ®
Asteraceae	* <i>Ageratina adenophylla</i>	Crofton ***	Spray G at (1:100+LI700 or 1:50 +LI700 if plants stressed) or handpull + hang to dry
Davalliaceae	<i>Nephrolepis cordifolia</i>	Fishbone Fern ***	Crown, spray G (1:100)- poor results. Trial Brush Off ®.
Caryophyllaceae	<i>Drymaria cordata</i> subsp. <i>Diandra</i>	Tropical Chickweed	Spray (1:100+LI700) or handpull. Shade out
Commelinaceae	* <i>Tradescantia fluminensis</i> (<i>albiflora</i>)	Wandering Jew ***	Spray with G at (1:50+LI700) when growing. Roll or rake then handpull remaining parts and compost.
Iridaceae	* <i>Crococsmia X crocosmiiflora</i>	Monbretia or Crocosma ***	Spray between flower and fruit (1:100 + Li700), hand pull, dig up bulbs-compost in black plastic
Phytolaccaceae	* <i>Rivina humilis</i>	Coral Berry ***	Bag seed heads, Shrubs- handpull or spray G at 1:100)

Species with *** are either:

- known as serious environmental weeds
- display the characteristics of a serious weed

Conservation Code

2 The Distribution Category (can be 1, 2 or 3)

- 1 Known by one collection only,
- 2 Geographic range in Australia less than 100 km.
- 3 Geographic range in Australia greater than 100 km.

K The Conservation Status (can be X, E, V, R or K)

X Presumed Extinct: taxon not collected or otherwise verified over the past 50 years despite thorough searching in all known and likely habitats, or of which all known wild populations have been destroyed more recently.

E Endangered: taxon in serious risk of disappearing from the wild within 10–20 years if present land use and other threats continue to operate. This category includes taxa with populations possibly too small (usually less than 100 individuals) to ensure survival even if present in proclaimed reserves.

V Vulnerable: taxon not presently Endangered, but at risk over a longer period (20–50 years) of disappearing from the wild through continued depletion, or which occurs on land whose future use is likely to change and threaten its survival.

R Rare: taxon which is rare in Australia (and hence usually in the world) but which currently does not have any identifiable threat. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wide range or some intermediate combination of distribution pattern.

K Poorly Known: taxon that is suspected, but not definitely known, to belong to one of the above categories. At present, accurate field distribution information is inadequate.

C Reserved: indicates taxon has at least one population within a national park, other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora. The taxon may or may not be considered adequately conserved within the reserve(s), as reflected by the conservation status assigned to it. Where applicable, the 'C' symbol immediately follows the conservation status symbol in the written code, e.g. 2RC.

i Size-class of all reserved populations (options are a, i or –)

- a 1000 plants or more are known to occur within a conservation reserve(s),
- i less than 1000 plants are known to occur within a conservation reserve(s),
- reserved population size is not accurately known;

t Total known population reserved;

+ Overseas occurrence (included if the taxon has a natural occurrence overseas);

P1 CALM Priority Flora Code (can be P1, P2, P3, P4 – see Appendix for definitions).

State and regional distribution and extent of reservation

Ws State(s) or Territory in which the taxon still occurs (upper case), or where it once occurred but is now Presumed Extinct (lower case). Any one or more of the symbols WYSQNAV T or wysqnavt are possible: W = Western Australia, Y = Northern Territory, S = South Australia, Q = Queensland, N = New South Wales, A = Australian Capital Territory, V = Victoria and T = Tasmania.

6, 23 Regions of occurrence (can be in any of 1–80 regions; see Figure 1, p. 17).

C The use of the C symbol in conjunction with a region number indicates that the taxon is reserved in that region (region 6 in this example).

i Size-class of the total population within the reserve referred to (options are a, i or –). In this example, the size-class in Cape Arid National Park is less than 1000 individuals).

x Indicates that the taxon is Presumed Extinct within a region (region 23 in this example).

Cape Arid The name of a proclaimed reserve or other area dedicated to the protection of flora within which the taxon occurs in the region referred to (the taxon may occur within several reserves within a particular region and sometimes a reserve may extend across two or more regions).

NP Indicates the class of reserve which is listed e.g. Nature Reserve, National Park, Heritage Agreement Area (in this example, National Park) (see Table 2, p. 15 for the key to conservation reserve types listed in this publication).

APPENDIX 5

Recommended guidelines for weeding near threatened plants, particularly for *Isoglossa eranthemoides*

- Individual plants or clumps of plants should be tagged for easy location and identification during regeneration work, (including primary & follow-up).
- Hand weeding should be undertaken wherever feasible, particularly around herbs.
- Small populations should preferably be hand weeded. If herbicide techniques are required cover individual plants with plastic containers prior to spray application.
- Care should be taken not to use herbicide to treat neighbouring plants which may have root contact with plants.
- Where herbicide techniques are the main restoration technique applied, maintain a herbicide free area within the regeneration site.
- Where herbicide techniques are used bottom prune and direct herbicide spray away from plants.
- Hand weeding is recommended amongst isolated patches of herbs within a sub-population prior to spray work to avoid direct contact with herbicide spray.
- Whenever *Isoglossa* or other species (common and threatened) are inadvertently sprayed with herbicide, affected parts of the plant should be immediately removed with secateurs.
- Herbicide based control of ground weeds may be more appropriate when *Isoglossa* plants are in fruit. This may encourage seedling establishment by removing weed competition and by increasing light penetration to the ground layer.
- In heavily weed infested sites determine if the microclimate created by weeds is required by the threatened plant. If microclimate is favoured incrementally control weeds.

Note that licences under Section 91 of the Threatened Species Conservation Act (1995) are required to carry out work which may involve "picking" or "harming" a threatened species.

I.P. I

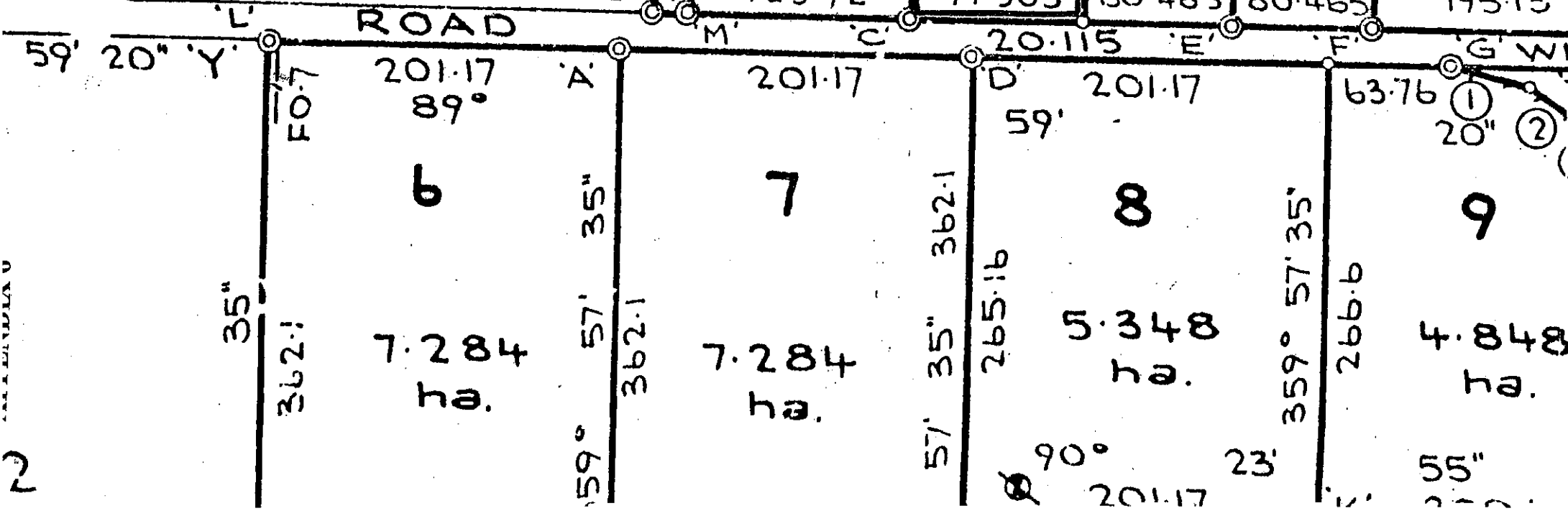
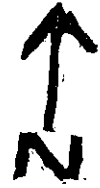
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