

THE BUSHLANDS OF MT FOXLOW - HARRISONS PEAK

A PRELIMINARY ECOLOGICAL ASSESSMENT



A REPORT TO THE SAVE THE BUSH GRANTS SCHEME,
AND THE STONEY CREEK LANDCARE GROUP

by

Nicki Taws

January 1998

THE BUSHLANDS OF MT FOXLOW - HARRISONS PEAK

A PRELIMINARY ECOLOGICAL ASSESSMENT

CONSULTANTS REPORT TO THE SAVE THE BUSH GRANTS SCHEME,
AND THE STONEY CREEK LANDCARE GROUP

by
Nicki Taws

January 1998

Inquiries about this report should be made to:

Stoney Creek Landcare Group
c/- 25 Radcliffe Circuit
via Queanbeyan
NSW 2620



F0072843

SUMMARY

A survey of the flora of south-east Yarrowlumla Shire carried out by Peter Barrer in 1994-95 identified a 10,000 hectare block of bushland around Mt Foxlow - Harrisons Peak as being of particular conservation significance and worthy of a more detailed ecological assessment (Barrer 1997).

The first stage of a three stage study of the bushlands was completed in 1997, assessing the ecological qualities and values of the study area. In particular, significant plant species, associations and faunal habitats were identified, and management guidelines in relation to planned burning in the area have been proposed.

The bushlands contain a range of vegetation types including small areas of wet sclerophyll forest and wet heath - shrubland, intermediate sclerophyll forest, dry sclerophyll forest, and savannah woodlands. Within the vegetation types a range of vegetation associations were identified and mapped.

Significant vegetation associations include wet sclerophyll forest of *Eucalyptus fastigata*, *E. viminalis* and *E. robertsonii*; intermediate sclerophyll forests of *E. viminalis*; *E. bridgesiana* granite rocklands; *E. sieberi* dry sclerophyll forest; wet heath and *Banksia marginata* shrublands.

A total of 197 native plant species have been recorded in the bushlands. Significant species include *Eucalyptus cinerea* subsp. *triplex*, *Discaria pubescens*, *Pomaderris phyllicifolia* var. *phyllicifolia*, *Allocasuarina littoralis*, *Eucalyptus aggregata*, *Bossiaea prostrata*, *Hypolepis rugulosa* and *Polystichum australiense*.

A predator scat survey of the area collected 253 scats for analysis. Fourteen native mammal species and five introduced mammals were identified from the analysis. Significant species identified in the scats were Yellow-bellied Glider, possible Squirrel Glider, Feathertail Glider and Wallaroo.

Appropriate management of fire in the bushland will be important in protecting the natural values of Mt Foxlow - Harrisons Peak. It is proposed that the bushlands be divided into three zones for fire management; a protection zone, an ecological burn zone and a no-burn zone. Guidelines for fire regimes in the ecological burn zone have been provided.

Recommendations are given for further survey work and fire research in the bushlands.

ACKNOWLEDGMENTS

This project was carried out with funding from the Australian Nature Conservation Agency through the Save the Bush grants scheme. Peter Barrer held a particular interest in the ecological values of the area and provided the initial guidance and impetus for the project. A number of local landholders, particularly Hugh Gault of "The Springs" and Shenna Joiner, "Camelot", assisted in gaining access to the bushlands and gave freely of their knowledge of the area. The NSW National Parks and Wildlife Service loaned the aerial photographs used for the vegetation mapping. The following people were involved with the scat collection: Tim Booth, Tom Baker, Les Manning, Lynton Bond, Pam Handyside, Peter and Harry Hess. Anthony Scott helped greatly with map production. Assistance with the report editing was provided by Lynton Bond, Tom Baker and Tim Booth of the Stoney Creek Landcare Group.

SUMMARY

ACKNOWLEDGMENTS

1. INTRODUCTION & AIMS

2. THE STUDY AREA

3. VEGETATION

3.1 Methods

3.1.1 Vegetation Mapping

3.1.2 Vegetation Classification

3.2 Results

3.2.1 The Vegetation Types, Communities and Associations

1. Wet Sclerophyll Forest

2. Intermediate Sclerophyll Forest

3. Dry Sclerophyll Forests and Woodlands

4. Savannah (Grassy) Woodland

5. Heathland

3.2.2 Significant Vegetation Associations

3.2.3 Plant Species

3.2.4 Significant Plant Species

3.2.5 Areas for Further Study

4. FAUNA

4.1 Methods

4.2 Results

4.2.1 Predator Scat Analysis

4.2.2 Significant Fauna Records and Faunal Habitat

5. FIRE MANAGEMENT

5.1 Fire Ecology and Conservation

5.2 Fire Management of Mt Foxlow - Harrison's Peak Bushlands

6. RECOMMENDATIONS

REFERENCES

APPENDICES

1. Native Plant Species List

MAPS

1. The Study Area
2. Vegetation Types
3. Vegetation Associations
4. Areas for Further Study
5. Fire Zones

1. INTRODUCTION & AIMS

A survey by Barrer (1997) of remnant native vegetation in the south-east section of Yarrowlunla Shire identified areas of high or potentially high nature conservation significance. The largest and most valuable of these remnants was the bushlands of the Mt. Foxlow - Harrison's Peak area, with two smaller but connected areas, the Queanbeyan River corridor and Captains Flat bushlands also identified as of high conservation significance. These three areas were identified as being vulnerable to a range of existing and proposed activities, likely to lead to vegetation and biodiversity loss or decline. Funds were applied for to undertake a three-year assessment of the significance of these bushlands and to gather ecological information for management purposes.

AIMS OF THE STUDY

1. To assess the ecological qualities and values of the study area in detail sufficient to identify most or all community-, habitat- and species-specific management needs and constraints.
2. To work with Crown Lands, interested landholders (freehold and leasehold) within the study area, Yarrowlunla Shire Council, and other interested parties to identify and implement actions to ensure the continued survival of the study area's natural ecological values.

Anticipated Outcomes:

1. Maps and descriptions of major native plant communities and associations with reference to:
 - a. their distributions, abundances, habitats and conditions within the study area
 - b. any management needs and constraints
 - c. any communities/associations that may be uncommon, rare or threatened at the local, regional, state or national levels.
2. Lists of native plant species with particular reference to:
 - a. their distributions, abundances, habitats and conditions within the study area
 - b. the locations of any unusual examples of plants
 - c. any management needs and constraints of 'sensitive' or otherwise significant species
 - d. any species that may be uncommon, rare or threatened at the local, regional, state or national levels.
3. Maps of locations and extents of any areas that are unusually 'plant species rich', together with descriptions.
4. Lists of introduced plant species, with particular reference to the location (and distribution) of any 'environmental weeds'.
5. Maps of locations and extents of any areas that particularly prone to soil erosion if their vegetation cover is damaged, and of areas with past or currently active soil erosion.
6. Lists of faunal habitats and species, with particular reference to :
 - a. descriptions, distributions, locations and conditions of faunal habitats
 - b. lists of birds, small and large terrestrial mammals, arboreal mammals, aquatic mammals, reptiles, frogs and threatened invertebrates, with information on distributions, abundances and habitats (where available).
 - c. any specific management needs or constraints for particular habitats or species
 - d. species that are uncommon, rare or threatened at the local, regional, state or national levels.

The project was planned to be undertaken in three stages, and funding was applied for to cover all stages. Funding for the first stage of the project was received from the Save the Bush Grants Scheme, however it was less than half of the amount applied for.

In light of the limited resources available, the aims and scope for the study in the first stage were necessarily reduced. Effort was concentrated on assessment of the largest of the three areas, the Mt Foxlow-Harrisons Peak bushlands. The primary aim was:

1. To assess the ecological qualities and values of the study area in detail sufficient to identify most or all community-, habitat- and species-specific management needs and constraints.

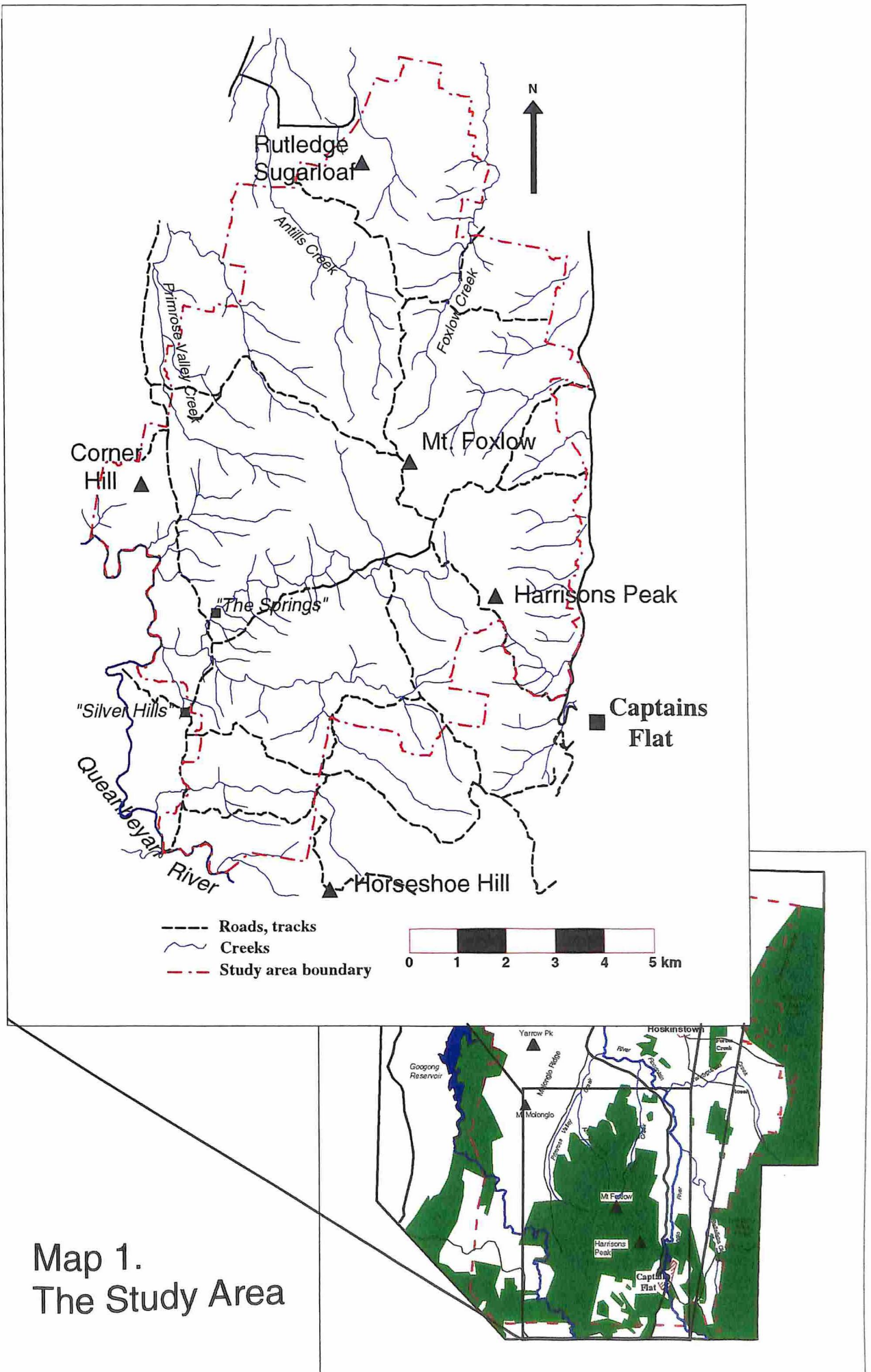
Particular objectives were:

- to identify and define the distributions of plant communities, associations, species and faunal habitats that may be sensitive to possible future fuel reduction burns
- to identify and define the distributions of sites, communities, habitats, species, etc that are likely to warrant more detailed study in stages 2 & 3 of the project.

From the list of outcomes above, the first stage of the project aimed to produce:

1. Maps and descriptions of plant associations
2. Lists and descriptions of native plant species
3. Descriptions of significant areas warranting further detailed study
4.
 - a. Preliminary descriptions of faunal habitats
 - b. Preliminary list of mammals from predator scat analysis
5. Preliminary information to guide proposed fuel reduction burns.

This report presents the results of the first stage of the survey.



2. THE STUDY AREA

Location

The study area covers approximately 10,000 hectares of bushland in the south-east corner of the Yarrowlunla Shire, near Captains Flat (see Map 1). It lies between the Molonglo River to the east and the Queanbeyan River along the western boundary. The bushland covers the two peaks of Mt Foxlow (1215 metres) and Harrisons Peak (1173 m.) and the surrounding slopes down to an altitude of 750 metres along the Queanbeyan River.

Geology and rainfall

Most of the study area is underlain by old (Ordovician) sedimentary rocks. A narrow strip of slightly younger (Silurian) sediments runs along the western boundary near Corner Hill. The main geological variation in the area is found in the large outcrop of Devonian granite around Harrisons Peak, and in the steep quartzite ridges near Rutledge Ridge in the north of the study area.

Although no rainfall stations are found within the study area, general rainfall figures can be determined from the climate map for the region produced by McAlpine and Yapp (1969). Rainfall in the north of the study area is around 650 mm per annum, and at Captains Flat in the south-east it is about 750 mm. However the highest peaks in the study area undoubtedly receive greater rainfall due to orographic effects, and although it is unmeasured, totals may reach 900 mm or more per annum.

Land tenure and uses

Land tenure in the area is approximately two-thirds leased Crown Land, and one-third freehold lands which lie mostly in the south-east of the study area and along the Captains Flat Road.

Much of the study area has retained its cover of native vegetation. Most of the area is leased for grazing purposes, although at present there is little direct evidence of stock other than along the lower slopes overlooking the Molonglo River, and in areas currently cleared for grazing.

Early and more recent clearing appears to have occurred in a patchy fashion, mainly on the lower slopes and footslopes. Many of these areas are in early or advanced stages of regeneration. In general, areas shown as discrete portions on the 1:25,000 Captains Flat map appear to have received this treatment. One high-country valley (part Portions 73, 115) was cleared in the more distant past and is now regenerating. Another, nearby valley (Portions 140, 6, 207, 208, 115, 116, 29) was part-cleared more recently, apparently illegally, and is in the early stages of regeneration. This latter valley appears to be periodically lived in.

Some areas have been cleared and maintained for grazing purposes, forming open grasslands. These are found mostly in the south-east and along the lower sections of some major creeks (eg Foxlow Creek, Primrose Valley Creek) and gullies.

A network of fire trails is present, although entry is gained through private properties and access is generally restricted. Vegetation along some of these fire trails shows evidence of past attempts to widen them. Currently, there are plans to conduct fuel-reduction burns over some or all of the area.

In the far north-west, development for rural residential lots has impinged on areas of intact vegetation in a minor way.

3. VEGETATION

3.1 Methods

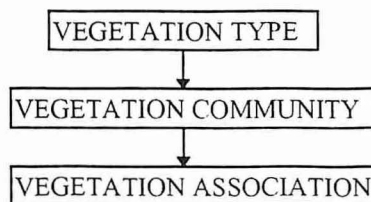
3.1.1 Vegetation Mapping

Mapping was carried out by interpretation of stereo pairs of colour aerial photographs, at a scale of 1:25,000. Preliminary boundaries between vegetation associations were drawn on the photos using differences in colour, texture and tree crown size, and ecological factors such as aspect, slope and elevation. Ground truthing was carried out to define the associations and verify boundaries. Classification and boundaries were revised where necessary following ground truthing.

The boundaries were transferred from the aerial photos to the 1:25,000 scale topographic maps covering the study area, Captains Flat and Hoskinstown, and were then digitised into MapInfo Pro v.4 so that the information would be available digitally and easily reproduced.

3.1.2 Vegetation Classification

The vegetation of the Mt Foxlow - Harrisons Peak area was classified on three levels:



The vegetation of the wider region was originally mapped by Storey (1969) who defined seven broad vegetation types, and within each type a number of vegetation communities. These definitions of type and community have been retained for this report.

Within the forest and woodland communities a wide range of tree species may occur, growing in various combinations with each other depending on environmental factors. These tree associations form the basis of the vegetation map. The associations have been defined, in most cases, by the two commonest tree species, but sometimes three, and very occasionally four species were judged to be codominant. The associations defined resemble those described by Costin (1954) but no attempt was made to confine the classification to his associations.

Mapping has been confined predominantly to the distribution of tree associations, as this is the most visible vegetation feature on the aerial photographs. The understorey can rarely be seen beneath the canopy and therefore does not influence the classification of tree associations. However, within the tree associations of one community (for eg. the Gum community) there is usually a characteristic suite of understorey species. By mapping the tree associations, the understorey is also mapped in a broad sense, and the map of tree associations can generally be considered as a map of vegetation associations.

3.2 Results

3.2.1 The Vegetation Types, Communities and Associations

Descriptions of the broad vegetation types and communities of the study area have been taken from Storey (1969) and Barrer (1997). The map of vegetation types of the study area (Map 2) has been produced from the detailed map of vegetation associations. This is slightly different and more accurate than the broadscale vegetation type map produced by Storey which was drawn using poorer quality aerial photographs and after much less fieldwork in the area.

Map 3 shows the distribution of the vegetation associations. The associations are described below from observations made in the field at the time of mapping, and notes are included on location, structure, tree species and understorey composition. Each association is labelled on the map with a code abbreviation of the names of the tree species, for eg. "da-di" is the association of *Eucalyptus dalrympleana* and *E. dives*.

A summary of the vegetation types, communities and associations occurring within the study area is presented on the next page in Table 1.

1. Wet Sclerophyll Forest

Fully developed wet sclerophyll forest is rare in the study area, restricted to sheltered aspects and gully sites in the highest rainfall areas. It is more abundant to the east of the study area, in parts of Tallaganda State Forest.

Trees of wet sclerophyll forests are typically very tall (20-35 metres). The understorey is fairly uniform, consisting of scattered small trees (*Acacia melanoxylon*) and tall shrubs (*Coprosma*, *Pomaderris*, *Olearia*, *Lomatia*, *Polyscias*). Only one of Storey's wet sclerophyll communities occurs in the study area.

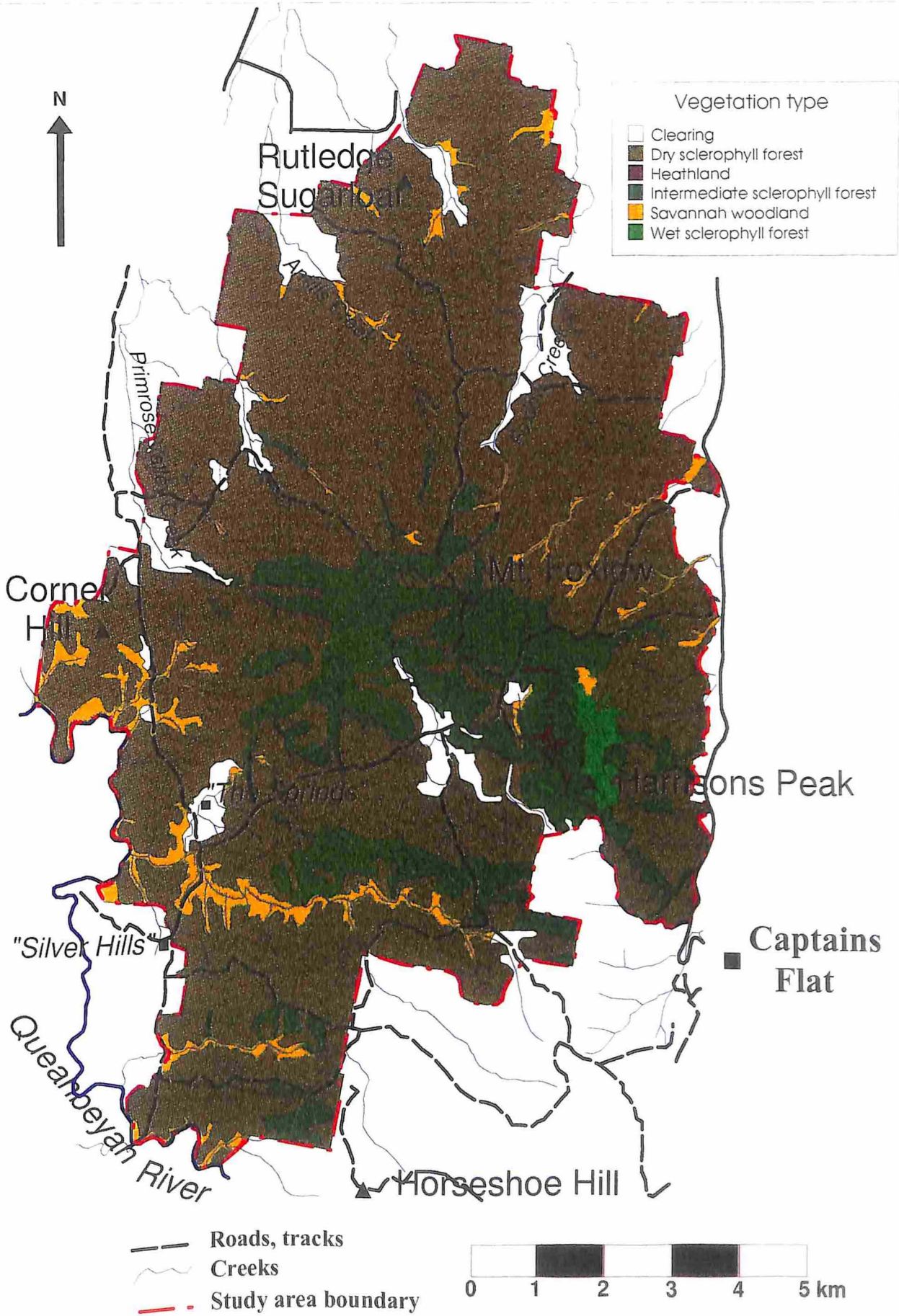
1a. The Mountain Community: Brown Barrel (*E. fastigata*) - Narrow-leaved Peppermint (*E. robertsonii*)- Manna Gum (*E. viminalis*).

The only location in the study area where conditions are moist enough to support this community is on the highest parts and east facing slopes of the Harrisons Peak ridgeline. Geology also plays a role in the occurrence of wet sclerophyll forest at this site, as the granitic soils of Harrisons Peak allow a moister vegetation type to exist than the adjacent finer textured soils which occur on Mt Foxlow.

E. fastigata is restricted to the highest granite knolls with a mix of *E. viminalis*, *E. robertsonii* and occasionally *E. pauciflora* on the intervening slopes.

Associations of the Mountain community found in the Harrisons Peak area are listed below:

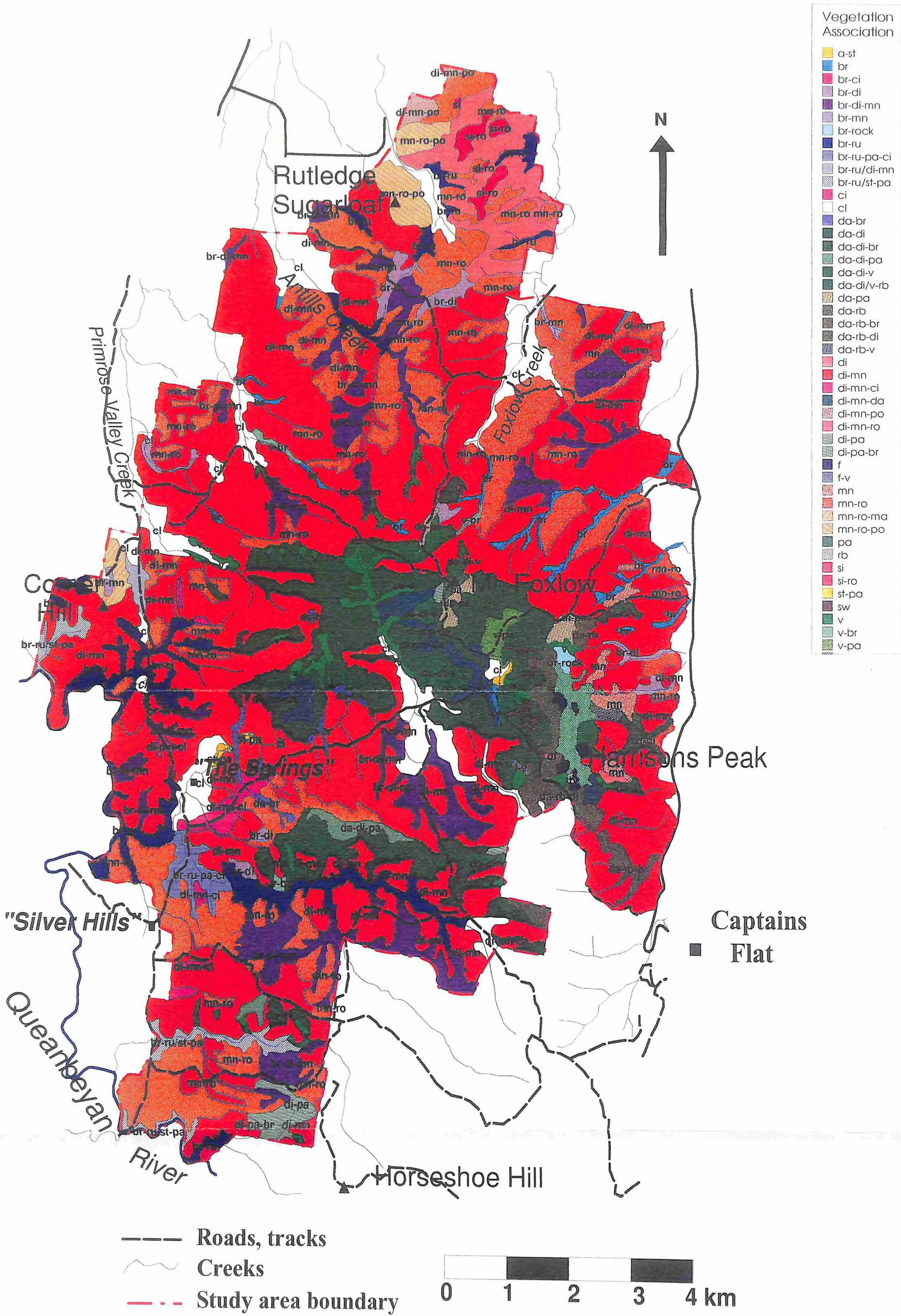
- **f - *E. fastigata***
This association forms a tall open forest restricted to the highest altitudes on the granite soils of Harrisons Peak. *E. fastigata* forms mostly pure stands but occasionally includes *E. viminalis* as a codominant (**f-v**), or *E. robertsonii* and *E. pauciflora* as subdominant species. The understorey includes wet sclerophyll species such as *Acacia melanoxylon* and *Lomatia myricoides*, however shrubs are usually scattered and the understorey is often limited to a few herbaceous species between granite rocks and a deep litter.
- **v-rb - *E. viminalis* - *E. robertsonii***
Occurring as a tall to very tall open forest at higher altitudes on granite around Harrisons Peak. The understorey varies from dense patches of shrubs such as *Acacia dealbata*, *A. falciformis* and *Pomaderris phyllicifolia* var. *phyllicifolia* to open with boulders, litter and scattered herbs or sedges, *Dianella tasmanica* and *Lepidosperma laterale*. *E. robertsonii* is very occasionally found in pure stands (**rb**), in similar situations to the v-rb association.



Map 2. Vegetation Types

Table 1. Vegetation Types, Communities and Associations in the Study Area

Vegetation Type	Vegetation Community	Vegetation Association
Wet sclerophyll forest	Mountain community	<i>E. fastigata</i> (f) <i>E. fastigata</i> - <i>E. viminalis</i> (f-v) <i>E. robertsonii</i> (rb) <i>E. viminalis</i> - <i>E. robertsonii</i> (v-rb)
Intermediate sclerophyll forest	Gum community	<i>E. dalrympleana</i> - <i>E. bridgesiana</i> (da-br) <i>E. dalrympleana</i> - <i>E. dives</i> (da-di) <i>E. dalrympleana</i> - <i>E. dives</i> - <i>E. bridgesiana</i> (da-di-br) <i>E. dalrympleana</i> - <i>E. dives</i> - <i>E. pauciflora</i> (da-di-pa) <i>E. dalrympleana</i> - <i>E. dives</i> - <i>E. viminalis</i> (da-di-v) <i>E. dalrympleana</i> - <i>E. pauciflora</i> (da-pa) <i>E. dalrympleana</i> - <i>E. robertsonii</i> (da-rb) <i>E. dalrympleana</i> - <i>E. robertsonii</i> - <i>E. bridgesiana</i> (da-rb-br) <i>E. dalrympleana</i> - <i>E. robertsonii</i> - <i>E. dives</i> (da-rb-di) <i>E. dalrympleana</i> - <i>E. robertsonii</i> - <i>E. viminalis</i> (da-rb-v) <i>E. dives</i> - <i>E. pauciflora</i> (di-pa) <i>E. dives</i> - <i>E. pauciflora</i> - <i>E. bridgesiana</i> (di-pa-br) <i>E. pauciflora</i> (pa) <i>E. viminalis</i> (v) <i>E. viminalis</i> - <i>E. bridgesiana</i> (v-br) <i>E. viminalis</i> - <i>E. pauciflora</i> (v-pa)
Dry sclerophyll forest and woodland	Brittle Gum - Scribbly Gum Community	<i>E. bridgesiana</i> - <i>E. cinerea</i> ssp. <i>triplex</i> (br-ci) <i>E. bridgesiana</i> - <i>E. dives</i> (br-di) <i>E. bridgesiana</i> - <i>E. dives</i> - <i>E. mannifera</i> (br-di-mn) <i>E. bridgesiana</i> - <i>E. mannifera</i> (br-mn) <i>E. cinerea</i> ssp. <i>triplex</i> (ci) <i>E. dives</i> (di) <i>E. dives</i> - <i>E. mannifera</i> (di-mn) <i>E. dives</i> - <i>E. mannifera</i> - <i>E. cinerea</i> ssp. <i>triplex</i> (di-mn-ci) <i>E. dives</i> - <i>E. mannifera</i> - <i>E. dalrympleana</i> (di-mn-da) <i>E. dives</i> - <i>E. mannifera</i> - <i>E. polyanthemos</i> (di-mn-po) <i>E. dives</i> - <i>E. mannifera</i> - <i>E. rossii</i> (di-mn-ro) <i>E. mannifera</i> (mn) <i>E. mannifera</i> - <i>E. rossii</i> (mn-ro) <i>E. mannifera</i> - <i>E. rossii</i> - <i>E. macrorhyncha</i> (mn-ro-ma) <i>E. mannifera</i> - <i>E. rossii</i> - <i>E. polyanthemos</i> (mn-ro-po)
	Silver-topped Ash Community	<i>E. sieberi</i> (si) <i>E. sieberi</i> - <i>E. rossii</i> (si-ro)
Savannah (grassy woodland)	Apple Box - Yellow Box Community	<i>E. bridgesiana</i> (br) <i>E. bridgesiana</i> rocklands (br-rock) <i>E. bridgesiana</i> - <i>E. rubida</i> (br-ru) <i>E. bridgesiana</i> - <i>E. rubida</i> - <i>E. pauciflora</i> - <i>E. cinerea</i> (br-ru-pa-ci)
	Frost-pocket Community	<i>E. stellulata</i> - <i>E. pauciflora</i> (st-pa) <i>E. aggregata</i> - <i>E. stellulata</i> (a-st)
Heathland	Mountain Heath	<i>Baeckea utilis</i> - <i>Epacris microphylla</i> - <i>Restio australis</i> (sw)



Map 3. Vegetation Associations

2. Intermediate Sclerophyll Forest

The term "intermediate" is not commonly used to describe sclerophyll forests, which are more normally known as either "wet" or "dry". A classification of "intermediate sclerophyll forest" was established by Storey (1969) for the Queanbeyan - Shoalhaven land study to describe vegetation types characterised by *Eucalyptus dalrympleana*, *E. viminalis* and *E. pauciflora* growing where annual rainfall is about 875 mm.

The understorey is usually open and grassy with a sparse shrub layer containing species from both wet and dry sclerophyll forests. Those species more typical of wet forest understoreys include *Acacia melanoxylon*, *Polyscias sambucifolia*, *Olearia erubescens*, *O. stellulata*, *Lomatia myricoides*, *Coprosma* spp., and the ferns *Dicksonia antarctica* and *Cyathea australis*.

Only one community of intermediate sclerophyll forests occurs in the study area:

2a. **The Gum Community - Mountain Gum** (*E. dalrympleana*) - **White Sallee** (*E. pauciflora*) - **Manna Gum** (*E. viminalis*)

The most common tree species are the Gums *E. dalrympleana*, *E. pauciflora*, *E. viminalis*, and *E. rubida*, mixed in varying proportions. Both peppermints, *E. robertsonii* and *E. dives* are also frequent, except at the upper and lower extremes.

E. bridgesiana may be present in association with any of the gums or peppermints, although usually only at lower altitudes.

The gum species form a topographic sequence over the range of altitude where this community occurs. The sequence from highest altitude to lowest is:

E. pauciflora
E. pauciflora, *E. dalrympleana*
E. pauciflora, *E. dalrympleana*, *E. viminalis*
E. pauciflora, *E. dalrympleana*, *E. rubida*, *E. viminalis* (below approx 1075 m.)
E. pauciflora, *E. rubida*, *E. viminalis*

Associations of the gum community which occur in the study area are given below:

- **da-di** - *E. dalrympleana* - *E. dives*
A widespread open forest association occurring at mid to high altitudes. Where *E. dalrympleana* grows at lower altitudes it resembles *E. rubida* in appearance, and may have been confused with this species in some situations. The understorey is generally open and grassy. Scattered shrubs include *Exocarpos strictus*, *Omphacomeria acerba* and *Daviesia mimosoides*. Occasional associations occur with other tree species, usually *E. bridgesiana* (**da-di-br** association) or *E. viminalis* (**da-di-v** association).
- **da-br** - *E. dalrympleana* - *E. bridgesiana*
At the lowest altitudes of its range, *E. dalrympleana* is restricted to cooler moist situations in gullies where it associates with *E. bridgesiana*. The understorey is open and grassy with occasional shrubs of moist places such as *Acacia dealbata* and *Cassinia longifolia* along the drainage lines.
- **da-pa** - *E. dalrympleana* - *E. pauciflora*
Occurring at high altitudes in cool dry locations, this open forest merges with **da-di** or **di-pa** in warmer situations. The understorey is usually open with scattered shrubs such as *Leucopogon lanceolatus* and *Acacia dealbata*, the grass *Poa sieberiana* or Bracken, *Pteridium esculentum*.
- **da-rb** - *E. dalrympleana* - *E. robertsonii*
This tall open forest association occurs only at high altitudes on granite soils around Harrisons Peak. It occasionally includes *E. viminalis* (**da-rb-v**) and at the lower edges of its range may include *E. dives* (**da-rb-di**). The ground is often rocky and understorey

may be limited to herbaceous plants such as *Dianella tasmanica* and *Lomandra longifolia*, with a deep litter layer. Around bare rock slabs, water seepages may allow the development of stands of the Tea-tree, *Leptospermum myrtifolium*. Rarely, *E. bridgesiana* occurs, forming the **da-rb-br** association.

- **di-pa** - *E. dives* - *E. pauciflora*

Occurring at high altitudes on dry sheltered slopes. Merges with the **da-di** association, sometimes forming a **da-di-pa** association, and will occasionally include *E. bridgesiana* (**di-pa-br**). The understorey is open and similar to that of the **da-pa** association. At the highest altitudes, such as around the peak of Mt Foxlow, *E. pauciflora* occurs in pure stands (**pa**).

- **v** - *E. viminalis*

A tall to very tall open forest found at higher altitudes on better soils and in more sheltered situations. Also occurring at lower altitudes but only in well protected south facing gullies. The understorey is open with scattered shrubs typical of moist situations such as *Acacia melanoxylon*, *Cassinia longifolia* and *Lomatia myricoides*, and a ground layer mainly of litter with scattered herbs and grasses. On high altitude flats, particularly between Mt Foxlow and Harrisons Peak, *E. viminalis* associates with *E. pauciflora* (**v-pa**), however much of this association was subject to clearing and is only now slowly regenerating. More rarely, *E. bridgesiana* is found with *E. viminalis* forming a **v-br** association.

3. Dry Sclerophyll Forest and Woodland

Trees of dry sclerophyll forest and woodland are not as tall as those of intermediate or wet sclerophyll forest, usually ranging from 6-20 metres in height. The most common species are *Eucalyptus mannifera*, *E. rossii* and *E. dives*.

The understorey is characterised by the presence of ericoid (heath-leaved) and sometimes prickly shrubs, rather than the broader and softer-leaved shrubs typical of wet sclerophyll forest. Typical species of the heath shrub component include: the heaths, *Brachyloma daphnoides*, *Leucopogon fletcheri* ssp. *A* and *Melichrus urceolatus*; the pea-flowering shrubs *Bossiaea buxifolia*, *Daviesia mimosoides*, *Dillwynia sericea*, *Hardenbergia violacea*, *Hovea linearis*, *Pultenaea microphylla* and/or *P. procumbens*; and the Guinea Flower, *Hibbertia obtusifolia*.

Not infrequently, however, understorey shrubs occur as very sparse or isolated individuals or groups, and the below-tree vegetation is dominated by a ground layer of tall grasses, mainly *Chionochloa pallida*. Much of the earlier cleared forest has reverted to an immature and dense form of the original forest. Two of the dry sclerophyll forest communities identified by Storey (1969) are found in the Mt Foxlow-Harrisons Peak bushlands.

3a. The Brittle Gum (*E. mannifera*) - Scribbly Gum (*E. rossii*) Community

This is by far the most widespread community in the study area, common throughout the intermediate altitudes on a range of soil types and aspects.

E. dives has been included with this community as it rarely forms a definite community on its own. It is characteristically dominant or subordinate in mixtures with other communities, including the intermediate sclerophyll forests, however it is most common in the dry sclerophyll forests.

E. cinerea ssp. *triplex* is a rare species occurring on the western edge of the study area. It is codominant or subdominant with a number of species of the Brittle Gum - Scribbly Gum community, including *E. bridgesiana*, *E. dives* and *E. rubida*.

- **di-mn** - *E. dives* - *E. mannifera*

The most widespread vegetation association in the study area, occurring from low to high altitudes. It merges with the **mn-ro** association on the warmer drier slopes to form **di-mn-ro**, and with the **da-di** association in higher cooler situations to form **di-mn-da**. The understorey contains a variety of shrubs such as *Daviesia leptophylla*, *Brachyloma daphnoides*, *Pultenaea microphylla*, *Leucopogon fletcheri* and *Acacia dealbata*, or it may be quite open and grassy, dominated by the grass *Chionochloa pallida*. At higher altitudes the small tree *Acacia falciformis* is an important part of the association, occasionally growing in dense patches as tall as the eucalypts. At lower altitudes in the west and south-west of the study area, *E. cinerea* subsp. *triplex* occurs in this association as a sub-dominant tree species, forming a **di-mn-ci** association. *E. polyanthemos* may be present where this association merges with savannah woodland forming a **di-mn-po** association.

- **br-di-mn** - *E. bridgesiana* - *E. dives* - *E. mannifera*

Similar to the widespread di-mn open forest association but with *E. bridgesiana* as a codominant species. Found most commonly along creeks at low to mid altitudes, but also on some sheltered slopes. Either of *E. dives* or *E. mannifera* may be locally absent forming **br-di** or **br-mn** associations.

- **ci** - *E. cinerea* subsp. *triplex*

On rare occasions *E. cinerea* subsp. *triplex* forms almost pure stands, although it is more commonly mixed with the **di-mn** (**di-mn-ci**) association or with *E. bridgesiana* (and occasionally *E. rubida*) in gullies (**br-ci**)

- **di** - *E. dives*

E. dives occasionally grows in pure stands, usually at higher altitudes, forming an open forest with elements of both intermediate and dry sclerophyll forests. The tree, *Acacia falciformis* is often present, growing in clusters. Where the overstorey is dense the ground cover is sparse or may consist purely of litter.

- **mn-ro** - *E. mannifera* - *E. rossii*

A widespread open forest at low to mid altitudes and drier exposed slopes. In the harsher situations *E. rossii* becomes dominant, whereas on better sites *E. mannifera* may form pure stands (**mn**). In northern parts of the study area, this association may include *E. macrorhyncha* (**mn-ro-ma**) or *E. polyanthemos* (**mn-ro-po**). A variety of low shrubs such as *Brachyloma daphnoides*, *Leucopogon* spp., *Daviesia leptophylla*, *Acacia* spp., *Dillwynia sericea*, *Pultenaea* spp. and *Comesperma ericinum* form a diverse and interesting understorey. *Chionochloa pallida* is the dominant grass with a range of herbs and orchids present.

3b. The Dry Silver-topped Ash (*E. sieberi*) Community

- **si-ro** - *E. sieberi*-*E. rossii*

Restricted to the quartzite outcrops around Rutledge Ridge in the north of the study area. *E. sieberi* may occur in pure stands (**si**) or include *E. rossii*, and occasionally *E. dives*. A common small tree in the understorey is *Allocasuarina littoralis*. The ground layer is very sparse or represented only by litter over the quartz boulders and gravel. Most of this vegetation association was burnt in 1985 resulting in dense stands of *E. sieberi* and *A. littoralis* regrowth

4. Savannah (Grassy) Woodland

Savannah woodland is characterised by a woodland or open woodland structure, an understorey that is very sparse or absent, and a mid-dense to dense groundlayer dominated by native grasses and forbs. It occurs on the deeper soils bordering drainage lines and valley floors, and on gently undulating tablelands.

A species gradient is often evident on the footslopes bordering broad valleys. In the shallower soils higher on the slopes, associations are dominated typically by Red Box and/or Brittle Gum and/or Red Stringybark. Below this, Apple Box and/or Yellow Box tend to dominate. Below these in turn, White Sallee dominates. Black Sallee appears at the extreme cold edge of the treeline. This pattern is attenuated along drainage lines, where Apple Box tends to dominate and where other species occur according to the terrain. Adjacent to drainage lines, a sparse to dense understorey of riverine shrubs sometimes displaces the grassy groundlayer.

4a. **The Apple Box (*E. bridgesiana*) - Yellow Box (*E. melliodora*) Community**

- **br-ru** - *Eucalyptus bridgesiana* - *E.rubida*
Eucalyptus bridgesiana and *E.rubida* commonly occur as a woodland along the main creeks at lower altitudes. Where the creek valleys broaden out forming frost hollows, *E.pauciflora* and *E.stellulata* may occur. The understorey is typically grassy, with *Poa labillardieri* forming large tussocks on creek flats, and herbs such as *Acaena novae-zelandiae* and *Stellaria pungens* growing between the tussocks.
- **br** - *E.bridgesiana*
E. bridgesiana occurs as a woodland to open woodland along creeklines without *E. rubida*, mostly where the creeklines are narrow or steep-sided. Understorey shrubs such as *Cassinia longifolia* and *Acacia dealbata* may occur in dense patches.
- **br-rock** - *E.bridgesiana* granite rocklands
An association of *E. bridgesiana* with clumps of the tree *Acacia falciformis* is found on the bare granite slopes at the northern end of the Harrisons Peak range. The trees are well-spaced, forming a tall woodland to open woodland. The understorey is limited to plants growing between or around the rock slabs, but includes species not commonly found elsewhere in the study area, such as *Dodonaea viscosa* ssp. *angustissima*, *Pelargonium australe*, *Vittadinia* spp., *Drosera* spp. and rock ferns, *Cheilanthes* spp.

4b. **The Frost Pocket Community - White Sallee (*E. pauciflora*) - Candlebark (*E. rubida*) - Black Sallee (*E. stellulata*) - Black Gum (*E. aggregata*)**

- **st-pa** - *E. stellulata* - *E. pauciflora*
This association occurs along broad flat gullies at lower altitudes where cold air drainage in winter causes severe frosts. It merges with the **br-ru** association described above at the upper edge of its limits, and has a similar understorey.
- **a-st** - *E.aggregata* - *E. stellulata*
A woodland to open woodland restricted to the edges of the clearing in Portion 73 between Mt Foxlow and Harrisons Peak. *E.aggregata* is an uncommon tree in the region, found scattered across the Southern Tablelands in damp, frost-hollow situations. It is likely that this association would have occurred across the clearing, however it is now limited to a thin strip around the edge, and few *E. aggregata* remain.

5. **Heathland**

Heathlands are treeless communities characterised by heath shrubs (shrubs with small prickly leaves, usually less than 2 metres tall). Only one heath community is found in the study area, a subalpine wet heath restricted to high altitude drainage lines on granite substrate. Some tall shrubs and areas of sedgeland occur with the wet heath, and all have been mapped together as vegetation of swampy soils.

5a. **Mountain Heath Community: Mountain Baeckea** (*Baeckea utilis*) - **Heath** (*Epacris breviflora* &/or *E. microphylla*) - **Small-fruited Hakea** (*Hakea microcarpa*)

- **sw** - vegetation of swampy soils (*Baeckea utilis*, *Epacris microphylla*, *Restio australis*)
Well developed in only a few gentle gullies on the western footslopes of Harrisons Peak. In the waterlogged soils few eucalypts grow, and the vegetation becomes a tall open shrubland of *Banksia marginata*. A denser wet heath composed of the shrubs *Leptospermum myrtifolium*, *Epacris microphylla*, *Hakea microcarpa* and *Baeckea utilis*, and sedges such as *Restio australis*, forms along the drainage lines.

6. Clearings

- **cl** - clearings
Areas along the larger creeks and other flats have been cleared in the past to provide grazing land. The vegetation is now a grassland consisting mostly of native species with some exotic grasses and herbs.

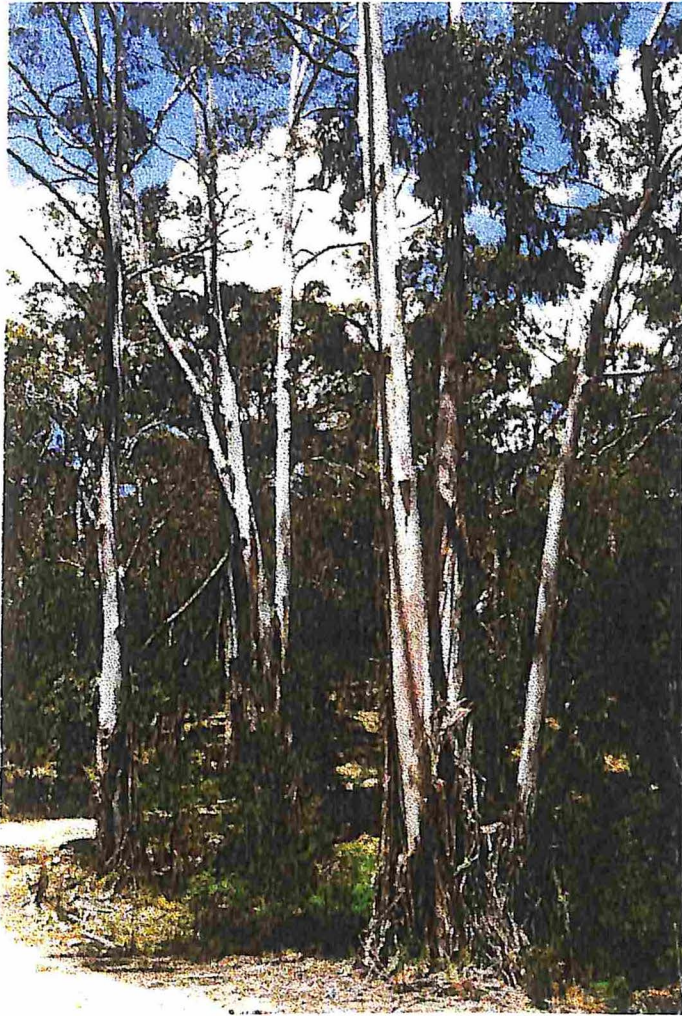
3.2.2 Significant Vegetation Associations

In a regional context, vegetation of the Mt Foxlow - Harrison's Peak area is intermediate between the dry sclerophyll forests and woodlands of the Queanbeyan Fault Escarpment to the west, and the intermediate and wet sclerophyll forests of Tallaganda State Forest to the east. In its relationship with geology and altitude, the vegetation probably has its greatest affinities with that of the Tinderry Nature Reserve, although not reaching quite the height and extent of the Tinderry peaks. The majority of Mt Foxlow - Harrison's Peak vegetation occurs at mid-altitudes on sedimentary rock, similar to the dry and intermediate sclerophyll forests of the Tinderries.

The limited area of Harrison's Peak granite supports a wet forest similar to that found on granite patches south-east of Tinderry Peak, and in much larger areas of the Tallaganda State Forest. Vegetation on the quartzite of Rutledge Ridge is much more typical of northern Tallaganda State Forest and other rocky outcrops further northeast of the study area.

Significant vegetation associations found in the Mt Foxlow - Harrison's Peak area are listed below.

- ***Eucalyptus bridgesiana* rocklands**
The upper eastern slopes of Harrison's Peak and the ridgeline to the north support a small area of granite rocklands. The rocklands are bordered by a mature forest of stunted *Eucalyptus bridgesiana* and extremely tall *Acacia falciformis*. The rocklands themselves are vegetated with a sparse to dense heathland/dry heathland and sometimes fernland. Grazing by goats has impacted severely on the vegetation of the larger of these rocklands. (Of MODERATE LOCAL SIGNIFICANCE).
- **Swamp vegetation**
Areas of wet heath and sedgeland surrounded by *Banksia marginata* open shrublands are restricted to only a few areas on the western side of Harrison's Peak. This community only forms in poorly drained areas of granite substrates occurring at high altitude, and is naturally of limited extent. A similar community is found in a restricted area of the Tinderry Nature Reserve. (Of MODERATE LOCAL SIGNIFICANCE).
- ***Eucalyptus fastigata* tall open forest**
Eucalyptus fastigata is a common tree of wet mid-altitude forests east of the Great Dividing Range, however it rarely extends west of the Divide. In the study area, the *E.fastigata* association occupies only the highest parts of the Harrison's Peak granite. It is also found in similar situations on high-altitude granite of the Tinderry Range, but then not again until the mountains of the ACT where it reaches its western limit. (Of MODERATE LOCAL SIGNIFICANCE).
- ***Eucalyptus sieberi* open forest**
Eucalyptus sieberi is a very common tree of coastal New South Wales but is rare west of the Great Dividing Range. In the study area the *E.sieberi* association is restricted to the Rutledge Ridge quartzite. The only occurrence further west is an extreme outlier in the ACT. (Of MODERATE LOCAL SIGNIFICANCE).
- ***Eucalyptus viminalis* tall open forest**
Extensive, pure or mixed stands of mature *Eucalyptus viminalis* (Manna Gum) occur on the high or intermediate altitude slopes and flats associated with several drainage lines. *Eucalyptus robertsonii* (Narrow-leaved Peppermint) occurs in similar sites and in mixed or pure stands on predominantly south-facing slopes. *Eucalyptus pauciflora* (Snow Gum) and *Eucalyptus dalrympleana* (Mountain Gum) are often present. Many of these stands appear to offer high quality habitat for the larger arboreal mammals, including species listed as Vulnerable in the Threatened Species Conservation Act (eg Koala, Yellow-bellied Glider). The potential for this fauna requires follow-up studies. (Of MODERATE LOCAL and potentially of MODERATE STATE or NATIONAL SIGNIFICANCE).
- ***Eucalyptus dives* - *E.mannifera* - *E.dalrympleana* open forest**
Much of the vegetation at intermediate altitudes is characterised by what appear to be undescribed and unusual or unique associations between the Brittle Gum - Scribbly Gum community, characterised by *Eucalyptus dives* and *Eucalyptus mannifera*, and the Gum community, characterised by *Eucalyptus dalrympleana* rather than the elsewhere more commonly associated (and closely related) species, *Eucalyptus rubida*. (Possibly of MINOR REGIONAL SIGNIFICANCE).



Manna Gum (*Eucalyptus viminalis*)
(pictured at left)

Often grows in pure stands in sheltered gullies and on flats at mid to high altitudes. It also occurs in association with Narrow-leaved Peppermint (*E. robertsonii*) at high altitude on the granitic soils of Harrisons Peak. Such stands provide high quality habitat for fauna, and may contain threatened species such as the Koala and Yellow-bellied Glider.



A widespread association on north-facing exposed ridges is the *Eucalyptus mannifera* - *E. rossii* association (mn-ro) (pictured at left). Soils are often skeletal supporting a sparse understorey of Forest Wallaby Grass (*Chionochloa pallida*), and various low shrubs and herbs.

3.2.3 Plant Species

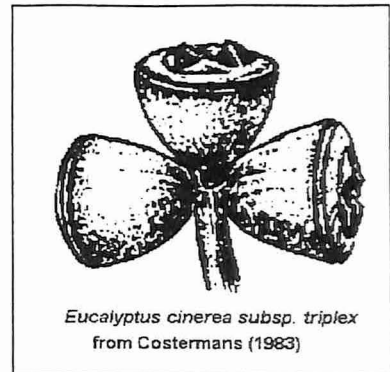
Nearly 200 native plant species have been recorded from the Mt Foxlow - Harrison's Peak bushland. Where species could not be identified in the field, a sample was collected for identification in the office or at the Australian National Herbarium in Canberra. Much of the assessment was conducted out of peak flowering season and it is expected that a number of species, particularly annuals and geophytes (orchids and lilies), would not have been recorded. Efforts were made to sample all vegetation associations in the study area, however the field surveys were limited by time and access, and further field work is likely to record more species, particularly in the more inaccessible areas.

The list of plant species is given in Appendix 1, with notes on abundance and broad vegetation types where the species was recorded.

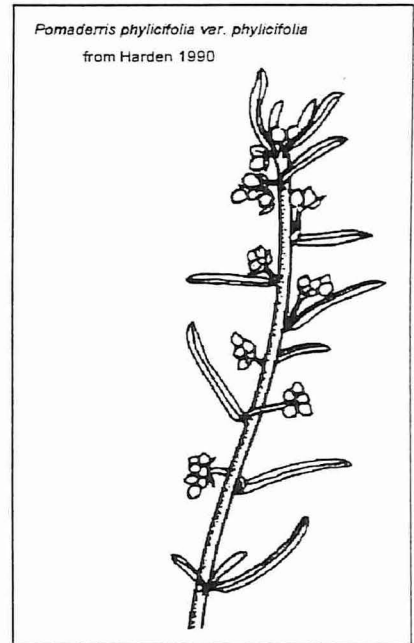
3.2.4 Significant Plant Species

Plants may be significant because the species is endangered, rare or uncommon on a local, regional, state or national basis, or they may represent an outlying population or a distributional limit of the species. The following species occurring on Mt Foxlow - Harrison's Peak are considered to be of conservation significance.

- An apparently large population of *Eucalyptus cinerea* ssp. **triplex** occurs near the WSW boundary of the Mount Foxlow-Harrison's Peak bushlands. This subspecies is described in a paper by Ian Brooker (CSIRO), accepted for publication but not yet published, and is endemic to the ACT and the Mount Foxlow-Harrison's Peak area. Although large, the population is of unknown size and extent (of MODERATE NATIONAL SIGNIFICANCE).
- An individual Anchor Plant (*Discaria pubescens*) was found in *Eucalyptus stellulata* - *E. pauciflora* grassy woodland near "The Springs". The species is considered to be nationally rare, but not currently at risk of disappearing as a species from the wild. It can be found scattered sparsely across the NSW Southern Tablelands, with some populations conserved in Kosciusko and Namadgi National Parks. (Of MODERATE NATIONAL SIGNIFICANCE).
- Black Oak (*Allocasuarina littoralis*) occurs as an open woodland on the south-eastern and western slopes of Harrison's Peak in one or possibly more large stands. It also occurs in dense stands with *Eucalyptus sieberi* on the quartzite of Rutledge Ridge. This species is common closer to the east coast, but represents an isolated and outlying population here (of HIGH LOCAL and MODERATE REGIONAL SIGNIFICANCE).
- A montane fern endemic to NSW, *Polystichum australiense* (Shield Fern) appears to be widespread through the area. This species appears not to have been formally recorded for the Southern Tablelands (of MODERATE REGIONAL SIGNIFICANCE).
- One small population of Creeping Bossiaea (*Bossiaea prostrata*) was found on the granite rocklands high on the east-facing slopes of the ridgeline extending north from Harrison's Peak. Creeping Bossiaea is listed as ?ST in Harden (1990-93), and is listed as a rare local species for the ACT in Burbidge & Gray (1970). It is a coastal and tablelands species in NSW (of MODERATE LOCAL or MINOR REGIONAL SIGNIFICANCE).
- Ruddy Ground Fern (*Hypolepis rugulosa*) - A large patch of this species was located in an intermediate sclerophyll gully on the western slopes of Mt. Foxlow. According to Harden (1990-93), the species has not been recorded in ST, but is known from CT, CWS, SWS; QLD; VIC; TAS; SA; WA. However, the species has been recorded in the ACT (Hogg, 1990) (of MODERATE LOCAL or MINOR REGIONAL SIGNIFICANCE).



- A few scattered Black Gums (*Eucalyptus aggregata*) were located in Portion 73 between Mt Foxlow and Harrisons Peak. *E. aggregata* is an uncommon to rare tree in the region, found scattered across the Southern Tablelands in damp, frost-hollow situations (of MODERATE LOCAL or MINOR REGIONAL SIGNIFICANCE).
- A shrub, *Pomaderris phyllicifolia* var. *phyllicifolia* occurs scattered through the intermediate sclerophyll forests of the eastern and western slopes and high valleys below Harrisons Peak and its ridgeline to the north (and also in one riparian site on the Molonglo River below). This variety is considered rare in NSW, and probably on the Australian mainland (of HIGH STATE SIGNIFICANCE).
- A hybrid swarm of *Eucalyptus radiata* x *Eucalyptus pauciflora* occurs on Harrisons Peak and along the ridgeline to the north. Although a not uncommon hybrid in disturbed sites (Brooker - pers. comm.), it is probably much less common in natural situations. The Harrisons Peak hybrids exhibit a complete range of forms between both parent species, suggesting that they are at least several generations old. The area shows no evidence of human interference, and appears too limited in area and inaccessible to have attracted past attention by timber-getters (probably of HIGH LOCAL SIGNIFICANCE).
- The understorey of the dry sclerophyll forests throughout the area is dominated by *Daviesia leptophylla*, rather than *Daviesia mimosoides* which is the much more characteristic *Daviesia* of dry sclerophyll forests outside the study area (of MODERATE LOCAL, or MINOR REGIONAL SIGNIFICANCE).
- Black Cypress Pine (*Callitris endlicheri*) has been reported by Barrer (1997) in Crown lands at the north-east extreme of the Mt. Foxlow - Harrisons Peak bushlands, where it may be uncommon. Very occasional remnants also survive to the south-west of the Mt. Foxlow - Harrisons Peak bushlands, in cleared and regenerating bushlands between the latter and the Googong Foreshores Reserve. However the species was not located within the study area during the present survey, but if confirmed, the species location may have implications for fire management (possibly of MODERATE LOCAL SIGNIFICANCE).



3.2.5 Areas for Further Study

Several of the vegetation associations, particularly the significant ones, warrant further, more detailed investigation, either because they are species rich, or they contain species which are not found in other habitats. Further vegetation surveys should be carried out in spring to early summer when most plant species are flowering to maximise the chances of finding annual or ephemeral species.

The areas recommended for further study are detailed below and shown in Map 4.

- ***Eucalyptus bridgesiana* rocklands**

The granite rocklands to the north of Harrisons Peak support several plant species not found elsewhere in the study area. In particular, rock ledges and crevices are good habitat for a number of herbs and ferns, and may be the only places where browsing animals such as goats are unable to reach.

- ***Eucalyptus sieberi* open forest**

The *Eucalyptus sieberi* forests in the north of the study area grow on the harsh quartzite of Rutledge Ridge. The understorey is very open and appears to be species poor, however has not been surveyed in spring. The overstorey association of *E. sieberi* and *Allocasuarina littoralis* is restricted to this habitat, and it may be that some understorey species are also found only on the quartzite.

- **Swamp vegetation**

Swamp vegetation includes the *Baeckea utilis* - *Epacris microphylla* - *Restio australis* wet heath and sedgeland, and the surrounding *Banksia marginata* open shrublands. This vegetation is restricted to only a few higher altitude gullies over granite and has not been fully surveyed. Although of limited extent, most plant species it contains do not occur in other habitats. This vegetation may also provide specific habitat for fauna such as frogs and reptiles and certain bird species.

- **Wet sclerophyll forest associations**

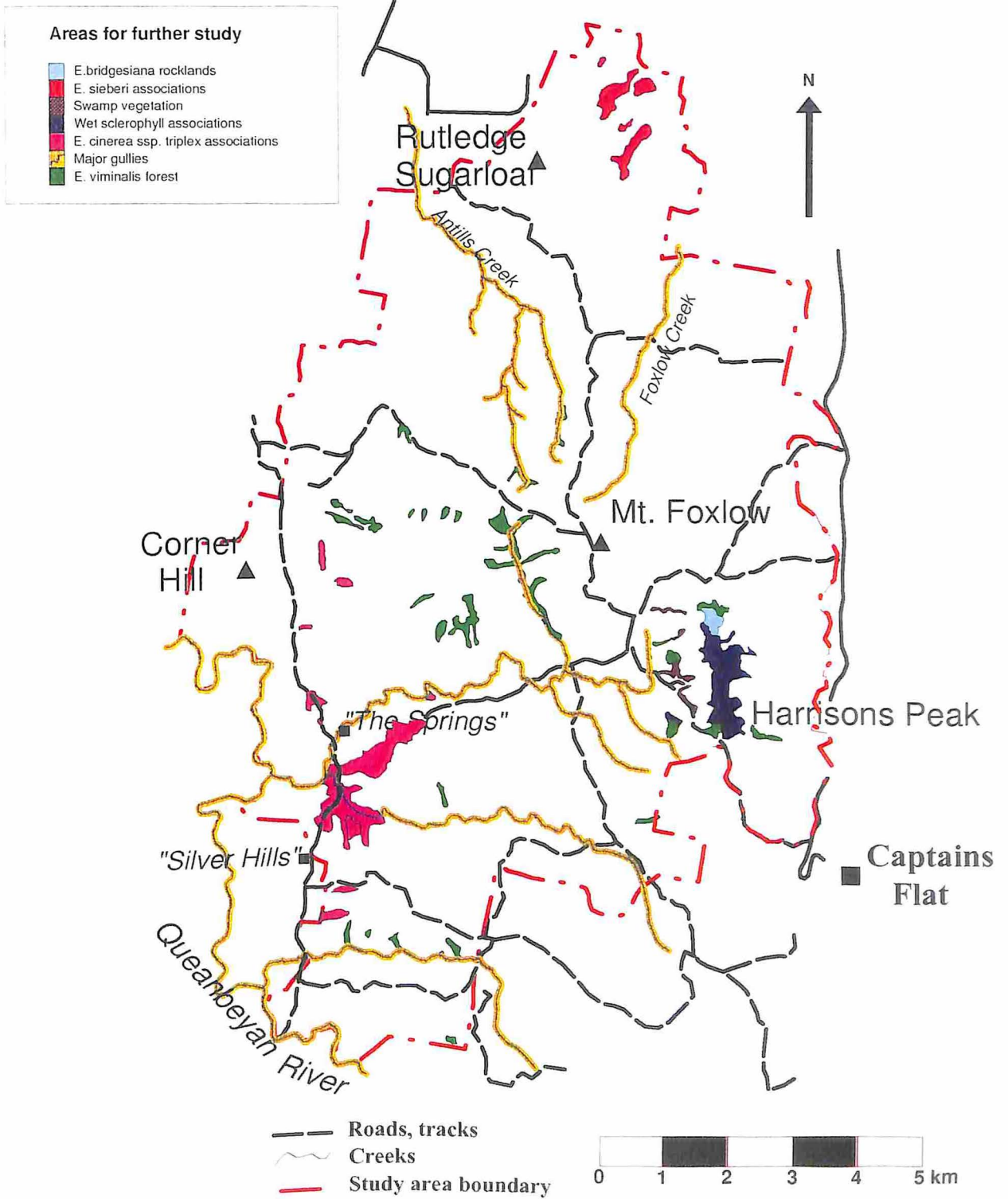
The wet sclerophyll forest associations including *Eucalyptus fastigata*, *E. fastigata* - *E. viminalis* and *E. viminalis*- *E. robertsonii* are of limited extent in the study area, occupying only the highest altitudes on Harrisons Peak granite. The understorey is fairly open, however further field surveys, particularly around rocky areas may find more understorey species typical of wet sclerophyll forests.

- ***Eucalyptus cinerea* subsp. *triplex* associations**

Eucalyptus cinerea subsp. *triplex* occurs in the western part of the study area in association with several other eucalypts of the Brittle Gum - Scribbly Gum community. At present, its distribution appears to be mostly confined to the area underlain by Silurian sedimentary rocks, although this may not be a true reflection of its distribution. During the vegetation mapping *E. cinerea* ssp. *triplex* itself could not be distinguished on the aerial photographs, therefore it has only been mapped where it was encountered during field work. Time did not permit further field work in the area, however it would be worthwhile surveying the areas around the mapped *E. cinerea* associations to determine their full extent.

- **Major Gullies**

Gullies provide a moist and sheltered habitat for a number of plant species, particularly ferns. Several minor creeks and one of the major gullies in the study area (Primrose Valley Creek) were surveyed during fieldwork, however there are a number of other major gullies which would be worthwhile surveying for the occurrence of restricted species. These include Foxlow Creek, Antills Creek, the creek running through "The Springs", the main creek south of "The Springs", and the next main un-named creek south of this running into Lighthouse Creek.



Map 4. Areas for Further Study

- **The Queanbeyan River**

The Queanbeyan River corridor downstream from the study area to the Googong Foreshores Reserve was previously identified as warranting ecological assessment, and would have been included in this present study had adequate funding been available. The River where it bounds the study area has not been surveyed and is also likely to be of high conservation value. Further surveys should be carried out along the full stretch of the River from the edge of the Mt Foxlow - Harrisons Peak study area (upstream of Tinderry Crossing), down to the Googong Reserve.

- ***Eucalyptus viminalis* tall open forest**

The stands of *Eucalyptus viminalis* in the mid to high altitude gullies and flats offer good habitat for arboreal mammals. These forests warrant further fauna survey work, in particular to follow up on the possibility of Yellow-bellied Gliders in the area.

4. FAUNA

4.1 Methods

Scats of predatory mammals (dogs, cats and foxes) were collected by volunteers along the fire trails of Mt Foxlow - Harrisons Peak during organised surveys in October 1995 and September-October-November 1996. The location of each collection was recorded, although some of the location maps have since been lost. The scats were bagged individually and sent to Barbara Triggs in Genoa, Victoria, for analysis of their contents.

4.2 Results

4.2.1 Predator Scat Analysis

A total of 253 scats were collected. Most were scats of predators, but a small number were of herbivorous animals. Table 1 gives a breakdown of the scats collected, and shows that scats of foxes and dogs were the most commonly collected.

Table 1. Scats collected from Mt Foxlow - Harrisons Peak

Predator / Other		No. of scats collected	
		Definite	Probable
Dog / dingo	<i>Canis familiaris</i>	67	38
Fox	<i>Vulpes vulpes</i>	65	64
Cat	<i>Felis catus</i>	1	2
Herbivore		2	
Macropod		7	
Possum	<i>Trichosurus</i> sp.	2	
Wombat	<i>Vombatus ursinus</i>	4	

Analysis of the hair contained within a scat provides an indication of the prey species likely to occur in the area. The mammal species identified from hairs in the scats are listed below in Table 2, along with the number of scats containing that species. Fourteen native mammal species and five introduced mammals were identified. Several scats contained unidentified reptile scales, bird feathers or insect remains.

The number of scats containing a certain species provides an indication, but is not an accurate guide to abundance of prey species. Size of prey and ease of catching, as well as prey abundance will determine a predator's catch. However it would seem that the Swamp Wallaby (*Wallabia bicolor*) is a common macropod in the area, as it is easily the most common prey item in this sample of predator scats.

Table 2. Mammal species recorded in predator scats from Mt Foxlow - Harrisons Peak.

Species	Scientific name	No. of scats recorded in
Native mammals		
a Brushtail Possum	<i>Trichosurus sp.</i>	10
a Marsupial mouse	<i>Antechinus sp.</i>	2
a Microbat	<i>(Probably Nyctophilus sp)</i>	1
Dusky Antechinus	<i>Antechinus swainsonii</i>	1
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	14
Echidna	<i>Tachyglossus aculeatus</i>	3
Feathertail Glider	<i>Acrobates pygmaeus</i>	1
Red-necked Wallaby	<i>Macropus rufogriseus</i>	1
Ringtail Possum	<i>Pseudocheirus peregrinus</i>	29
Sugar Glider / Squirrel Glider	<i>Petaurus breviceps / P. norfolcensis</i>	18
Swamp Wallaby	<i>Wallabia bicolor</i>	79
Walleroo	<i>Macropus robustus</i>	4
Wombat	<i>Vombatus ursinus</i>	9
Yellow-bellied Glider	<i>Petaurus australis</i>	1
Introduced mammals		
Cow	<i>Bos taurus</i>	4
Goat	<i>Capra hircus</i>	4
Pig	<i>Sus scrofa</i>	4
Rabbit	<i>Oryctolagus cuniculus</i>	11
Sheep	<i>Ovis aries</i>	7

4.2.2 Significant Fauna Records and Faunal Habitats

- Of considerable interest is the record of the Yellow-bellied Glider (*Petaurus australis*), a species listed as Vulnerable in the NSW Threatened Species Conservation Act. The Yellow-bellied Glider was identified in a probable fox scat collected on 21 September 1996 approximately 1 km west of the summit of Mt Foxlow (AMG Captains Flat 8726-1-N, 164645). This is not a definite record of the Glider for the Mt Foxlow Harrisons Peak area, as a predator may travel some distance between eating its prey and passing the scat. However the collection was made from a very central area of the bushlands and at the head of the largest stand of *Eucalyptus viminalis* in the area, which provides the most likely habitat for the Glider. Further surveys involving spotlighting would be needed to fully confirm the presence of this species. (potentially of MODERATE STATE SIGNIFICANCE).
- Analysis of hairs in the scats could not differentiate between two closely related glider species, the Sugar Glider (*Petaurus breviceps*) and the Squirrel Glider (*P. norfolcensis*). The Sugar Glider is a common and widespread species, known to occur in suitable habitat in the Queanbeyan area and Tinderry Nature Reserve (NPWS 1997), and is likely to account for most of the scat analysis records for Mt Foxlow - Harrisons Peak. The Squirrel Glider is much less common across its range, and is listed as Vulnerable in the NSW TSC Act. It has been recorded from the Michelago area but not confirmed in the ACT (Hogg 1990). One of the scat collections from Mt Foxlow contained particularly long hairs, much more typical of the Squirrel Glider than the Sugar Glider. Additional surveys including spotlighting would be needed to fully confirm the presence of this species (potentially of MODERATE STATE SIGNIFICANCE).
- One fox scat was analysed as containing hair from a Feathertail Glider (*Acrobates pygmaeus*). The scat was collected on September 21 1996, however the location map for this scat collection has been lost. It is likely to have been collected along one of the tracks leading up to Mt Foxlow, as this is where other scats were known to have been collected on the same day. This tiny possum has been recorded from the Tinderry Nature Reserve (NSW NPWS 1997) and is listed as uncommon in the ACT (Hogg 1990). Suitable habitat occurs in the Mt Foxlow - Harrisons Peak bushlands, as it is found in wet and dry sclerophyll forests to

woodlands (Russell 1983). This predator scat analysis record indicates that the Feather Glider is highly likely to occur in the bushlands, but probably in low numbers (of MODERATE REGIONAL SIGNIFICANCE).

- Within the Mt Foxlow - Harrison's Peak bushlands there is extensive suitable habitat for the Tiger Quoll (*Dasyurus maculatus*, a species listed as Vulnerable in the Threatened Species Conservation Act 1995). The presence of this species is considered likely as it has been recorded from Tallaganda State Forest and Tinderry Nature Reserve. Specific surveys are needed to determine the species' presence (potentially of MODERATE STATE SIGNIFICANCE).
- There is a high probability that the nationally rare Rosenberg's Monitor (*Varanus rosenbergi*, listed as Vulnerable, in the TSC Act), occurs throughout the drier, more low-lying woodland and open forest habitats of the area. Several Rosenberg's Monitors have been sighted or collected from roadkills in the Queanbeyan area in the past two years (T. Baker, pers. comm. 1998) (of MODERATE STATE and NATIONAL SIGNIFICANCE).
- The Eastern Wallaroo (*Macropus robustus*), a locally uncommon species, was not observed in the area, but was recorded in the predator scat analysis. It has been sighted immediately east, on the Molonglo River north-east of Captains Flat, and is expected to occur in the Mt Foxlow - Harrison's Peak bushlands (of MINOR LOCAL SIGNIFICANCE).
- The area forms the major part of a linkage between the bushlands of Tallaganda State Forest to the east, and those of the Queanbeyan Fault Escarpment and Tinderry Nature Reserve to the west. Retention of connecting areas of native vegetation are important for long term maintenance of the viability of plant and animal communities. In turn, the Mt Foxlow - Harrison's Peak area acts as a refuge from which species can disperse to other areas. (of MODERATE or HIGH REGIONAL SIGNIFICANCE).
- Stands of mature *Eucalyptus viminalis* (Manna Gum) on the high or intermediate altitude slopes and flats may offer high quality habitat for the larger arboreal mammals, including species listed as vulnerable in the TSC Act (eg Koala, Yellow-bellied Glider). The one record of Yellow-bellied Glider from scat analysis was collected near the largest stand of *E. viminalis* in the area. The potential for this fauna in this habitat type requires follow-up studies. (Of MODERATE LOCAL and potentially of MODERATE STATE or NATIONAL SIGNIFICANCE).

5. FIRE MANAGEMENT

Fire management is an important and complex issue. In the Mt Foxlow - Harrisons Peak bushlands, fire management should aim to achieve long term conservation of the vegetation, fauna and soils, whilst also providing protection of life and property in the area. The pre-European fire pattern for the area is not known, however from research conducted elsewhere it appears that the frequency and intensity of fire is now different from traditional Aboriginal burning practices (NSW NPWS 1997). In order to manage fire to achieve long term conservation of the plants and animals of the area some aspects of fire ecology must be understood.

5.1 Fire Ecology and Conservation

Fire is a natural component of the Australian environment and most native plant species have evolved strategies to cope with periodic fire. Fire management for vegetation conservation involves ensuring that the fire regime (ie. the frequency, intensity and season of fire) does not prevent plant species from reproducing.

Plant species survive fires in two ways:

1. In resprouter species the individual plant survives and resprouts from the base or from the trunk and branches (for eg., many eucalypts).
2. In seeder species (also called fire sensitive species), the individual plant is killed by fire but the species survives through seeds which germinate and grow after fire (for eg. many acacias).

Some species recover from fire in both ways; by resprouting and regenerating from seed.

Some seeder species produce seed which can survive in the soil or on the plant for many years. These species usually survive fire quite well, as the seed is readily available to germinate after fire. However, many seeder species produce seed which is short-lived, and can only grow again after fire when seed from plants in adjacent unburnt areas disperses into the burnt area.

Seeder species must have enough time between fires for the seedlings to grow into adult plants and flower and produce seed. If fires are too frequent, young seeder plants will be killed and there will be no seed to replace them, eliminating the species from that area. Resprouter species require enough time between fires to replenish nutrient stores, and for young plants to develop fire resistant adaptations, such as thick bark, lignotubers or epicormic buds.

The response to fire and life cycles of a number of native plant species is known, however there are many species for which this knowledge is incomplete or absent. Also, the reported fire responses and times taken to flower and set seed after a fire may vary between sites, depending on soil conditions and climate. Without knowing the life cycles of all plant species found in a particular area, the fire regime which suits each species cannot be known, and fire management must be carried out with caution to avoid causing species declines or losses.

Within any of the vegetation communities there will be plant species adapted to a range of fire regimes, involving variable fire frequency and fire intensity in different seasons (within certain limits). The full diversity of plant species will only be maintained by this variety of fire regimes. Repeated sequences of the same fire regime, whether hot or cool, of high or low frequency, may lead to species declines or losses. For example, frequent cool fires will favour short-lived or resprouting species such as grasses over shrubs which regenerate from seed. Repeated hot fires will favour those species which require fire to stimulate seed germination over those which are more sensitive to fire.

Rather than trying to prescribe the fire regime variability that will best maintain diversity, an easier approach may be to define and then avoid fire regimes that are likely to result in the decline or local extinction of species (Bradstock *et al* 1995). The fire regime thresholds beyond which species declines may occur can be used as guidelines when planning burning operations or controlling unplanned fires.

Other ecological considerations when planning fire management strategies include the following:

Vegetation at higher altitudes is slow growing and takes many years to recover from disturbance. Similarly, vegetation growing in harsh situations (dry, exposed, skeletal soils) takes a longer time to recover from fire. Slow recovery of a litter layer and ground cover in these situations leaves soil prone to erosion.

Moist situations such as gullies and swampy areas often contain many fire sensitive species, such as ferns and soft herbs. These areas are rarely burnt as they are usually moister than surrounding vegetation, however if fire does occur, it can be particularly damaging, eliminating the fire sensitive species.

Fires that are widespread may affect animal populations over a large area and make it difficult for species to recolonise a burnt area. Animals require refuges from which they can expand and repopulate after fire. When considering the extent of a burning operation, planned fires, and if possible, unplanned fires, should be restricted to only part of a vegetation type at any one time. This will allow plant seeds to disperse from unburnt areas, and will help animal populations escape from and repopulate burnt areas.

5.2 Fire Management of Mt Foxlow - Harrison's Peak Bushlands

Planned fires in the Mt Foxlow-Harrison's Peak area should be undertaken only after a Bush Fire Management Plan for the area (or wider region) has been prepared. The plan should consider (amongst other things):

- ◆ protection of life and property
- ◆ fuel levels
- ◆ the risk of unplanned ignitions in any one area
- ◆ protection of soils from erosion
- ◆ protection of significant and sensitive vegetation
- ◆ maintenance of plant and animal diversity

In terms of fire management, it is proposed that the Mt Foxlow - Harrison's Peak bushlands be divided into three zones (shown in Map 5):

1. A protection zone.
2. An ecological burn zone.
3. A no-burn zone.

1. The Protection Zone

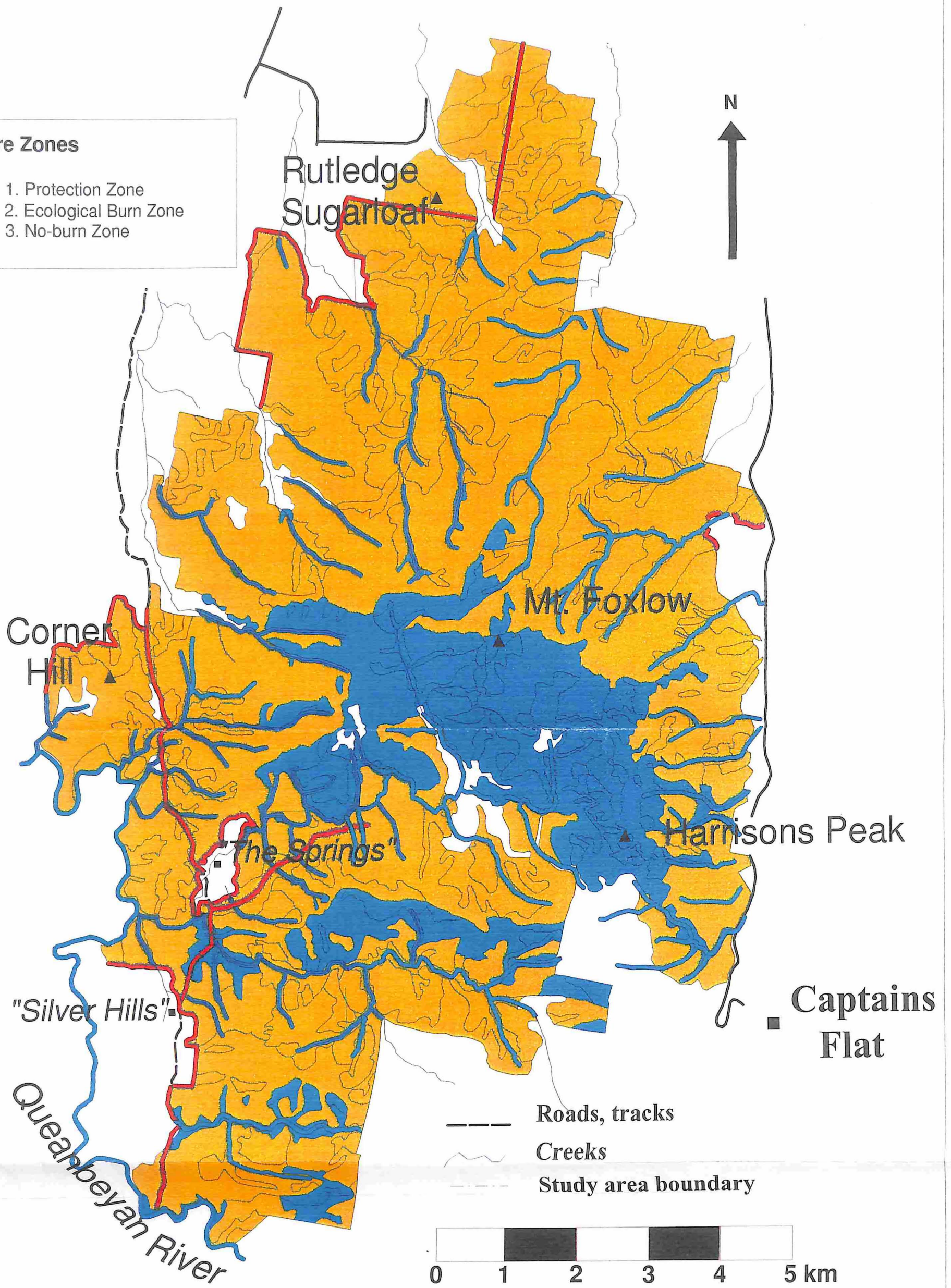
The protection zone is the area where protection of property and prevention of fires entering or leaving the area is a priority. The zone is a narrow strip around the edge of inhabited areas such as "The Springs", "Silverton" and properties along the Captains Flat Road. It also extends along the boundary of the bushland with freehold land, and along roads where the public have access, as this is usually where unplanned fires start. In this zone, where the risk of ignition and the risk of property loss is highest, fire management aims to reduce the hazard so that ignition is less likely to occur or fires within that zone are more easily controlled.

Developments and subdivisions to the north-west of the bushlands are perhaps the greatest potential source of unplanned fires. Particular efforts in hazard reduction and landowner education may be needed in this area to reduce the probability of fires starting in or entering the bushland from neighbouring properties. Caution is required, however with frequent or extensive burning in this area which may cause long term damage to the vegetation and result in erosion on the steep slopes.

All planned burns, even in the protection zone need to be carried out in a sensitive manner. Burning vegetation in major creeklines and gullies should be avoided to protect water quality.

Fire Zones

- 1. Protection Zone
- 2. Ecological Burn Zone
- 3. No-burn Zone



Map 5. Fire Zones

Steep slopes should not be burnt frequently to prevent the loss of a protective litter layer and the subsequent soil erosion.

The protection zone illustrated in Map 5 is a preliminary guide and may be expanded if additional properties or significant sites are identified as needing protection, or it may be reduced if found to be unnecessary in particular areas.

2. The Ecological Burn Zone

In the ecological burn zone, fuel reduction burning may be carried out but only in accordance with ecological principles.

To assist with fire management of this zone, a set of fire regimes likely to lead to plant species declines has been defined for the study area, partly following the example in Bradstock *et al* (1995). When determining the need for a planned burn in this zone, an assessment should be made of fuel levels, the risk of ignition and the risk to property in the area. Then the guidelines below should be used to determine whether the fire is within the thresholds defined.

These fire regime thresholds are only preliminary guidelines, as no information has been collected specifically on the fire responses and life histories of the plants of Mt Foxlow - Harrisons Peak. However, information on some of the species has been collected from Black Mountain in the ACT (Purdie 1977a & b) which has a similar climate and soils. This has been extrapolated to the study area, with some differences erring on the side of caution.

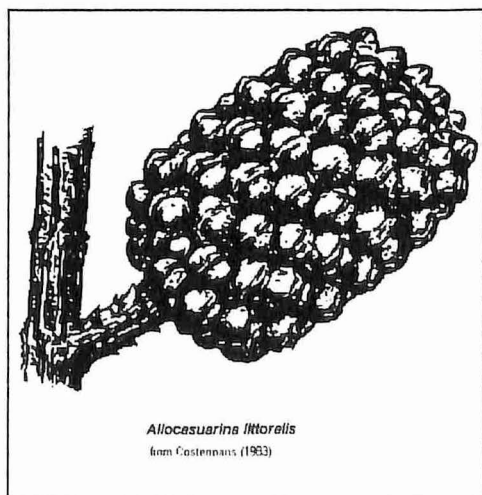
Fire regimes which are likely to lead to plant species declines or losses:

- more than two consecutive fires less than 8 years apart (fire-sensitive shrubs decline)
- intervals between fires exceed 40-50 years (herbs and shrubs with short-lived individuals and seedbanks decline)
- more than two consecutive fires of low intensity, ie. consuming less than 8 t/ha of fine surface fuel (species with heat stimulated seedbanks in the soil decline)
- more than two consecutive fires of very high intensity less than 20 years apart (the more fire sensitive tree species decline)

Following is an example of how these guidelines might work.

The hot fires of 1985 burnt through patches of *Eucalyptus sieberi* dry sclerophyll forest on Rutledge Ridge in the north of the study area. Most of the mature *E. sieberi* survived the fire,

however some mature *Allocasuarina littoralis* (a resprouting species) in the understorey were killed in the intense fire. Dense seedling regeneration of *Eucalyptus sieberi* and *Allocasuarina littoralis* emerged after the fire. The young trees need time to develop fire resistant structures such as thick bark if they are to survive the next hot fire. Alternatively, they need to have flowered and set sufficient seed before the next hot fire. This is particularly important for the *Allocasuarina*, as the mature trees weakened by the 1985 fire, may not survive the next fire, and there must be some seed on the trees to produce new seedlings post-fire. Nominally, a time of 20 years has been given as the minimum between hot fires to allow trees to develop fire resistant structures and seed banks. Should a hot wildfire threaten the area again before 2005, particular efforts should be made to



prevent it burning through Rutledge Ridge and other areas burnt in 1985. A low intensity fire may not have such a deleterious affect on the vegetation. If a fire should burn this area, the effects on the vegetation should be carefully monitored to determine the effects of two intense fires in quick succession.

Understanding of fire effects on the vegetation would be improved by establishing a simple system of monitoring. In particular, areas targeted for planned burns should be assessed for species presence and abundance at marked sites prior to the burn and then in the following years. Information gathered would be useful in guiding future burns in the area.

For the guidelines to be followed effectively as much information as possible needs to be gathered on the fire history of the Mt Foxlow - Harrisons Peak area. Sources could include the local bushfire brigade, the Shire Council, or anecdotal accounts from local landholders. To be most effective this information should be mapped and if possible, include details on fire intensity and patchiness. It is also important that all future fires, planned or unplanned, are accurately mapped and details kept on fire intensity and patchiness.

Using the guidelines above, fire management in the ecological burn zone becomes more flexible rather than something carried out by rote. The occurrence of unplanned fires can be taken into account and the proposed fire regime for any one area adjusted accordingly. The guidelines may change as more information becomes available. Overall, fire management within this zone should aim for variability of regimes.

3. **The No-burn Zone**

Planned fires are excluded from the no-burn zone because the vegetation is considered to be fire sensitive, or significant for some other reason, or warranting further study. Unplanned fires in this zone (it is hoped) would be very infrequent. The risk of ignition and the risk to property in this zone is usually minimal.

Areas included in the no-burn zone are:

- Moist situations including gullies, creeklines and swamps, which often contain fire sensitive species and may take a very long time to recover if burnt. Protection of gully vegetation from fire is also important for protecting water quality.
- Wet sclerophyll vegetation on Harrisons Peak Granite, including all associations containing *Eucalyptus fastigata*, *E. viminalis* and *E. robertsonii* (labelled on the map as **f**, **f-v** and **v-rb**). This vegetation type contains a number of significant and/or fire sensitive species, such as *Pomaderris phyllicifolia* var. *phyllicifolia*. Protection of the erodible granite soils is also an important consideration.
- Intermediate sclerophyll forests, which include all the associations containing *Eucalyptus dalrympleana*, *E. viminalis*, *E. robertsonii* and *E. pauciflora* (**da**, **v**, **rb** and **pa**). These forests mostly occur at higher altitudes where growing conditions are more difficult and recovery from fire takes longer. There are also several significant or fire-sensitive species found within these forests.
- Any other associations containing *Eucalyptus pauciflora* or *E. stellulata*, which are the more fire sensitive of the eucalypt species. This applies mainly to the frost pocket community with associations such as *E. stellulata* - *E. pauciflora* and *E. aggregata* - *E. stellulata* (**st-pa** and **a-st**).
- The *Eucalyptus bridgesiana* granite rocklands which contain a number of ferns and other species restricted to this habitat. Due to the expanses of bare rock, this habitat does not accumulate large amounts of fuel and fire is unlikely to travel across the rocklands.

If efforts are made to control unplanned fires in the bushlands, priority would be given to the protection zone and then to preventing fires from reaching the no-burn zone.

6. RECOMMENDATIONS

Information is now available to suggest that the bushlands of Mt Foxlow - Harrisons Peak are of conservation significance. The presence of a number of significant plant species, the high probability of several significant animal species, and the position of the bushlands as a link between Tallaganda State Forest, Tinderry Nature Reserve and the Queanbeyan Fault Escarpment justifies consideration of the conservation status of the bushlands. ***The majority of the area is leasehold Crown Land, and it needs to be determined whether the bushlands can be protected from damaging activities, such as clearing and inappropriate grazing, under its current tenure system. If protection of the natural values of the area can't be enforced, then a change of status of the land needs to occur.***

Further survey work in significant vegetation associations, and other areas which were not covered by this study would be worthwhile in determining the full values of the area. In particular, additional fauna surveys including spotlighting may confirm the presence of one or more significant species. ***Follow up survey work is recommended in areas identified as being of particular value.***

Protection of the bushlands from inappropriate burning regimes is an important consideration. Fire management should aim to achieve long term conservation of the vegetation, fauna and soils, whilst also providing protection of life and property in the area. ***Planned burns need to be carried out in an ecologically sensitive manner and with clear objectives. A zoning system for the area has been outlined and it is recommended that the guidelines provided within this system be used to assist planning of fuel reduction burns in the area.***

The guidelines proposed for ecological burning are preliminary due to a lack of detailed information on the effects of fire on the vegetation of the area. ***Understanding of fire effects would be improved by establishing a simple system of monitoring. In particular, areas targeted for planned burns should be assessed for species presence and abundance at marked sites prior to the burn and then in the following years.***

To assist with implementation of the burning guidelines, a knowledge of the fire history of the area is needed. This may have been compiled by the local bushfire brigade, but if not, ***information on fire history and effects on the bushlands should be gathered from available sources including anecdotal accounts from locals.***

REFERENCES

- Barrer, P.M. 1997. The **Flora of South-east Yarrolumla**. Unpublished report to the Save the Bush Grants Scheme and the Stoney Creek Landcare Group.
- Bradstock, R.A., Keith, D.A. and Auld, T.D. (1995). Fire and conservation : imperatives and constraints on managing for diversity. In: R.A. Bradstock, T.D. Auld, D.A. Keith, R.T. Kingsford, D. Lunney and D. P. Sivertsen (eds). **Conserving Biodiversity: Threats and Solutions**. Surrey Beatty and Sons, Chipping Norton.
- Costin, A.B. 1954. **A Study of the Ecosystems of the Monaro Region of NSW**. Government Printer, Canberra
- Hogg, D. McC., 1990. **The Ecological Resources of the A.C.T. A Review of Recent Information**. Report to the National Capital Planning Authority, Canberra.
- McAlpine, J.R. and Yapp, G.A. (1969). Climate of the Queanbeyan - Shoalhaven Area. In: CSIRO **Lands of the Queanbeyan - Shoalhaven Area, A.C.T. and N.S.W.** Land Research Series No. 24. CSIRO, Melbourne.
- NSW National Parks and Wildlife Service (1997) **Tinderry Nature Reserve Draft Plan of Management**.
- Purdie, R.W. (1977a). Early stages of regeneration after burning in dry sclerophyll vegetation. 1. Regeneration of the understorey by vegetative means. **Aust. J. Bot.** **25**, 21-34.
- Purdie, R.W. (1977b). Early stages of regeneration after burning in dry sclerophyll vegetation. 2. Regeneration by seed germination. **Aust. J. Bot.** **25**, 35-46.
- Russell, R. (1983) Feathertail Glider. In: R. Strahan ed). **The Australian Museum Complete Book of Australian Mammals**. Angus & Robertson Publishers.
- Story, R. 1969. Vegetation of the Queanbeyan - Shoalhaven Area. In: CSIRO, **Lands of the Queanbeyan - Shoalhaven Area, ACT and NSW**. Land Research Series No. 24. CSIRO, Melbourne.

