

5 Woodland Complexes: Planning and Management for Conservation

5.1

Principles Underlying Conservation Planning for Lowland Woodland

Principles for a systematic approach to conservation planning in the ACT context were developed in 1995 when strategic options for native grassland conservation were prepared for Gungahlin (Williams *et al.* 1995). The principles and the associated methodology were used to identify high priority areas for grassland conservation, based on vegetation qualities and habitat for threatened species. The ACT Government adopted the approach at that time, and subsequently three nature reserves were established in the Gungahlin area with the primary aim of protecting Natural Temperate Grassland (an endangered ecological community) and habitat for the Striped Legless Lizard (*Delma impar*) (a vulnerable species). More recently, McIvor and McIntyre (2002) proposed principles for the conservation management of grassy woodland ecosystems.

The two sets of principles complement each other and are relevant to lowland woodland conservation in the ACT into the foreseeable future. The principles have been applied generally to development of this *Strategy*, with some directly reflected in its goals, objectives and actions. Others are appropriate considerations when actions are being implemented and can most appropriately be used to inform decisions made by planning and management agencies, private landholders and governments.

When assessing conservation priorities, the *Lowland Woodland Conservation Strategy* considers woodland remnants at scales that take into account their potential contribution to the ACT nature conservation estate, as well as the relationship of the ACT to the Southern Tablelands region. The *Strategy* recognises

the importance of addressing the conservation needs of threatened, declining and/or uncommon plants and animals in an integrated way, and not separated from consideration of the ecological communities of which they are a part. An understanding of the key life history properties and habitat requirements of species, the dynamic processes operating within ecosystems, and the importance of connectivity in making fragmented communities more viable across a variety of local and regional scales are accepted as being essential to sound conservation planning.

In response to 'the need for more detailed ecological analyses to define better the botanical significance of the understorey and the conservation value of each woodland patch' (ACT Government 1999a, p. 5), considerable additional information has been collected since the 1999 Action Plans for Yellow Box–Red Gum Grassy Woodland and threatened birds were prepared. Still more information will be gathered as resources, time and seasonal conditions allow, and this will be used progressively to improve decision making for conservation planning and woodland management.

A key objective of this *Strategy* is to establish a comprehensive, adequate and representative system of reserves and other woodland areas protected for their conservation values. Generally these areas will be those with the highest value in terms of meeting local, regional and national objectives. Assessment of conservation value includes concepts of size (viability), diversity, representativeness, distinctiveness (rarity) and naturalness.

Replication of protected areas containing lowland woodland is an important safeguard against the possibility of catastrophic loss or damage from unforeseen circumstances (e.g. major bushfires), changed land use priorities or management practices. Replication is essential at local and regional scales to

ensure natural diversity is maintained and as a hedge against stochastic events causing local extinction of species. The importance of replication was dramatically demonstrated in the January 2003 bushfires that burnt almost all lowland woodland west of Canberra, while woodlands in the Jerrabomberra, Majura and Gungahlin areas were unaffected. With Yellow Box–Red Gum woodlands having suffered major clearing since European settlement, replication of large woodland fragments across the region is probably no longer possible, rendering the remaining large areas in the ACT significant at both the regional and local scale, particularly for known declining woodland birds.

Canberra's growth as a city continues to exert significant development pressures on land in and around existing urban areas. Although some of this land is generally regarded as available for development, it may still retain natural features worthy of consideration for their potential contribution to the nature conservation estate or to enhancing the natural environment of the city. Rehabilitation of woodland fragments to improve habitat qualities, to enhance ecological connectivity, or to assist with increasing the effective size of remnants will be an important management priority for some time to come, particularly in rural areas. Linking woodlands with other natural ecological communities such as native grasslands, wetland areas and forests increases the overall conservation value of areas by building habitat heterogeneity in the landscape.

Planning for, and management of conservation areas in the ACT must take into account the potential impact of land uses and other activities on adjacent land. Compatible land uses or management practices will help to moderate adverse external influences on nature conservation values. Conservation management supported by research, monitoring and community participation are identified as key actions for this *Strategy*.

In order to bring together the information on woodland type, vegetation condition, habitat features and occurrences of threatened and declining species with the relevant conservation planning and management issues, the following attributes, derived from the principles outlined above, have been incorporated into the material that is the basis for Chapters 5 and 6 of the *Strategy*:

- **Regional context:** regional biodiversity conservation significance; distribution across ACT.
- **Ecological characteristics:** vegetation condition; resident populations(s) of threatened species; habitat heterogeneity.
- **Physical data:** size; area/perimeter ratio.
- **Landscape context:** connectivity with other native vegetation; altitudinal range.
- **Planning and management:** compatible adjacent land uses; potential for regeneration and restoration management.

5.2

Identifying Areas of Highest Conservation Significance

Information from woodland surveys carried out in the ACT since 1995, together with information on threatened or declining birds and other animals is summarised in a series of maps and accompanying notes that describe five woodland complexes for the ACT (Figures 5.1a–5.5a). Methods used to derive assessments of botanical significance and habitat values are summarised in Chapter 3.

Consideration of conservation value is central to planning and management decisions with regard to natural ecosystems. Woodland areas may have both natural and cultural heritage values, which may be related and are sometimes difficult to separate. Some people, including many Indigenous people, do not see these values as separate. Natural heritage, as distinct from cultural heritage, focuses on natural and dynamic ecological processes, earth processes (e.g. soil formation), evolutionary processes and the ability of ecosystems to be self-perpetuating (Australian Heritage Commission 2002).

The focus of this *Strategy* is conservation of natural heritage (the natural values of woodland communities across the ACT), and the policies and actions required to achieve conservation of woodland communities and their values. Cultural values are outside the scope of this *Strategy*, which must meet the requirements of an Action Plan prepared under the *Nature Conservation Act 1980*. The place to document cultural values (e.g. artefacts of Aboriginal material culture, places of historical interest, or 'cultural landscapes') and some natural values (e.g. earth processes), not immediately

central to woodland conservation is in management plans or other planning and management documents focused on particular places. These documents bring together the complete range of natural and cultural values. More generalized or less area-specific issues (e.g. greenhouse gas reduction measures or ecologically sustainable development) are addressed in planning statements such as the Territory Plan, or Government policy documents at the strategic level.

Documenting the conservation values of ACT lowland woodlands requires an assessment and integration of several factors, namely:

- the intrinsic value of woodlands as remnants of the previous extent of lowland grassy woodland;
- the value of woodlands as functioning ecosystems and habitat for woodland flora and fauna, including microbiota;
- the presence of, and habitat for, threatened plants and animals; and
- the ecological role woodlands play at the landscape scale such as connecting natural areas, and buffering other natural areas from adverse impacts of nearby land uses or activities.

Using an approach similar to that used for the Gungahlin grasslands (Williams *et al.* 1995), the data were used to identify areas with the highest potential value to the conservation of lowland woodlands and the flora and fauna dependent upon them.

Polygons with the following attributes were selected:

- partially modified lowland woodland;
- Yellow Box–Red Gum Grassy Woodland endangered ecological community;
- good vegetation condition rating; and
- threatened or declining species.

Woodland areas in the ACT that satisfy all the above criteria and therefore identified as having the highest conservation significance are located at:

Hall–Kinlyside; Mulligans Flat; Gooroo; Mt Majura; Mt Ainslie (Campbell Park); Black Mountain–Belconnen Hills; Red Hill–Callum Brae; Castle Hill (Tharwa); and Naas. Other areas satisfying the criteria, but which are not Yellow Box–Red Gum woodland are located at North Gungahlin Hills, Bullen Range, and Booroomba.

Identification of these areas which have the combination of characters that give them high conservation value, confirms previous assessments of the ACT's natural resources, being either sites of ecological interest (NCDC 1984), or significant

locations for rare or declining birds (Taylor and COG 1992). These locations were also identified as important in the Action Plans for threatened birds (ACT Government 1999b–e). Some of the areas are now included in ACT nature reserves (e.g. Ainslie–Majura, Mulligans Flat). However, other areas are managed under rural lease (with up to 99 year terms) or are subject to land use policies or short-term arrangements that leave their future uncertain in terms of habitat maintenance or enhancement of natural values.

Once areas with the highest conservation significance have been identified, other conservation and management principles can be considered (after Williams *et al.* 1995). The extent to which these or other areas may contribute to a comprehensive, adequate and representative conservation reserve system and thus help achieve the vision for this *Strategy* is outlined in Chapter 6. Application of principles related to ecological connectivity, size and area/perimeter ratio, habitat heterogeneity (e.g. Snow Gum woodlands, wetlands, secondary grasslands) is appropriately dealt with when identifying boundaries between different land uses and the compatibility of overlapping values. These issues are not fully resolved in this *Strategy*, although some key issues are identified in the following descriptions of the woodland complexes.

Some woodland areas that do not meet the primary criteria but which play a role in linking the key habitat areas in the ACT and into NSW include the Majura Field Firing Range, the Newline Quarry, and Rob Roy Range.

While the above process identifies areas with the highest conservation significance that therefore warrant a high priority for protection and management to conserve their values, it should not be construed that other areas have no conservation value. Areas that do not have all the attributes may:

- provide habitat for woodland fauna including threatened species (even when the vegetation is moderately or substantially modified);
- contain sufficient remnants of former woodland tree cover and/or understorey for regeneration to occur and to warrant restoration activities;
- be important to provide or enhance links between high conservation value areas; and
- provide the means to enlarge core conservation areas and to reduce the perimeter area ratio.

Examples of areas where remnant trees or substantially modified woodlands are likely to have the above attributes include woodland trees at the Newline Quarry, the Mugga property in the Jerrabomberra valley, and many smaller patches of trees in rural areas.

The greater the extent of modification of woodland the more valuable scattered remnants such as paddock trees and clumps become. 'When woodland levels are below 30%, scattered trees become a key resource for restoring viable amounts of woodland' (McIntyre 2002, p. 97).

The extent and condition of ACT lowland woodlands, particularly the Yellow Box – Red Gum Grassy Woodland endangered ecological community, in the regional and national context has been outlined in Chapter 2. It is clear that the remaining areas of lowland woodland in the ACT are likely to have greater conservation significance in the context of the clearing of woodlands regionally and nationally and also in terms of the ongoing degradation of remnants.

5.3

ACT Lowland Woodland Complexes

The remaining lowland woodland in the ACT (Figure 2.3) has been grouped into five woodland complexes. These are recognisable assemblages of lowland woodland vegetation (including secondary grassland), in particular geographic areas of the ACT, and in general separated by major land uses, especially urban development, rural land use and arterial roads. The complexes, units within them and areas are shown in Table 5.1 and they are discussed in detail in the following sub-sections 5.4 to 5.8.

Figures quoted for the area of each type of woodland in each complex or unit are estimates derived from computer calculations of mapped woodland units. They should therefore be regarded as an estimate that may be subject to minor mapping errors. Ecological survey is an ongoing activity and mapping is subject to continual refinement.

Table 5.1: ACT Lowland Woodland Complexes, Units and Areas

COMPLEX	UNITS	Total woodland* In complex (ha)	Yellow Box–Red Gum in complex (ha)	Percentage YBRG of total woodland
Gungahlin	(a) North Gungahlin (b) Gooroo–Mulligans Flat (c) Central Gungahlin	4435	1920	43%
Majura–Kowen	(a) Mt Ainslie–Mt Majura (b) East Majura (c) Kowen	4900	1560	32%
Callum Brae	(a) Red Hill (b) Mugga Lane West (c) Mugga Lane East (d) Wanniasa Hills (e) Farrer Ridge	2325	1040	45%
Tuggeranong–Naas	(a) Tidbinbilla–Booroomba (b) Rob Roy (c) Naas	18 800	5405	29%
North Murrumbidgee– Lower Molonglo	(a) Bulgar Creek (b) Uriarra (c) Belconnen	6545	940	14%
Total	All Units	37 005	10 865	29%

* Includes all woodland types in all states of modification.

5.4

Gungahlin Woodland Complex

(Figures 5.1 a&b)

(Units which make up this complex (North Gungahlin, Gooroo–Mulligans Flat, Central Gungahlin) are discussed below under 5.4.1–5.4.3.)

Total area of woodland (All figures ha)	4435
Total YBRG community in complex	1920
Lowland woodland (partially modified)	
YBRG	915
Other	764
Lowland woodland (moderately modified)	
YBRG	481
Other	603
Secondary grassland (moderately modified)	
YBRG	467
Other	209
Lowland woodland vegetation (substantially & severely modified)	985

DESCRIPTION

The Gungahlin complex (4435 ha) retains continuous areas of lowland woodland along the northern and eastern hills, inter-mixed with dry forest on the upper slopes. It is one of the largest areas of contiguous woodland in the ACT region. Woodland (including 1920 ha of Yellow Box–Red Gum) merges with native and exotic grasslands on the valley floors where scattered trees of the former Yellow Box–Red Gum woodland are frequently retained. Highly modified woodland, much of which contains only scattered trees, as well as areas that have been cleared of trees and native understorey and developed as part of new town of Gungahlin, form a major discontinuity in the central area.

The Gungahlin complex is considered to be a 'Variegated' landscape (after McIntyre *et al.* 2002).

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Areas of vegetation in good to very good condition tend to occur on the mid slopes of the hills surrounding Gungahlin and the areas in poorer condition occur generally on the lower slopes and plains. Although there has been extensive clearance of trees mostly in the lower lying areas, there are large areas of secondary grassland derived from Yellow Box–Red

Gum woodland remaining where the native groundlayer has been retained. Some woodland areas have been planted with non-indigenous trees in forward planting and woodlot projects, with the result that these may have a structure that is more forest than woodland in nature.

The complex contains extensive habitat for many threatened and declining bird species, particularly at Mulligans Flat, Gooroo and Hall–Kinlyside, with records of Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater, Regent Honeyeater, Superb Parrot and four species of declining woodland birds. The endangered Golden Sun Moth and uncommon Key's Matchstick Grasshopper have been recorded from woodlands in this complex.

The complex contains a population of the endangered Tarengo Leek Orchid at the Hall Cemetery and a population of Austral Toadflax in Mulligans Flat Nature Reserve. Remnants of Snow Gum woodland form an ecotone between Yellow Box–Red Gum woodland and natural grassland in Kinlyside (4.6 ha), at several sites in Kenny (9.1 ha), and one in Gungaherra Nature Reserve (0.3 ha).

PLANNING AND CONSERVATION ISSUES

- Resolution of structure planning proposals for north Gungahlin, and future development areas east of the Town Centre in the suburbs of Throsby and Kenny.
- Maintaining ecological connectivity from woodlands near Hall–Kinlyside, through Mulligans Flat Nature Reserve to Gooroo and Mt Majura.
- Protection of the conservation significance of large areas of partially modified Yellow Box–Red Gum woodland, secondary grassland and habitat for threatened birds in the Gooroo area.
- Implementing the Village of Hall Master Plan so that the threat to the survival of orchids at Hall Cemetery is relieved and landscape protection for the village is supported.
- Protection of the small remnants of Snow Gum woodland.

5.4.1 North Gungahlin Unit

<i>Total area of woodland (All figures ha)</i>	2219
<i>Total YBRG community</i>	649
<i>Lowland woodland (partially modified)</i>	
YBRG	121
Other	513
<i>Lowland woodland (moderately modified)</i>	
YBRG	247
Other	549
<i>Secondary grassland (moderately modified)</i>	
YBRG	281
Other	180
<i>Lowland woodland vegetation (substantially & severely modified)</i>	328

UNIT DESCRIPTION

The unit (2219 ha) extends along the hills and lower slopes from Hall – Kinlyside to Gundaroo Road (Mulligans Flat Nature Reserve). It is bounded by forest and woodland on the border of NSW/ACT to the north and west, suburbs to the south and the Mulligans Flat woodlands to the east. The unit includes the section of Mulligans Flat Nature Reserve west of the Gundaroo Road. One third of the unit (634 ha) is partially modified woodland, with some Yellow Box–Red Gum. Lower lying areas in the central part are highly modified or retain little of conservation value due to past clearing of woodland remnants. To the west, on the mid and lower slopes of Kinlyside, significant areas of partially and moderately modified areas of woodland remain. Almost one quarter of the woodland in the unit is Yellow Box–Red Gum woodland (649 ha).

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

The vegetation condition in this unit varies greatly, with some patches still in good to very good condition in the hilltop woodlands and at Hall–Kinlyside, and others in much poorer condition. Throughout much of the unit, and particularly on the mid slopes the tree canopy has been largely retained, providing good ecological connectivity. Areas in poorer condition tend to be on the lower slopes, although there remains one area to the north of Ngunnawal that is in good condition, with plant species that are sensitive to disturbance still retained.

There is a population of the Tarengo Leek Orchid (*Prasophyllum petilum*) in the Hall Cemetery. This is

one of only three natural populations known to exist. The unit contains habitat, particularly in the western section, for the Hooded Robin, White-winged Triller, Varied Sittella and two species of declining woodland birds. The endangered Golden Sun Moth has been recorded from Mulligans Flat Nature Reserve (west of the Gundaroo Rd) and the uncommon Key’s Matchstick Grasshopper has been recorded from woodlands near Hall. There are two remnants of moderately modified Snow Gum woodland that form an ecotone between Yellow Box – Red Gum woodland and natural grassland in Kinlyside (total 4.6 ha) and several relictual stands of trees (total 4.8 ha) in the vicinity of Hall and on Harcourt Hill.

PLANNING AND CONSERVATION ISSUES

- Finalising the boundary between urban development in north Gungahlin and woodland areas to be managed for nature conservation.
- Maintaining ecological connectivity from woodlands near Hall–Kinlyside to Mulligans Flat Nature Reserve.
- Protection of conservation significance of large areas of partially modified Yellow Box–Red Gum woodland and habitat for threatened birds in the Kinlyside and border hills.
- Maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, including rehabilitation management on rural leases, strengthening ecological connectivity between woodland remnants and restoring where possible tree cover in secondary grassland communities.
- Maintenance of the remnant stands of Snow Gum woodland.

5.4.2 Gooroo–Mulligans Flat Unit

<i>Total area of woodland (All figures ha)</i>	1623
<i>Total YBRG community</i>	1146
<i>Lowland woodland (partially modified)</i>	
YBRG	770
Other	215
<i>Lowland woodland (moderately modified)</i>	
YBRG	191
Other	47
<i>Secondary grassland (moderately modified)</i>	
YBRG	185
Other	0
<i>Lowland woodland vegetation (substantially & severely modified)</i>	215

UNIT DESCRIPTION

The unit (1623 ha) occurs on the mid to lower eastern slopes between Gundaroo Road and the Federal Highway, and includes the section of Mulligans Flat Nature Reserve east of the Gundaroo Rd). It is bounded to the west and south by highly modified or extensively cleared plains on which there has been more intense pastoral activity. More than half of the unit (985 ha) is partially modified woodland, and almost 80% (770 ha) of this is Yellow Box–Red Gum woodland.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of the vegetation in the unit is in very good condition, including areas of secondary grassland that are derived from Yellow Box–Red Gum. Much of the woodland retains ground flora moderately to very sensitive to disturbance. The unit contains one of the largest, most intact and contiguous areas of Yellow Box Red Gum grassy woodland and other woodland types remaining in the ACT, providing habitat for threatened birds and other species. The nationally vulnerable species Austral Toadflax has been recorded in Yellow Box–Red Gum woodland in Mulligans Flat Nature Reserve.

The unit contains extensive habitat for many threatened and declining bird species, with records of Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater (Mulligans Flat), Regent Honeyeater and four species of declining woodland birds. Recent COG records indicate declines in the Hooded Robin and Brown Treecreeper at Mulligans Flat (see Appendix 2). The Golden Sun Moth, Key's Matchstick Grasshopper and the Black-headed Snake (*Suta spectabilis dwyeri*), an uncommon reptile in the ACT, have been recorded in Mulligans Flat Nature Reserve.

PLANNING AND CONSERVATION ISSUES

- Finalising the boundary between urban development in east Gungahlin and woodland areas to be managed for nature conservation.
- Maintaining ecological connectivity from Mulligans Flat Nature Reserve, through Gooroo to Mt Majura.
- Protection of the conservation significance of large areas of partially modified Yellow Box–Red Gum woodland, secondary grassland and habitat for threatened birds at Gooroo and the border hills.
- Maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland

woodland types, including restoration management on rural leases, strengthening ecological connectivity between woodland remnants, and restoring, where possible, tree cover in secondary grassland communities.

5.4.3 Central Gungahlin Unit

Total area of woodland (All figures ha)

579

Total YBRG community

68

Lowland woodland (partially modified)

YBRG **24**

Other **36**

Lowland woodland (moderately modified)

YBRG **43**

Other **7**

Secondary grassland (moderately modified)

YBRG **1**

Other **29**

Lowland woodland vegetation (substantially & severely modified)

439

UNIT DESCRIPTION

The unit (579 ha) comprises the lower slopes and undulating plains of central Gungahlin, where the woodland merges into natural grassland and highly modified former open woodland. Prior to European settlement the central valley of Gungahlin would have been largely treeless or only sparsely treed. Only highly fragmented areas of woodland now occur, primarily on the slopes of hills at Palmerston and Mitchell and on Gungahlin Hill and Percival Hill (Canberra Nature Park). With the expansion of Gungahlin, the remaining woodland is now close to urban development. Only a small amount (68 ha) of Yellow Box–Red Gum woodland remains, although most of the woodland in the area would have been Yellow Box–Red Gum prior to clearing.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Most of the remaining patches of woodland in this unit are in poor condition, reflecting the high level of clearance due to pastoral activities on the relatively deep, fertile soils throughout the valley. Gungahlin Hill and adjacent areas of woodland in the Gungahlin Nature Reserve contain ground flora moderately sensitive to disturbance. There are several remnants of modified Snow Gum woodland (total 9.1 ha) that form an ecotone between Yellow Box–Red Gum woodland and natural grassland in the unit. One of

these (0.3 ha) is in Gungaherra Nature Reserve and there is a remnant stand of trees along Well Station Road.

Three declining woodland bird species have been recorded in the unit; one from Gungahlin Hill, and two from Crace Nature Reserve, south of Mitchell.

PLANNING AND CONSERVATION ISSUES

- Protection for small woodland remnants and mature trees, including the stands of Snow Gum woodland.

5.5

Majura–Kowen Complex

(Figures 5.2 a&b)

(Units which make up this complex (Mt Ainslie–Mt Majura, East Majura Valley, Kowen) are discussed below under 5.5.1–5.5.3.)

Total area of woodland (All figures ha)	4900
Total YBRG community in complex	1560
Lowland woodland (partially modified)	
YBRG	231
Other	110
Lowland woodland (moderately modified)	
YBRG	1312
Other	1514
Secondary grassland (moderately modified)	
YBRG	30
Other	146
Lowland woodland vegetation (substantially & severely modified)	1555

DESCRIPTION

The Majura–Kowen complex (4900 ha) contains 1560 ha of Yellow Box–Red Gum woodland comprising the Mt Ainslie – Mt Majura unit, and land on and adjacent to the Majura Field Firing Range south to the New Line quarry and east of Fyshwick. The woodland vegetation is well connected north to south on both sides of the valley and can be regarded as an extension to the Gungahlin Hills woodlands. Highly modified areas, largely retaining the original mature trees, are found in the northern part, but these give way to naturally treeless native and exotic grasslands in the central and southern parts of the valley. Following extensive development of pine plantations in the Kowen area, only small remnant patches of woodland now remain.

The Majura Valley woodlands are connected to woodland and forest in NSW and Gungahlin to the north, via Gooroo and Greenwood Hill. They are also connected to the Callum Brae–Jerrabomberra complex via woodland at New Line quarry and east of Fyshwick, and other patches of remnant woodland vegetation.

The Majura–Kowen complex is considered to be a ‘Fragmented’ landscape becoming ‘Relictual’ in the Kowen area (after McIvor and McIntyre *et al.* 2002).

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

There are extensive areas of woodland vegetation of high conservation value in the Majura Valley. The natural temperate grassland adjacent to woodland on the eastern slopes of Mt Ainslie and to the north and east of the Canberra International Airport provides habitat for several threatened plants and animals, including the Grassland Earless Dragon, Striped Legless Lizard, Perunga Grasshopper, Golden Sun Moth and Button Wrinklewort.

There is one remnant of modified Snow Gum woodland in Kowen (1 ha) that forms an ecotone between Yellow Box–Red Gum woodland and natural grassland, and several relictual stands of trees along the edge of Mt Ainslie (near the Australian War Memorial) and Mt Pleasant.

The unit contains habitat for several threatened and declining bird species, with records of Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater, Regent Honeyeater, Superb Parrot and three declining woodland bird species. Surveys undertaken on different occasions in the last 20 years within the Majura Field Firing Range and on Mt Majura–Mt Ainslie have recorded populations of Common Dunnarts (*Sminthopsis murina*) and Yellow-footed Antechinus (*Antechinus flavipes*) in these areas. Lace Monitors, an uncommon lizard in the ACT, have been occasionally observed in woodlands on Mt Ainslie.

PLANNING AND CONSERVATION ISSUES

- Maintenance and enhancement of woodland condition in Mt Ainslie and Mt Majura Nature Reserves, and the Majura Field Firing Range.
- Protection of ecological connectivity between east facing slopes of Mt Ainslie and adjacent natural grassland habitat (Campbell Park), and similarly between woodland and grassland east of the Canberra International Airport.

- Maintenance of ecological connectivity with the Callum Brae–Jerrabomberra woodland via the New Line quarry area and woodlands east of Fyshwick.
- Maintenance of connectivity across the Federal Highway to Gooroo.
- Protection of the Snow Gum woodland remnant in Kowen.

5.5.1 Mt Ainslie–Mt Majura Unit

Total area of woodland (All figures ha)

1041

Total YBRG community

697

Lowland woodland (partially modified)

YBRG **176**

Other **13**

Lowland woodland (moderately modified)

YBRG **509**

Other **36**

Secondary grassland (moderately modified)

YBRG **12**

Other **18**

Lowland woodland vegetation (substantially & severely modified)

277

UNIT DESCRIPTION

The unit contains about 700 ha of Yellow Box–Red Gum woodland on all slopes of Mt Ainslie and Mt Majura and the saddle between them. The woodland on the western side of Ainslie–Majura is bounded by suburbs and on the eastern side by open woodland and grassland. It merges into dry sclerophyll forest on the higher slopes of the hilltops. On the eastern facing slopes of Mt Ainslie, Yellow Box–Red Gum woodland is adjacent to an area of natural grassland that provides habitat for several threatened plant and animal species. Impacts on Yellow Box–Red Gum woodland from recreational and other activities on Ainslie–Majura pose a management challenge, if conservation values are to be protected. The woodland in the Ainslie–Majura unit connects to woodland on Gooroo to the north and is joined across Majura Valley to woodland in east Majura by woodland and highly modified woodland containing isolated and scattered trees. Small patches of woodland are scattered through the suburbs of Campbell and Duntroon. In this unit there are valuable examples of Snow Gum woodland that form ecotones between natural grassland and woodland.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

The unit contains partially modified woodland with a high diversity of native plant species. Areas of woodland in good condition occur on the lower slopes of Mt Ainslie, near Fairbairn Ave and adjacent to grassland near the Campbell Park Offices. There are several relictual stands of Snow Gum and Candlebark trees on the southern edges of Mt Ainslie and Mt Pleasant.

Mt Ainslie, particularly the lower slopes at Campbell Park, contains habitat for several threatened and declining bird species, with records of Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater, Regent Honeyeater, Superb Parrot and one declining woodland bird species. Two other declining woodland bird species have been recorded at various locations within the unit. Yellow-footed Antechinus (*Antechinus flavipes*) and Brown Antechinus (*A. stuartii*) were found on Mt Majura and Mt Ainslie 20 years ago and have not been recorded since.

PLANNING AND CONSERVATION ISSUES

- Protecting ecological connectivity between the eastern slopes of Mt Ainslie and the adjacent areas of natural grassland (Campbell Park offices).
- Management of Mt Ainslie and Mt Majura Nature Reserves for conservation and recreation, including potential to improve ecological condition of the remaining woodland.
- Management of woody weeds and other impacts on Yellow Box–Red Gum from adjacent suburban development.
- Management of the Hackett horse holding paddocks on Mt Majura in a manner that maintains or improves condition of Yellow Box–Red Gum woodland.

5.5.2 East Majura Valley Unit

Total area of woodland (All figures ha)	3448
Total YBRG community	832
Lowland woodland (partially modified)	
YBRG	55
Other	91
Lowland woodland (moderately modified)	
YBRG	759
Other	1335
Secondary grassland (moderately modified)	
YBRG	18
Other	78
Lowland woodland vegetation (substantially & severely modified)	1112

UNIT DESCRIPTION

This unit contains 777 ha of Yellow Box–Red Gum woodland well connected to dry sclerophyll forest on the higher slopes and to natural grassland northeast of the Canberra International Airport. Other woodlands occur on the higher slopes. Much of the woodland (1167 ha) on the lower slopes and valley floors in the north of the unit is highly modified, containing scattered trees with an exotic groundlayer. There is some ecological connectivity north to woodland vegetation in NSW, and south through open woodland into the Jerrabomberra Valley.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of this unit is located within the Majura Field Firing Range, which retains a very diverse flora. Yellow Box–Red Gum woodland occurs on the lower slopes where it merges into natural temperate grassland east of the airport. Woodland to the south has been more highly modified and is more fragmented than that to the north.

The unit contains habitat for several threatened and declining bird species. Hooded Robins have been recorded in woodlands at the Majura Field Firing Range and from the Newline Quarry area. Regent Honeyeater and Brown Treecreeper have been recorded mainly from the Newline Quarry area. White-winged Triller, Varied Sittella and four declining woodland bird species have been recorded in the unit, mostly from the Newline Quarry area and woodlands at the Majura Field Firing Range.

PLANNING AND CONSERVATION ISSUES

- Protecting ecological connectivity between woodlands and adjacent areas of natural grassland (Majura Field Firing Range).
- Protecting habitat for threatened birds in fragmented and modified habitats between Pialligo Avenue and the Molonglo River.
- Creating habitat linkages between woodlands in the Majura and Jerrabomberra Valleys.

5.5.3 Kowen Unit

Total area of woodland (All figures ha)	409
Total YBRG community	44
Lowland woodland (partially modified)	
YBRG	0
Other	6
Lowland woodland (moderately modified)	
YBRG	44
Other	143
Secondary grassland (moderately modified)	
YBRG	0
Other	50
Lowland woodland vegetation (substantially & severely modified)	166

DESCRIPTION

Much of the Kowen area is pine plantation, leaving highly fragmented very small areas of woodland, mostly adjacent to the Kings Highway. Of the remaining woodland fragments only 44 ha are Yellow Box–Red Gum. Woodland in Kowen merges into heavily cleared pasture away from the Kings Highway and sparsely treed rural land in NSW to the east.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of the woodland in the unit is moderately to severely modified. An area of secondary grassland at the easternmost edge of the unit still retains a diversity of disturbance sensitive species. There are a small number of Black Gum (*Eucalyptus aggregata*) trees growing along the roadside of the Kings Highway, the only known naturally occurring population of this species in the ACT. The unit contains woodland habitat for the Varied Sittella. There is a very small remnant of Snow Gum woodland (1 ha) that is moderately modified, and a larger area of substantially modified Snow Gum woodland with an exotic understorey.

PLANNING AND CONSERVATION ISSUES

- Management for regeneration of the Black Gum population.
- Retention of the secondary grassland in the east of the area.
- Reinforcing connectivity between remaining fragments and other native vegetation, across rural land, the former travelling stock reserve and through pine plantations.
- Protection of the Snow Gum woodland remnant.

5.6

Callum Brae–Jerrabomberra Valley Complex

(Refer to Figures 5.3 a & b)

(Units which make up this complex (Red Hill, Mugga Lane West, Mugga Lane East, Wanniasa Hills, Farrer Ridge) are discussed below under 5.6.1–5.6.5.)

Total area of woodland (All figures ha)	2325
Total YBRG community in complex	1040
Lowland woodland (partially modified)	
YBRG	294
Other	111
Lowland woodland (moderately modified)	
YBRG	755
Other	394
Secondary grassland (moderately modified)	
YBRG	65
Other	63
Lowland woodland vegetation (substantially & severely modified)	711

DESCRIPTION

The Callum Brae–Jerrabomberra Valley complex (2325 ha) is one of the largest areas of contiguous woodland in the ACT region. It includes about 1040 ha of Yellow Box–Red Gum woodland merging into natural grassland in the valley floor to the east and dry sclerophyll forest on hilltops to the west. Highly modified areas of woodland, quarried hillsides and the Mugga landfill form major discontinuities in the central area. Only roads and some more sparsely treed rural land break woodland connectivity from Red Hill to Wanniasa and Fadden Hills. Stirling Park in Yarralumla would originally have been connected to Red Hill.

The Callum Brae–Jerrabomberra Valley complex is considered to be a ‘Variegated’ landscape (after McIvor and McIntyre *et al.* 2002).

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

There are extensive areas of woodland vegetation in very good condition. Areas in less good condition occur generally on the lower slopes to the east and south. This complex contains populations of Button Wrinklewort in Red Hill and Stirling Ridge and habitat for the Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater and two declining woodland bird species. Populations of the Pink-tailed Worm Lizard have been found at Mt Mugga Mugga, Farrer Ridge and at Woden Property.

There are several relictual stands of Snow Gum and Candlebark trees in the southern and eastern edges of the complex.

PLANNING AND CONSERVATION ISSUES

- Resolution of the future status of land in the Callum Brae–Jerrabomberra Valley complex is urgently needed if conservation options are to be retained.
- Conservation management of the Callum Brae woodlands east of the existing and former quarries that contain substantial areas of Yellow Box–Red Gum woodland in good condition and provide extensive habitat for woodland birds.
- Maintaining north-south ecological connectivity from Red Hill to Fadden Hills (and from there, west to Mount Taylor) and between the woodland and natural grassland communities along the eastern boundary are high priorities.
- Extending the Isaacs Ridge Nature Reserve to include Yellow Box–Red Gum woodlands on the lower slopes of Isaacs Ridge, along Mugga Lane would protect lower altitude Yellow Box–Red Gum woodland, strengthen north-south connectivity and reduce possible impacts from any future developments located on the western side of Mugga Lane.
- Maintaining and, in some places, creating habitat links between the Callum Brae–Jerrabomberra Valley complex: north to Majura Valley East (via the natural grasslands of the Jerrabomberra Valley and across the Molonglo River to the New Line Quarry and land east of Canberra International Airport), and south via the ACT/NSW border to the Rob Roy Range will make a significant contribution

to regional conservation by linking major remaining woodland fragments.

5.6.1 Red Hill Unit

<i>Total area of woodland (All figures ha)</i>	346
<i>Total YBRG community</i>	261
<i>Lowland woodland (partially modified)</i>	YBRG 46
<i>Lowland woodland (moderately modified)</i>	YBRG 212 Other 25
<i>Secondary grassland (moderately modified)</i>	YBRG 3 Other 21
<i>Lowland woodland vegetation (substantially & severely modified)</i>	39

UNIT DESCRIPTION

This unit (346 ha) comprises the Red Hill ridgeline and its upper slopes. It is surrounded by urban development and separated from Mugga Lane west by a major arterial road. Much of the Yellow Box–Red Gum woodland has been moderately modified (212 ha) but some parts in the north and west remain partially modified (46 ha) or have been substantially modified (39 ha). Secondary grassland occurs along the ridge tops at the southern end. Stirling Park contains 46 ha of moderately modified woodland between Lake Burley Griffin and the suburb of Yarralumla, broken internally by Alexandrina Drive, State Circle and some areas of exotic vegetation. The unit is largely isolated from other areas of woodland and other native vegetation by urban development and Lake Burley Griffin.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of the vegetation in the unit is woodland and open forest in good condition. Areas of vegetation in lower condition occur in the secondary grassland to the south and adjacent to urban developments and road infrastructure to the north. Over 5000 Button Wrinklewort plants occur in several populations and as individuals in Red Hill Nature Reserve. Stirling Park contains more than 70 000 Button Wrinklewort plants, one of the largest remaining populations of the species.

The unit contains habitat for the Varied Sittella and one declining woodland bird species.

PLANNING AND CONSERVATION ISSUES

- Maintenance and enhancement of the ecological condition of the Red Hill Nature Reserve.
- Management of weeds from adjacent residential and golf course leases.
- Protection of threatened species habitat.
- Connectivity across Hindmarsh Drive to Mt Mugga Mugga.
- National Capital uses that may impact on woodland conservation values of Stirling Park.
- Control of woody weeds and protection of Button Wrinklewort (endangered species) at Stirling Park and Red Hill.

5.6.2 Mugga Lane West Unit

<i>Total area of woodland (All figures ha)</i>	577
<i>Total YBRG community</i>	292
<i>Lowland woodland (partially modified)</i>	YBRG 98 Other 34
<i>Lowland woodland (moderately modified)</i>	YBRG 185 Other 160
<i>Secondary grassland (moderately modified)</i>	YBRG 9 Other 39
<i>Lowland woodland vegetation (substantially & severely modified)</i>	52

UNIT DESCRIPTION

This unit (577 ha) comprises the Isaacs Ridge and Mt Mugga hilltop and their east-facing slopes and is bounded by a pine plantation (west), Mugga Lane (east), Hindmarsh Drive (north) and Long Gully Road (south). The unit is predominantly moderately modified lowland woodland (345 ha) with some areas of partially modified woodland, two patches (52 ha) of highly modified woodland and several areas of secondary grassland. Almost half of the unit contains Yellow Box–Red Gum woodland, mostly on the lower slopes, grading upslope into other woodland types.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of the vegetation in this unit is in very good condition. Areas in poorer condition are adjacent to more intensively used areas (the former quarry, parts of O'Malley and on the corner of Mugga Lane and

Hindmarsh Drive). The unit contains habitat for the Varied Sittella, Painted Honeyeater (Mugga Lane woodland) and one declining woodland bird species. A record of the Perunga Grasshopper comes from the hilltop at O'Malley. The Pink-tailed Worm Lizard has been recorded from Mt Mugga Mugga.

PLANNING AND CONSERVATION ISSUES

- Maintenance of ecological connectivity between Red Hill and Wanniasa units of Canberra Nature Park.
- Potential to adjust Public Land (Nature Conservation) boundaries along Mugga Lane to secure Yellow Box–Red Gum woodlands on lower slopes.
- Opportunities to restore habitat values in woodlands modified by past land uses.

5.6.3 Mugga Lane East Unit

Total area of woodland (All figures ha)

872

Total YBRG community

395

Lowland woodland (partially modified)

YBRG **116**

Other **14**

Lowland woodland (moderately modified)

YBRG **231**

Other **102**

Secondary grassland (moderately modified)

YBRG **48**

Other **1**

Lowland woodland vegetation (substantially & severely modified)

360

UNIT DESCRIPTION

The unit (872 ha) is on the lower eastern facing slopes of Mt Mugga separated from Mugga Lane West woodland by a minor road and from Wanniasa Hills by the Mugga Lane landfill and sparsely treed, highly modified woodland. The northern and southern thirds of this unit, comprising mostly moderately modified woodland and some partially modified woodland are separated by substantially and severely modified woodland containing predominantly exotic understorey and isolated trees. The unit contains 395 ha of Yellow Box–Red Gum woodland and is one of the larger contiguous areas left in the ACT. Along the unit's eastern edge, the woodland merges into natural temperate grassland and exotic grass pasture in the Jerrabomberra Valley. The unit contains an active quarry and the Mugga landfill.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

About one third of the woodland in this unit is in very good condition. Much of the area is in moderate condition, characterised by retention of tree cover and loss of the native component in the groundlayer. There are several relictual stands of Snow Gum and Candlebark trees remaining in the unit.

The lower slopes of the unit tend to be in poorer vegetation condition than the upper slopes, but there are notable exceptions on the 'Callum Brae' property to the north and small areas in 'Woden' property to the south. The northern third of the unit contains high quality habitat for threatened and declining species with records of Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater ('Woden') and two declining woodland bird species. The Pink-tailed Worm Lizard has been recorded from the south-eastern part of the unit, on 'Woden' property.

PLANNING AND CONSERVATION ISSUES

- Potential to conserve a large area of the Callum Brae woodland containing Yellow Box–Red Gum and other woodland habitat for threatened and declining woodland birds.
- Maintaining ecological connectivity between woodland and native grassland ('Woden' property).
- Rehabilitation of stabilized landfill areas.
- Maintenance of tree cover to assist connectivity across future development areas.

5.6.4 Wanniasa Hills Unit

Total area of woodland (All figures ha)

369

Total YBRG community

113

Lowland woodland (partially modified)

YBRG **4**

Other **22**

Lowland woodland (moderately modified)

YBRG **109**

Other **85**

Secondary grassland (moderately modified)

YBRG **0**

Other **0**

Lowland woodland vegetation (substantially & severely modified)

149

UNIT DESCRIPTION

The Wanniasa Hills unit (369 ha) comprises the southern facing slopes of Mt Wanniasa separated from the Mugga Lane west woodland by a road and from Farrer Ridge by an arterial road. The unit is adjacent to residential development to the south. One third of the unit (113 ha) contains Yellow Box–Red Gum woodland most of which is part of the Rose Cottage Horse Paddocks. The unit contains mostly moderately modified woodland with some partially modified woodland along the southern edge. In the eastern part of the horse paddocks Yellow Box–Red Gum woodland merges into highly modified woodland with scattered trees.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Most of Wanniasa Hills contains vegetation in good to very good condition, particularly on the upper slopes. The lower slopes are more disturbed. Much of the unit contains ground flora moderately sensitive to disturbance and is good quality fauna habitat.

PLANNING AND CONSERVATION ISSUES

- Maintenance and enhancement of habitats in the Wanniasa Hills Nature Reserve.
- Management of horse holding paddocks in a manner that maintains or improves condition of Yellow Box–Red Gum woodland contained within them.

5.6.5 Farrer Ridge Unit

<i>Total area of woodland (All figures ha)</i>	174
<i>Total YBRG community</i>	53
<i>Lowland woodland (partially modified)</i>	
YBRG	30
Other	41
<i>Lowland woodland (moderately modified)</i>	
YBRG	18
Other	22
<i>Secondary grassland (moderately modified)</i>	
YBRG	5
Other	5
<i>Lowland woodland vegetation (substantially & severely modified)</i>	56

UNIT DESCRIPTION

The unit (174 ha) comprises the southeast facing upper slopes of Farrer Ridge and is bounded by

suburbs to the north and south, and Wanniasa Hills Nature Reserve to the east, separated by an arterial road. Approximately 40 percent (71 ha) is partially modified woodland. Areas to the south and patches to the north are highly modified, especially along the border of Sulwood Drive. One third of the Farrer Ridge unit is Yellow Box–Red Gum woodland.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of the vegetation in this unit is in good to very good condition. The edges of Fadden Hills, particularly where roads abut, tend to be in poorer condition. Much of the unit contains ground flora moderately sensitive to disturbance. The unit contains habitat for the Varied Sittella and one declining woodland bird species. The Pink-tailed Worm Lizard has been recorded in the unit.

PLANNING AND CONSERVATION ISSUES

- Recovery of fire affected areas (from January 2003 fires), and maintenance and enhancement of woodland habitat in the Farrer Ridge Nature Reserve, and connectivity to Mt Taylor and Wanniasa Hills Nature Reserves.
- Restoration of degraded parts could enhance habitat for woodland flora and fauna.

5.7

Tuggeranong–Naas Complex

(Refer to Figures 5.4 a & b)

(Units which make up this complex (Tidbinbilla–Booroomba, Rob Roy Range, Naas) are discussed below under 5.7.1–5.7.3.)

<i>Total area of woodland (All figures ha)</i>	18 800
<i>Total YBRG community in complex</i>	5405
<i>Lowland woodland (partially modified)</i>	
YBRG	2213
Other	4224
<i>Lowland woodland (moderately modified)</i>	
YBRG	3220
Other	2357
<i>Secondary grassland (moderately modified)</i>	
YBRG	154
Other	1563
<i>Lowland woodland vegetation (substantially & severely modified)</i>	5010

DESCRIPTION

The Tuggeranong–Naas complex (18 800 ha) is another of the few remaining large areas of contiguous woodland in the ACT region. It contains 5405 ha of Yellow Box–Red Gum woodland that merges into highly modified woodland along the Murrumbidgee River (at Lanyon–Lambrigg) and into dry sclerophyll forest in Namadgi National Park and Tidbinbilla Nature Reserve to the south and west. Yellow Box–Red Gum woodland occurs in a relatively narrow band (600–900 m) between the valley floors and the steeper slopes covered with dry woodland (to about 1100 m) or forest. Ecological connectivity across this complex is generally good and only broken by rural roads, the village of Tharwa and small areas of farmland from which trees have been cleared. Large parts of the woodlands in this complex were burnt in the January 2003 bushfire, although Castle Hill and some surrounding woodlands escaped major impact.

The Tuggeranong–Naas complex is considered to be a ‘Variegated’ landscape (after McIvor and McIntyre *et al.* 2002).

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

This complex contains extensive areas of woodland and secondary grassland (approximately 13 000 ha) that are partially modified or modified to the extent that there is still 50% or more native cover in the understorey. Areas that are highly modified tend to be on the lower slopes. These parts have an exotic understorey but contain scattered or isolated trees, providing continuous connectivity of tree cover for some fauna. The complex contains habitat for many threatened and declining bird species including, Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella, Regent Honeyeater and four declining woodland bird species. The Pink-tailed Worm Lizard is found along the Murrumbidgee River and on Tuggeranong Hill. Key’s Matchstick Grasshopper has been recorded from near Castle Hill and in easements for the Monaro Highway and railway.

There are extensive areas of Snow Gum grassy woodland dominated by Snow Gum, Candlebark and Black Sallee remaining at higher elevations (700–1250 m) in the Naas and Tidbinbilla Valleys.

PLANNING AND CONSERVATION ISSUES

- Providing support to landholders to manage woodlands under rural lease according to best practice management.

- Maintaining and/or enhancing woodland condition where protected in the Murrumbidgee River corridor, in Namadgi National Park and the Rob Roy and Tuggeranong Hill Nature Reserves.
- Recovery of fire affected areas (from January 2003 fires), and maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, including restoration management on rural leases, strengthening ecological connectivity between woodland remnants and restoring where possible tree cover in secondary grassland communities.
- Ensuring that any development in the area takes into account its potential impact on woodland vegetation, flora and fauna conservation, and maintenance of ecological connectivity across the rural landscape.

5.7.1 Tidbinbilla–Booroomba Unit

<i>Total area of woodland (All figures ha)</i>	6432
<i>Total YBRG community</i>	1806
<i>Lowland woodland (partially modified)</i>	YBRG 843 Other 1338
<i>Lowland woodland (moderately modified)</i>	YBRG 812 Other 851
<i>Secondary grassland (moderately modified)</i>	YBRG 151 Other 999
<i>Lowland woodland vegetation (substantially & severely modified)</i>	1438

UNIT DESCRIPTION

The unit (6428 ha) encompasses land in several valleys west of the Murrumbidgee River, including Sawyers Gully, Blue Gum Creek to Namadgi National Park, Paddy’s River to Tidbinbilla Nature Reserve and Tanners Flat Creek. Woodland is generally found from altitudes of 550 m to over 1200 m. Yellow Box–Red Gum grassy woodland (1769 ha) occurs within the 575 m to 900 m range, generally merging into other woodland, mostly dominated by Broad-leafed Peppermint, Mealy Bundy and Scribbly Gum or into forest at the higher altitudes and on steeper slopes. Castle Hill and surrounding woodland is a prominent feature and significant area of Yellow Box–Red Gum woodland. Woodland patches are separated by cleared areas that retain secondary grassland

characteristics, or by exotic pastures with some remnant trees.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Almost one third of the unit (2181 ha) is partially modified woodland. Areas of highly modified woodland can be found along the lower slopes and open plains towards the Murrumbidgee River. Secondary grassland patches retain the native groundlayer species (more than 50% total cover). Several populations of the nationally vulnerable plant species, Austral Toadflax, occur within woodland in Tidbinbilla Nature Reserve. Several areas of higher altitude Snow Gum woodland occur within the land unit, including remnant stands of trees within Tidbinbilla Nature Reserve.

The Castle Hill area has extensive areas of partially modified woodland, much of which is Yellow Box–Red Gum and contains high quality habitat for many threatened and declining bird species (Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella and Regent Honeyeater). Four other species of declining woodland birds have been recorded at various locations within this unit. The uncommon Key's Matchstick Grasshopper has been recorded in Yellow Box–Red Gum habitat near Castle Hill. Parts of this woodland complex in rural, plantation and nature reserve areas were subject to bushfires in January 2003, although Castle Hill and surrounds were less severely affected and will provide a source of recolonising species for woodlands as they recover.

PLANNING AND CONSERVATION ISSUES

- Maintaining the intact landscape mosaic of partially modified woodland on and around the Castle Hill area and retention of treed connectivity from north to south, and to the Rob Roy Range to the east.
- Maintaining and enhancing woodland habitat conditions on Castle Hill for threatened and declining birds.
- Recovery of fire affected areas (from January 2003 fires), and maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, including restoration management on rural leases, strengthening ecological connectivity between woodland remnants and restoring where possible tree cover in secondary grassland communities.

5.7.2 Rob Roy Range Unit

<i>Total area of woodland (All figures ha)</i>	4094
<i>Total YBRG community</i>	1012
<i>Lowland woodland (partially modified)</i>	YBRG 44 Other 67
<i>Lowland woodland (moderately modified)</i>	YBRG 968 Other 511
<i>Secondary grassland (moderately modified)</i>	YBRG 0 Other 0
<i>Lowland woodland vegetation (substantially & severely modified)</i>	2504

UNIT DESCRIPTION

This unit (4094 ha) is bounded by suburban Tuggeranong to the north, the Murrumbidgee River to the west and the ACT/NSW border to the east. It includes the Tuggeranong Hill, Rob Roy and Gigerline Nature Reserves and connects with similar woodland communities in the Royalla area (NSW). Rob Roy Range, mainly covered with forest vegetation, runs north to south but is surrounded by slopes on which Yellow Box–Red Gum woodland frequently occurs. Woodland vegetation on Tuggeranong Hill is well connected to forest and woodland on the lower slopes of Mt Rob Roy.

Very little of the unit now contains woodland that is partially modified (111 ha). Woodland with a modified understorey is patchy, surrounded by highly modified woodland that retains trees but with few native species in the groundlayer. One quarter of the woodland remaining in this unit is Yellow Box–Red Gum (1012 ha), much of which is moderately modified following a long history of rural use. Only a relatively small part of the complex was affected by the 2003 bushfires.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Less than one third of the woodland in this unit has retained its former native understorey vegetation, although there is an almost continuous coverage of trees throughout. Nevertheless the unit contains habitat for threatened and declining bird species. Hooded Robins and Varied Sittellas have been recorded in the higher quality woodland areas to the north and south, and Hooded Robins have been recorded in the central area close to the

Murrumbidgee River. Brown Treecreepers have been recorded mostly from areas close to the Murrumbidgee River. One declining woodland bird species has been recorded in this unit, and two others have been recorded from adjacent areas in NSW and ACT (mainly from areas close to the Murrumbidgee River). The uncommon Key's Matchstick Grasshopper has been recorded in suitable habitat on easements for the Monaro Highway and railway. The Pink-tailed Legless Lizard has been recorded from the lower slopes of Tuggeranong Hill and several locations along the Murrumbidgee River.

There is a remnant of higher elevation Snow Gum grassy woodland in the unit.

PLANNING AND CONSERVATION ISSUES

- Maintenance of the woodland and forested connectivity between Mt Tuggeranong, Mt Rob Roy and Gigerline.
- Maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, including restoration management on rural leases, strengthening ecological connectivity between woodland remnants and restoring where appropriate tree cover in highly modified woodland vegetation.

5.7.3 Naas Unit

<i>Total area of woodland (All figures ha)</i>	7306
<i>Total YBRG community</i>	2769
<i>Lowland woodland (partially modified)</i>	
YBRG	1326
Other	2819
<i>Lowland woodland (moderately modified)</i>	
YBRG	1440
Other	995
<i>Secondary grassland (moderately modified)</i>	
YBRG	3
Other	564
<i>Lowland woodland vegetation (substantially & severely modified)</i>	1068

UNIT DESCRIPTION

The unit (7306 ha) includes the north facing, mid and lower slopes of Mt Tennant and Billy Range and the valley floor of the Naas River. It is bounded by the higher forested margins of Namadgi National Park to the west and south and by the Murrumbidgee River to the northeast. Woodland occurs between altitudes of

625 m and 1100 m. Many of the mid and lower slopes are very steep.

Most of the woodland now remaining in this unit is partially modified or moderately modified woodland. Highly modified woodland occurs in the lower areas of the valley floor, mostly within the Naas River valley. One third of the woodland in this unit (2316 ha) is Yellow Box–Red Gum woodland. Lower elevation woodland in this complex was subject to moderate to high fire severity in the 2003 bushfires.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of unit contains woodland with more than 50% native species cover in the groundlayer (over 5 000 ha). Areas dominated by exotic species in the groundlayer tend to occur in the Naas Valley. The unit contains habitat for several threatened and declining bird species, with records of Hooded Robin, Brown Treecreeper and White-winged Triller mainly from areas close to the Murrumbidgee River. Varied Sittellas have been recorded in forest to the south west of the unit. Three declining woodland bird species have been recorded from various locations within the unit. The Pink-tailed Worm Lizard has been recorded in the north of this unit along the Murrumbidgee River.

There are extensive areas of higher elevation Snow Gum woodland within the Naas Valley.

PLANNING AND CONSERVATION ISSUES

- Resolution of land tenure arrangements south of the Namadgi Visitor Centre and around the site of a possible future water supply dam.
- Recovery of fire affected areas (from January 2003 bushfires), and maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types—including restoration management on rural leases, strengthening ecological connectivity between woodland remnants, and restoring where possible, tree cover in secondary grassland communities.

5.8

North Murrumbidgee–Lower Molonglo Complex

(Refer to Figures 5.5 a & b)

(Units which make up this complex (Bulgar Creek, Uriarra, West Belconnen) are discussed below under 5.8.1–5.8.3.)

Total area of woodland (All figures ha)	6488
Total YBRG community in complex	912
Lowland woodland (partially modified)	
YBRG	121
Other	283
Lowland woodland (moderately modified)	
YBRG	655
Other	700
Secondary grassland (moderately modified)	
YBRG	136
Other	57
Lowland woodland vegetation (substantially & severely modified)	4536

DESCRIPTION

The North Murrumbidgee–Lower Molonglo complex (6545 ha) covers rural land to the west of Belconnen, Woden and Weston Creek and includes several quite large patches of Yellow Box–Red Gum woodland totalling 940 ha. Two-thirds of the woodland in this complex is now highly modified with scattered trees to open woodland over mainly exotic pasture. This complex is connected southwards to woodland in the Tuggeranong – Naas area and northwards along the Murrumbidgee valley into NSW. Urban developments to the north and east and pine forests to the west separate this complex from other areas of woodland and forest in the ACT.

Large areas of this woodland complex in both rural, plantation and Canberra Nature Park areas were subject to bushfires in January 2003.

The North Murrumbidgee–Lower Molonglo complex is considered to be a 'Relictual' landscape (after McIvor and McIntyre *et al.* 2002).

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

There are few areas of vegetation in very good condition. Of note are woodlands in Aranda Bushland and Black Mountain, along the western edge of

O'Connor Ridge and patches of woodland that occur in the Mt Stromlo area. The unit contains habitat for several threatened and declining bird species, with records of Hooded Robin, Brown Treecreeper, White-winged Triller, Varied Sittella, Painted Honeyeater, Superb Parrot and three declining woodland bird species. The Pink-tailed Worm Lizard has been recorded along the Murrumbidgee and Molonglo River corridors and Key's Matchstick Grasshopper has been recorded from the Murrumbidgee River corridor and close to Hall. A few specimens of the Small Purple Pea (*Swainsona recta*) have been located in woodland near Caswell Drive.

The complex contains one of the few remaining partially modified Snow Gum woodland areas that forms an ecotone between Yellow Box–Red Gum woodland and natural grassland (Aranda Bushland, 0.5 ha) as well as a relictual stand of trees to the east of Caswell Drive.

PLANNING AND CONSERVATION ISSUES

- Maintenance and enhancement of woodlands along the Murrumbidgee River and nearby rural lands used by honeyeaters during their late summer migration.
- Recovery of fire affected areas (from January 2003 bushfires) and maintenance of the remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, especially Snow Gum woodland; including restoration management on rural leases, strengthening ecological connectivity between woodland remnants, and restoring where possible, tree cover in secondary grassland communities.

5.8.1 Bulgar Creek Unit

Total area of woodland (All figures ha)	3997
Total YBRG community	361
Lowland woodland (partially modified)	
YBRG	49
Other	176
Lowland woodland (moderately modified)	
YBRG	311
Other	275
Secondary grassland (moderately modified)	
YBRG	1
Other	57
Lowland woodland vegetation (substantially & severely modified)	3128

UNIT DESCRIPTION

The unit (3997 ha) includes mostly rural land in the Bulgar Creek catchment and south of the lower Molonglo River, and two Canberra Nature Park units: Mt Taylor and Coolamon Ridge. Very little of the unit contains partially modified or moderately modified woodland, and only 361 ha (9%) of the woodland in the unit is Yellow Box–Red Gum, including three relatively large patches. More than 75% of the woodland is highly modified, containing scattered trees over exotic pasture. Much of the latter would have comprised Yellow Box–Red Gum prior to modification.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Few areas in good condition remain in the unit. The exceptions are small remnants of woodland within Stromlo Forest, some of which are floristically diverse and partially modified. Areas subject to greater modification tend to be where introduced pastures have been established. A population of the endangered Small Purple Pea occurs on Mt Taylor. A population of the nationally vulnerable plant species, Austral Toadflax occurs in woodland above Kambah Pool.

The remaining woodlands retain habitat for several threatened and declining bird species, with records of Hooded Robin (southwest of Mt Stromlo), Brown Treecreeper (patches between Murrumbidgee River and Cotter Road, and Mt Stromlo), White-winged Triller (near Uriarra), Varied Sittella (various locations), Painted Honeyeater (Mt Taylor and historical records from along the Murrumbidgee and Molonglo Rivers) and two declining woodland bird species (various locations). The Pink-tailed Legless Lizard has been recorded from various locations, particularly along the Murrumbidgee and Molonglo Rivers. Key's Matchstick Grasshopper has been recorded from the Murrumbidgee River corridor in the south of this unit.

PLANNING AND CONSERVATION ISSUES

- Recovery of areas burnt in January 2003 fires and maintenance of remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, including restoration management on rural leases.
- Strengthening ecological connectivity between woodland remnants and to the Murrumbidgee River corridor.
- Restoring tree cover in secondary grassland communities on Coolamon Ridge.
- Possible consideration as future urban land.

5.8.2 Uriarra Unit

<i>Total area of woodland (All figures ha)</i>	904
<i>Total YBRG community</i>	15
<i>Lowland woodland (partially modified)</i>	YBRG 0 Other 0
<i>Lowland woodland (moderately modified)</i>	YBRG 15 Other 348
<i>Secondary grassland (moderately modified)</i>	YBRG 0 Other 0
<i>Lowland woodland vegetation (substantially & severely modified)</i>	541

UNIT DESCRIPTION

The unit (904 ha) is on the lower slopes of the Blue Range, west of the Murrumbidgee River near the confluence with the Molonglo River and adjacent to similar low lying areas in NSW. It is bounded by pine plantations (burnt in the 2003 fires) to the west, and the Murrumbidgee River to the east. Very little (15 ha) of Yellow Box–Red Gum woodland remains in this area. More than half of the woodland is highly modified, particularly in the southern parts of the unit.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

Much of the unit has been highly modified for pastoral use. However, remaining woodlands retain habitat for several threatened and declining bird species. Brown Treecreepers have been recorded from the Murrumbidgee River Corridor, Varied Sittella from the north of the unit, and one declining woodland bird species has been recorded from various locations within this unit. The Pink-tailed Worm Lizard has been recorded from various locations, particularly along the Murrumbidgee River.

PLANNING AND CONSERVATION ISSUES

- Connectivity with woodlands in adjacent land units.

5.8.3 Belconnen Unit

<i>Total area of woodland (All figures ha)</i>	1587
<i>Total YBRG community</i>	536
<i>Lowland woodland (partially modified)</i>	YBRG 72 Other 107
<i>Lowland woodland (moderately modified)</i>	YBRG 329 Other 77
<i>Secondary grassland (moderately modified)</i>	YBRG 135 Other 0
<i>Lowland woodland vegetation (substantially & severely modified)</i>	867

DESCRIPTION

The unit (1753 ha) is on the southwest facing lower and mid slopes of Black Mountain, Mt Painter and the Pinnacle and is bounded by suburbs to the north and the lower Molonglo River to the south. The woodlands merge into natural grassland near Aranda Bushland and the Glenloch Interchange. Of the woodland in the unit, over 500 ha is Yellow Box–Red Gum woodland, of which only 72 ha is partially modified. Secondary grassland derived from Yellow Box–Red Gum also occurs in the unit. Areas that are highly modified occur mainly on the lower slopes of the Belconnen Hills where there has been a greater degree of modification due to introduction of exotic pasture.

BOTANICAL SIGNIFICANCE, HABITAT AND FAUNA VALUES

The woodland that is in better condition tends to be the mid slopes of hill units of Canberra Nature Park. However, areas in better condition occur on rural land also, particularly on Kama, where it merges with open woodland and secondary grassland, connecting the Belconnen Hills with the Molonglo River corridor. There are significant areas that have retained ground flora moderately sensitive to disturbance, both within the reserves and on rural land.

There is a remnant Snow Gum woodland (0.5 ha) that forms an ecotone between Yellow Box–Red Gum woodland and natural grassland on the edge of Aranda Bushland and a stand of remnant trees east of Caswell Drive on the southwest edge of Black Mountain. Several specimens of the Small Purple Pea have been located near Caswell Drive.

The unit contains habitat for several threatened and declining bird species, with records of Brown

Treecreeper, White-winged Triller, Varied Sittella (all from the area Black Mountain to the Pinnacle) Superb Parrot (west of Higgins, Dunlop area and close to Hall), and two species of declining woodland birds (various locations). The Pink-tailed Worm Lizard has been recorded from the lower Molonglo River corridor. Key's Matchstick Grasshopper has been recorded from woodlands close to Hall in the north of this unit.

PLANNING AND CONSERVATION ISSUES

- North to south link as honeyeater migration route particularly tree connectivity between the Molonglo River through Glenloch Interchange to the western slopes of Black Mountain and O'Connor Ridge.
- Recovery of fire affected areas, and maintenance of remaining Yellow Box–Red Gum woodland within a matrix of other lowland woodland types, including restoration management on rural leases.
- Strengthening ecological connectivity between woodland remnants and to the Molonglo River corridor.
- Maintenance of the Snow Gum woodland in Aranda Bushland and the remnant trees east of Caswell Drive.
- Protection of Small Purple Pea near Caswell Drive.
- Restoring tree cover in secondary grassland communities on Mt Painter.
- Possible consideration as future urban land.

5.9

Woodland Management for Conservation

5.9.1 Conservation Management of Lowland Woodlands in the ACT

About two-thirds of the lowland woodlands remaining in the ACT are located on land that is subject to Territory Plan land use policies that would prevent clearance for urban or similar activities (Hills, Ridges and Buffers, River Corridors, Mountain and Bushlands and Urban Open Space). This land includes 4930 hectares that are contained in nature reserves. Additionally, Broadacre and Rural land use policies apply to another 30% of remaining woodland, leaving about 6% that is subject to urban and related land use policies.

If the conservation values of the ACT's remaining lowland woodlands are to be retained or enhanced, there will be an ongoing requirement for informed management, whether this is in association with other

activities or where nature conservation is the primary purpose (nature reserves). Existing management activities include grazing for economic return on the land, or in some (mostly urban) areas for fuel reduction; weed and pest control; fencing to improve grazing management; planting of indigenous trees and other species to enhance woodland habitat; fire hazard fuel reduction (burning and removal of woody material); provision and maintenance of recreational facilities. Many of these activities support the conservation of woodlands and the species dependent upon woodland habitats. Managers of woodlands will need to continue such activities on their land, link with others to achieve broader objectives and introduce new ideas as these are shown to be capable of improving conservation outcomes.

The following section outlines important aspects of the conservation management of lowland woodlands, with particular emphasis to management principles and protection and management of woodlands on rural leases in the ACT. A list of management issues follows each of the items discussed. These relate to the objectives and actions for the *Strategy* in Table 6.1.

5.9.2 Best Practice Management and Adaptive Management

Whatever type of formal or informal protection is provided for individual woodland areas, the key factor for their successful long-term conservation is the application of management practices that will maintain, and preferably enhance, biodiversity values. Management that is regarded by experts in a particular field to be of the highest standards at the time is termed 'best practice management'. In the context of biodiversity conservation, best practice management is that which best promotes biodiversity and healthy ecosystem function. It is underpinned by research and monitoring that assist in providing up to date information about the biodiversity effects of different management practices.

An example of a management technique that is considered by many as being 'best practice' in grassy ecosystems is the manipulation of vegetation biomass in order to maintain or enhance the biodiversity at a site. It involves the removal of excess vegetative material in the understorey by grazing, burning or slashing to create spaces for native plants to reproduce, whilst retaining the optimum habitat structure for native animals. It requires limiting defoliation of native plants during the flowering, seed production and seedling establishment phases, and

during periods when animals are susceptible to the lack of shelter and/or food. In some sites and in some years there may be no need to remove biomass to retain conservation values in grassy ecosystems.

In areas subject to grazing, appropriate rates of stocking, and low levels of cropping and fertiliser use contribute to the maintenance of biodiversity. Burning at different times of the year, at different frequencies and with different fuel loads can be used to manipulate species composition (McIvor 2002). Some of these management practices are already being used by public and private land managers, contributing to the quality and quantity of remaining woodland in the ACT.

Adaptive management allows for testing of management practices *in situ* to determine if they are achieving the desired outcomes, and adapting them if required. A flexible approach to applying management is therefore required (McIvor and McIntyre 2002). This form of management is also referred to as experimental management.

While the understanding of how to use a range of management practices for conservation outcomes is developing, the challenge of learning how to improve the use of management tools remains. The following guiding principles for the conservation of grassy woodlands have been identified in McIvor and McIntyre (2002) with particular application to woodlands in rural production landscapes:

- vary the management of native pastures to provide for a variety of species;
- favour natural regeneration of existing trees over planting and re-creating habitat;
- retain trees of different ages within stands to retain the long-term viability of tree populations;
- retain critical habitat elements such as mature trees, understorey vegetation and standing dead and fallen timber for animals;
- protect conservation areas from heavy or continuous grazing;
- manage exotic plants and fire;
- connect conservation areas to others in the landscape;
- maintain vegetation along watercourses; and
- limit the amount of bare ground. While McIvor and McIntyre (2002) suggest exposure of no more than 30% of the ground surface in grassy woodland pastures, a limit of 20% is recommended for the Southern Tablelands, and the maintenance of full cover in areas with more erodible soils.

As a threshold, Mclvor and McIntyre (2002) recommend that there should be a minimum of 30% woodland or forest cover on rural properties.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- An ongoing monitoring program for lowland woodlands in the ACT is essential to improve understanding of the dynamics of local woodland ecosystems.
- Encouragement for landholders to adopt an adaptive management approach.
- The value of research in assessing the effectiveness of conservation management practices (see, for example, Prober *et al.* 2002a, 2002b; Spooner *et al.* 2002).

5.9.3 Rehabilitation, Regeneration and Restoration of Grassy Woodlands

Rehabilitation of woodland fragments to improve habitat qualities, to enhance ecological connectivity or increase the size of remnants, particularly in rural areas is an important management priority for this *Strategy*. Linking woodlands with other natural ecological communities such as native grasslands, wetland areas and forests increases the overall conservation value of areas by supporting habitat heterogeneity in the landscape.

Rehabilitation may be undertaken in a variety of ways and with varying degrees of human intervention. Definitions adopted for this *Strategy* are from the *Australian Natural Heritage Charter*, 2nd Edit. (Australian Heritage Commission 2002).

- *Regeneration* means the natural recovery of natural integrity following disturbance or degradation.

Changes to management practices may be required to enable particular species to regenerate. Domestic stock and other grazers such as kangaroos and rabbits will preferentially graze the most palatable species, resulting in the loss of some species, and some areas becoming overgrazed (McIntyre 2002). Fencing out parts of paddocks or spelling entire paddocks from grazing by domestic stock allows for regeneration of the tree, understorey and groundlayer species. Fencing larger areas into smaller paddocks and rotation of grazing can assist this. Domestic stock, particularly horses and sheep, also inhibit tree regeneration, and control of their grazing pressure may be all that is required to enhance regeneration of trees and some shrubs.

- *Restoration* means returning existing habitats to a known past state or to an approximation of the natural condition by repairing degradation, by removing introduced species or by reinstatement.

Vegetation restoration may require weed control, direct seeding or planting with species known to have grown in the area. Habitat restoration involves artificially re-creating habitat such as replacing logs or rocks for fauna or planting of species to provide for specific animal habitat requirements.

- *Reinstatement* means to introduce to a place one or more species or elements of habitat or geodiversity that are known to have existed there naturally at a previous time, but that can no longer be found at that place.

Restoration and reinstatement are generally costly and time consuming, and should only be used if natural regeneration is not possible, or will not achieve the desired results. Natural regeneration is comparatively cheap, often requiring only the temporary removal of grazing. This is also necessary for plantings (McIntyre 2002). Many restoration projects fail if follow-up maintenance is not undertaken to control weeds, grazing, and competition from other species such as grasses or to provide adequate moisture until the plants are established. Tree, shrub or groundlayer planting may be required if natural regeneration is unsuccessful or areas do not contain adequate seed or conditions for regeneration to occur.

Restoration needs to be consistent with the natural significance of the area (Australian Heritage Commission, 2002) including consideration of the choice of species to be planted and the density of planting. In the ACT, knowing the source of plants or the provenance of seed used is important to ensure that new plants have the best chance of surviving local climatic conditions, and to avoid contaminating the genetic composition of local threatened species. Given that replanting is expensive it should be prioritised to ensure that the best ecological outcomes are achieved.

Although some native plant species may remain in substantially and severely modified woodlands (Table 2.3), restoration of the native understorey to resemble the former ecological community would be a considerable task in terms of cost and human effort. The potential for restoration depends upon the size of the substantially and severely modified area, the proximity of less disturbed areas, the extent of the native component, use of the area (in particular, if the area is grazed), and whether intensive, ongoing

rehabilitation work can be maintained over the long term. In a strategic sense, limited resources would be better directed to maintaining and restoring partially and moderately modified areas (McIntyre and Hobbs 1999). This approach, of working outwards from the areas in best condition, has been the basis for successful community based restoration work (e.g. the 'Bradley method' (Bradley 1988)). However, community or neighbourhood groups often wish to undertake work in their local areas and these may contain substantially modified woodland. Work undertaken by some Park Care groups in the ACT shows that intensive efforts may result in significant improvements, especially when combined with control of grazing. This work involves removing exotic plantings, wildings and non-local native trees, undertaking weed control, and reintroducing grassy woodland species.

While these improvements to local bushland may not necessarily equate to restoration of the grassy woodland ecological community in a strict sense, they can make a valuable contribution to grassy woodland and woodland species conservation overall by maintaining and improving habitat, improving connectivity, protecting occurrences of rare or threatened species, and controlling the spread of invasive weeds. Research is currently underway in the NSW South Western Slopes on recovery of degraded understoreys and there is considerable scope for undertaking rehabilitation trials with the aim of developing successful restoration methods for wider application.

Generalised purposes of rehabilitation of woodlands include:

- providing for, or increasing connectivity for animal movement where only scattered trees remain in a landscape;
- increasing the age diversity of tree species, especially where paddock trees are old or subject to dieback;
- increasing the size of remnants to at least 10 ha to increase habitat for birds and other animals, increase landscape heterogeneity and minimize the impact of edge effects from adjacent land uses;
- restoring specific habitat elements for reptiles, birds, small mammals and invertebrates especially for threatened species;
- mitigating against erosion in gullies or on steep slopes and to control salinity;
- rehabilitating weed infested areas in otherwise good sites; and

- replacing inappropriate introduced species.

Principles for undertaking regeneration and plant restoration activities (after McIntyre *et al.* 2002; Eddy 2002) are:

- ensure that the reasons for undertaking the activities are clear, that the project is viable, and that the activities will achieve the desired outcomes;
- consider managing to increase natural regeneration before undertaking planting to recreate habitat;
- encourage natural regeneration by controlling grazing and weeds, using fire, or preventing erosion or soil compaction;
- consider requirements for the regeneration of groundlayer and understorey species, as well as for tree regeneration;
- where possible, collect seed for restoration activities from local populations to maintain local genetic provenances;
- avoid soil disturbance while planting trees where native groundlayer is present;
- if appropriate, plant trees within secondary grasslands to restore the previous tree cover;
- use restoration to provide buffer areas to core conservation areas, to increase size of remnants and to enhance connectivity; and
- minimise opportunities for re-invasion by introduced species after rehabilitation.

RESTORATION OF HABITAT FOR FAUNA

In many areas, particularly in urban Canberra, fallen timber is removed for safety, for firewood use or to keep an area 'tidy'. There have been studies showing correlation between the presence of woody debris and bird species richness and occurrence of some taxa (see sections 4.3.2 and 4.6.2). For example, reintroduction of fallen timber in floodplain forests of the Murray River increased the density of the threatened Brown Treecreeper (Mac Nally *et al.* in press).

Many woodland areas contain woody weeds that are highly invasive (especially *Cotoneaster*, *Pyracantha* and *Hawthorn*), but they provide valuable habitat for many native animals, particularly birds. Control of these weeds is required to minimize their spread, but replacement with suitable native shrubs will provide alternative and compensating natural habitat for the species that are displaced.

Activities that can be undertaken to enhance fauna habitat in woodland include retaining woody debris and leaf litter, reintroducing logs and branches and preventing overgrazing to retain tussock structure and allow natural tree and shrub regeneration. New plantings to supplement natural regeneration of trees and shrubs and especially to replace introduced shrubs and trees will also enhance animal habitat.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- Identifying priority sites (such as habitat for threatened species) where modifying existing management will maximise regeneration opportunities.
- Encouragement of natural regeneration and restoration planting in the areas where woodland is fragmented or relictual (north Murrumbidgee, southern Majura Valley to northern Jerrabomberra Valley and Kowen).
- Development of guidelines for rehabilitation of vegetation and habitat for use by government agencies, non-government organizations and community groups.
- Establishment of seed banks as a seed source for local projects.

5.9.4 The Use of Fire in Managing Lowland Woodland

Burning is a form of biomass removal that can be used to manipulate species composition and abundance. Fire can assist regeneration through stimulating seed germination of some species and the creation of space that minimises competition by plants for resources, especially moisture and light. Fire can also be used to remove accumulated rank material that builds up in ungrazed or other unmanaged areas. However, there may be a resultant loss of soil and a decrease in the infiltration of moisture following fire in heavily stocked and disturbed sites, and some alteration to arthropod composition (Martin and Green 2002). For these reasons it is more appropriate to burn in a mosaic pattern leaving unburnt areas that can be used as refuges.

IMPACTS OF THE JANUARY 2003 BUSHFIRES IN WOODLANDS IN THE ACT

In January 2003 a wildfire from the west burnt 70% (164 914 ha) of the ACT, including Namadgi National Park, Tidbinbilla Nature Reserve, pine plantations and rural lands (about 30 000 ha) up to and including the

western edges of Belconnen, Weston Creek and Tuggeranong.

The fire burnt through woodland in the North Murrumbidgee–Lower Molonglo, Tuggeranong–Naas, and Callum Brae–Jerrabomberra Valley complexes. In July 2003 Environment ACT completed an audit of the extent of the burns and the likely outcomes for both flora and fauna. Programs are being developed to monitor the effects of the burns on the vegetation and wildlife (Carey *et al.* 2003). It is expected that the native woodland vegetation will recover relatively quickly from the fire and that there will be extensive regeneration. However, the long-term impacts of the fire on fauna are not clear, especially as few pockets of unburnt vegetation remain west of the urban area. The Castle Hill area is a notable exception, with little of the Yellow Box – Red Gum grassy woodland burnt. As birds have very diverse responses to fire (Martin and Green 2002), the resultant recovery will be varied, and for some species may take many years.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- The 2003 bushfires have created opportunities to re-fence areas in ways that will assist future best practice management of remnant lowland woodlands.
- An ongoing monitoring program will provide valuable information on the recovery of burnt woodlands.
- Tree planting or other plantings may enhance recovery of some species after the fire.
- There are opportunities arising from the fires to research the ecological response of species or groups of species to fire and thus provide managers with better information on the impact of frequency, seasonality and severity of fire on these species.

5.9.5 Stock Grazing as a Management Tool

Grazing by stock for production purposes is undertaken extensively in many woodlands located on rural leases in the ACT. In many of these and other areas (mostly nature reserves) free-ranging mobs of kangaroos also graze, often in native or exotic grasslands, and use nearby woodlands for shelter. Plants differ in their response to defoliation and animals selectively graze areas and both the species and parts of plants they eat (McIvor 2002). This results in differences in species composition reflecting the

intensity and frequency of specific grazing regimes. Species can be regarded as ranging from being highly sensitive to disturbance through to tolerant to disturbance (see Table 3.1 for examples of plants). Species that are more sensitive to grazing are frequently not found in grazed areas (Prober and Thiele 1995; Hamilton 2001), and even if a seed store remains, it is unlikely that species will return to those sites without changes to management. In addition, stock compact soil along trails, in camps and near watering points (Martin and Green 2002). They may also spread weeds through their faeces or transport seed or plant material on their bodies. Therefore, grazing is not appropriate in sites that have not been previously grazed or not for a long time, as new grazing stock are likely to cause the loss of grazing sensitive species that still occur at those sites.

Nevertheless, many areas that have been grazed by stock over a long period of time still retain habitat with considerable conservation value. Studies have indicated that grazed land where natural integrity is best retained is likely to have been grazed intermittently rather than continuously, and lightly rather than heavily (McIvor 2002). Continuation of grazing may well be appropriate in other sites that have been subject to previous grazing, especially where other methods of defoliation (fire or slashing) are not feasible. If grazing is being undertaken currently, and where the more sensitive species are likely to have already been lost, it is probable that grazing will at least maintain the existing values, as long as it is managed according to best practice principles.

Principles for conservation grazing (after McIvor and McIntyre 2002; Eddy 2002) are:

- avoid introducing grazing into areas that have not been grazed for a long time;
- use the likely past history of grazing intensity and frequency (for instance, by assessing the abundance of disturbance sensitive species) to determine the most appropriate levels of grazing;
- undertake some form of planned rotational grazing to allow for regeneration of trees, shrubs and groundlayer species; and
- graze to maintain more than 80% ground cover in pastures.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- The importance of providing up to date information and advice to land managers who graze stock in lowland woodlands.
- The role of grazing as a tool in conservation management of lowland woodlands.

5.9.6 Maintaining Integrity and Links between Remnants: Connectivity and Buffers

Maintenance and enhancement of ecological connectivity across the landscape is an important management priority in this *Strategy*. Ecological connectivity—‘the degree to which the landscape facilitates or impedes movements among patches’ (Bennett 1999) is enhanced by linking woodland fragments together and by linking woodlands with other natural ecological communities such as native grasslands, wetland areas and forests. Ecological connectivity increases the overall conservation value of areas by building habitat heterogeneity in the landscape. Long-term viability of populations of many species in fragmented landscapes is dependant on the extent to which individuals are able to move between fragmented populations. Such movement is necessary to maintain gene flow between populations, to facilitate immigration to (or re-colonisation of) populations that are not self-sustaining and for dispersal of offspring or seeds. The impacts of fragmentation (loss of connectivity) on fauna and the different forms of connections between patches are discussed in detail in section 4.3.1.

Buffers are areas that separate habitat from more intensive land-uses, and hence provide natural areas with some protection (buffer) from ‘edge-effects’ such as human disturbance, weed invasion and presence of domestic animals such as cats and dogs. Buffers are commonly used where protected areas (national parks or nature reserves) adjoin populated areas. Buffer areas can be incorporated into the boundary of the protected area (for example, lower quality habitat) or be outside the protected area (e.g. rural land uses). Woodland of lower vegetation condition or habitat quality can provide a buffer to woodland of higher conservation value. Similarly, other ecosystems such as grasslands or forest can provide a buffer to woodlands (and *vice versa*). In many places in the ACT, open grazed areas provide a buffer for woodland and other natural ecosystems.

Assessment of the overall conservation value of woodland patches should take into account the contribution to landscape pattern (size, shape, connectivity, buffer), in addition to vegetation condition and habitat value for fauna. Vegetation condition and habitat value are intrinsic attributes of a woodland patch and generally will change only with changes in vegetation structure and composition. In contrast, the value of a patch for connectivity is related to overall landscape pattern and hence this value may increase or decrease as changes (such as clearing or restoration) occur elsewhere in the landscape.

Principles adopted in the *Strategy* for maintaining habitat connectivity are:

- linking large woodland patches in the ACT;
- linking ACT woodland patches to the surrounding region;
- linking woodlands to other ecological communities (grassland, forest, riparian communities);
- maintaining key east-west and north-south wildlife corridors;
- maintaining riparian areas as corridors;
- linking by 'stepping stone' patches should be considered where corridors are impractical.
- woodland areas with lower conservation value, and other ecosystems and rural areas can provide buffers to high conservation value woodlands; and
- paddock trees and clumps of trees can provide a valuable basis for building connectivity between fragments.

Connectivity can be considered at many scales, from that necessary to facilitate movement of small animals between adjoining leases, to maintenance of large uninterrupted corridors at the regional landscape level. It is beyond the scope of this *Strategy* to assess the fine-scale connectivity and buffer values of individual patches. Priorities for broad landscape level connections between remaining woodlands in the ACT, based on the above principles, are outlined in section 6.5.1 and shown in Figure 6.1.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- The application of connectivity and buffer principles to land use planning and environmental impact assessment in the ACT and adjoining areas of New South Wales.

5.9.7 Monitoring

Monitoring is the repeated assessment of a particular feature at selected sites for an identified purpose. To assess whether management activities for conservation purposes are achieving the desired results, it is important to undertake some form of monitoring to measure changes or to record the results of management activities.

The results of monitoring can show whether species, habitats and ecological communities are being adequately conserved. The results of monitoring are used to help determine whether changes should be made to management aims or activities. Monitoring results can provide information that advances collective knowledge about the impacts of particular management activities on the ecological community or species that is the main focus. Management that is recommended today is based on such work in the past, and new information continually helps to inform and improve recommended management actions (see s. 5.9.2).

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

Monitoring is a fundamental part of any management program as it will:

- Detect positive or negative short or long term changes that require management intervention;
- Assist in tracking changes in distribution and abundance of populations of threatened species;
- Identify changes in species composition in threatened ecological communities;
- Identify whether management activities are producing the desired results; and
- Assist land managers with future planning and management.

5.9.8 Land Management Agreements

Land Management Agreements (LMAs) are required under the *Land (Planning and Environment) Act 1991* for all non-urban leases in the ACT. Linked to the granting of long-term leases (20 and 99 years), the purpose of LMAs is to establish a co-operative management regime for non-urban land in the ACT. Over seventy agreements were in place in 2003.

The principal objective of LMAs is to establish management practices on leases that support the land management aims of both the lessee and the ACT Government. This involves agreement on general

management goals and responsibilities; documentation of the current state of the property (including nature conservation, cultural heritage or other significant values); and identification of land management issues and the means for their resolution. Environment ACT provides environmental information to lessees, drawing attention to conservation issues, in particular, presence of, or habitat for, threatened species and ecological communities.

Lessees are required to address the following objectives in the LMA within a framework of sustainable agricultural and pastoral land use practices:

- retain or improve the ecological functioning and integrity of the natural and modified resources of the leased area;
- preserve the extent and character of any threatened ecological community or population of a threatened species;
- pursue all development and management of the land in a way that is consistent with any Action Plan for a threatened species or ecological community;
- manage vegetation identified in the LMA as being of significant conservation value, with the aim of maintaining its structure, floristics and habitat value; and
- ensure that any activities do not adversely impact on riparian or other wetland areas.

The LMA also provides for Land Action Plans to be prepared for a range of issues, including drought risk management, pest plants and animals, sites of significant natural or cultural heritage value, maintenance of water quality, and protection of riparian zones and other native vegetation. Lessees are required to ensure that a flexible grazing strategy is in place designed to achieve conservation objectives.

In 2000, the ACT Government established the Rural Conservation Fund with the primary objective of fostering ecologically and economically sustainable rural land management. Applications for financial assistance must target practical biodiversity conservation outcomes through on-ground works, an education program or demonstration project, or the gathering of information about conservation assets and their management requirements. Funded projects are typically on-ground works e.g. fencing to protect native vegetation remnants or better managing grazing pressure, off-stream watering facilities to protect streamlines, and revegetation to provide habitat links.

Where the project involves a continuing commitment by a lessee to a particular management strategy, relevant details of the commitment are entered in the Land Management Agreement for the land in question. The intention is to protect the investment that has been made and to ensure longer-term conservation outcomes.

5.9.9 Conservation Management Networks

A Conservation Management Network (CMN) is a network of remnants of an ecological community, their owners and managers as well as other people with an interest in that community (Rehwinkel 2002). There is a particular focus on sites, including encouragement of protection measures and the adoption of conservation management. The CMN provides opportunities for information dissemination (including regular newsletters) and participation in knowledge sharing and decision-making. A CMN can assist land managers to access technical and funding assistance, develop site management plans, establish formal protection measures such as voluntary agreements, and link up with people with similar interests. Membership can provide a sense of being part of a larger system, and facilitate access to a range of quality sites (Oliver 2003).

One of the most important goals of CMNs is to help integrate conservation principles and practices into land use management. CMNs are a potential way of developing an integrated conservation estate that is more than the existing nature conservation estate on public land, where the existing landholders would continue to manage their own sites, with support and advice from the CMN (Oliver 2003).

In the ACT region, CMNs have been developed for White Box Woodlands in NSW, Monaro Grasslands and Southern Tablelands (NSW) Grasslands. There is potential for Environment ACT to link with this initiative of the NSW Department of Environment and Conservation and become part of an enlarged ACT and Southern Tablelands CMN for grassy ecosystems.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- An ACT based grassy ecosystem CMN with links to NSW CMNs would provide a means to bring together all those with an interest in grassy woodland conservation.

5.9.10 Voluntary Agreements

Voluntary agreements enable landholders to acknowledge the conservation values of their land through mechanisms designed to provide a level of protection but allow for current land uses to continue. Some involve arrangements that are binding on future landholders, some are binding for current landholders and others can be revoked by landholders at any time. Examples of some of the arrangements that exist in NSW are Voluntary Conservation Agreements, Joint Management Agreements and Wildlife Refuges. Similar arrangements do not exist in the ACT, although Memoranda of Understanding have been signed with major Commonwealth landholders in the ACT (Department of Defence, CSIRO and National Capital Authority), and these provide protection for large areas of land that contain lowland woodland.

Landholders with such agreements contribute land, their skills, labour, time and materials towards the conservation of native ecosystems, which in turn provide a range of ecosystem services such as clean water and air and healthy soils (Stephens 2002). For such voluntary agreements to work well, it has been shown that landholders require sufficient support, particularly on-ground labour, advice on non-financial as well as funding sources, technical advice, evaluation of remnant vegetation and habitat values, and links with other landholders (Stephens 2002).

The Conservation Management Network described above can provide such support, and is therefore seen as a way of maintaining management agreements and assisting in their implementation.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- Voluntary agreements provide another means of conserving grassy woodlands (and other ecological communities) in the ACT.

5.9.11 Education and Communication

In the ACT, lowland woodland occurs on public and leased land under a range of land tenures and on National Land. Remnants occur on rural leases, roadsides, cemeteries, in nature reserves, urban parks and other open space and special purpose sites (e.g. National Land in the Majura valley managed by the Department of Defence). As a result, potential interest in conservation of lowland woodland is wide ranging (Environment ACT 2002). Stakeholder involvement is assisted by education and communication programs. These can be facilitated through the establishment of a

Conservation Management Network, as well as the community networks that currently play a significant role in conserving lowland woodland.

Community groups and individuals provide an extensive and invaluable contribution with voluntary work in the on-ground maintenance of areas (e.g. Park Care groups in Canberra Nature Park, urban and rural Landcare groups, and the Rural Lessees Association and Greening Australia in rural areas), as well as involvement in policy, management planning, education and liaison (e.g. Friends of Grasslands, Australian Native Plant Society). These groups have regular newsletters and meetings that disseminate information about the conservation and management of woodlands.

Communication and education is recognised as a very important part of conservation activity by Government. Environment ACT undertakes regular ranger guided walks in woodlands and other ecosystems, provides signage for sites, regularly publishes or updates brochures and pamphlets, presents talks to community groups and holds field days. There are liaison or extension officers who work with Park Care and Landcare groups, rural lessees and landholders to encourage and assist with the conservation management of grassy ecosystems.

MANAGEMENT ISSUES FOR THE ACT

(Refer to Actions in Table 6.1)

- Education and communication needs to be provided strategically and efficiently to landholders and stakeholders, through a range of media.

Figure 5.1a

Gungahlin complex

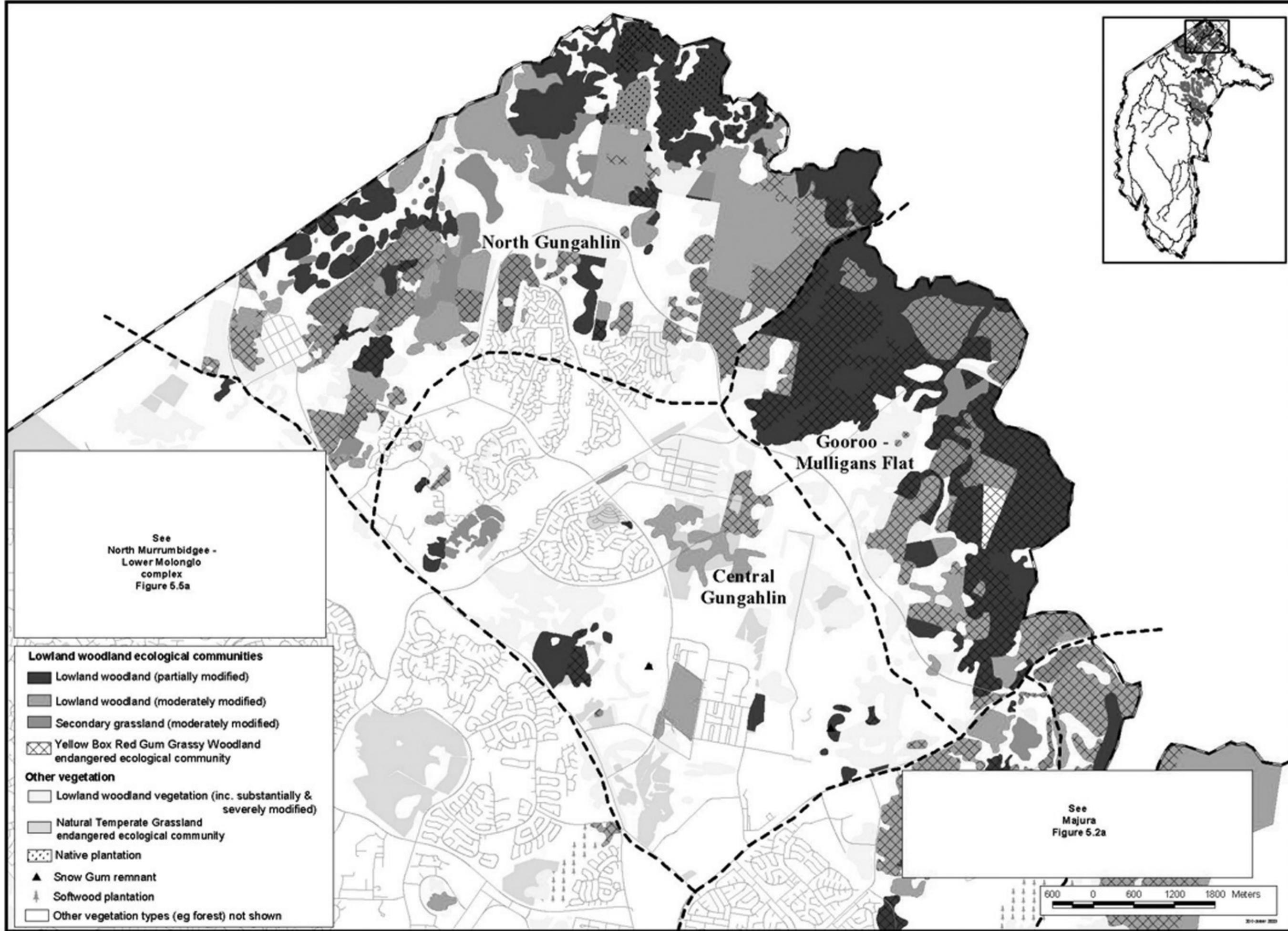


Figure 5.1b

Gungahlin landuse

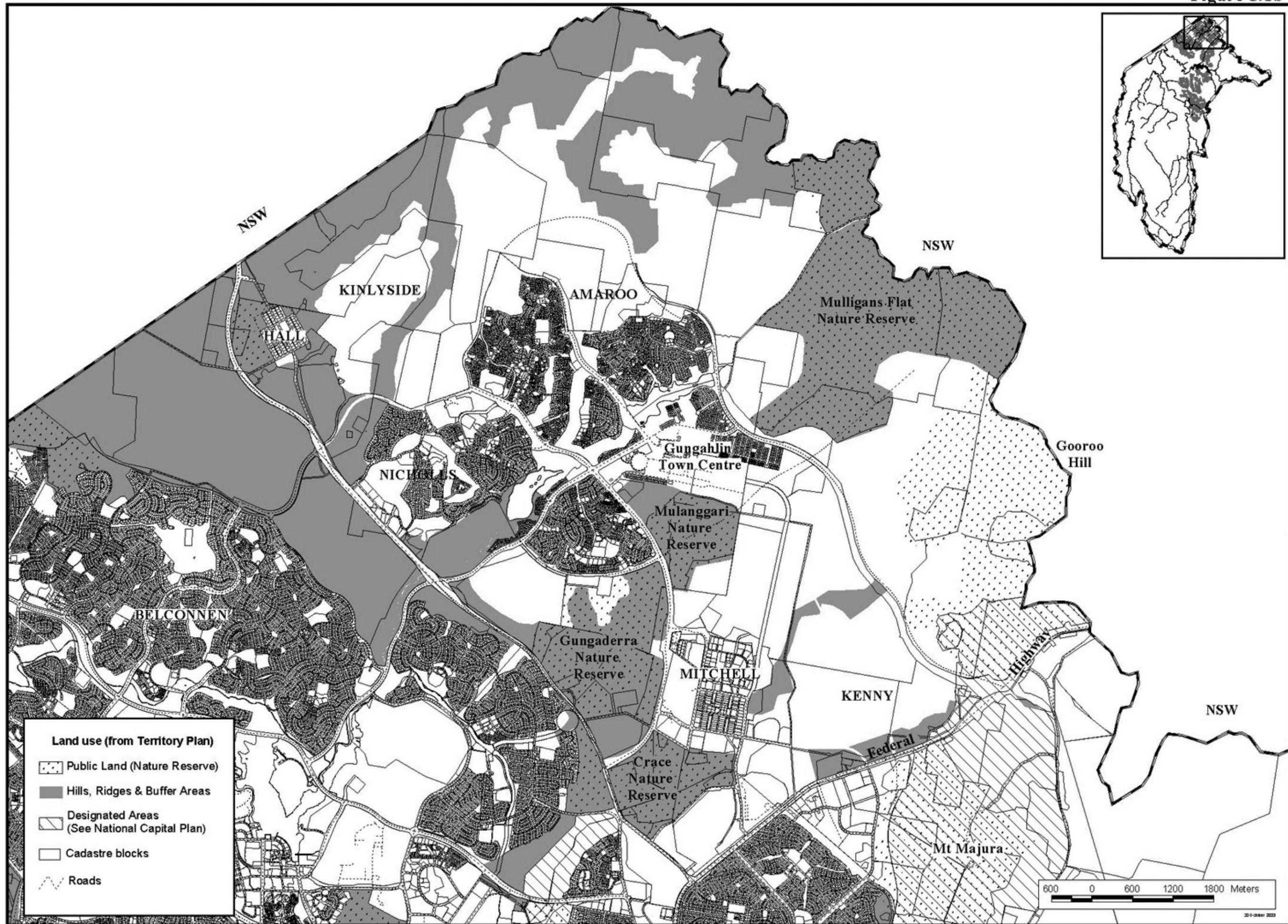
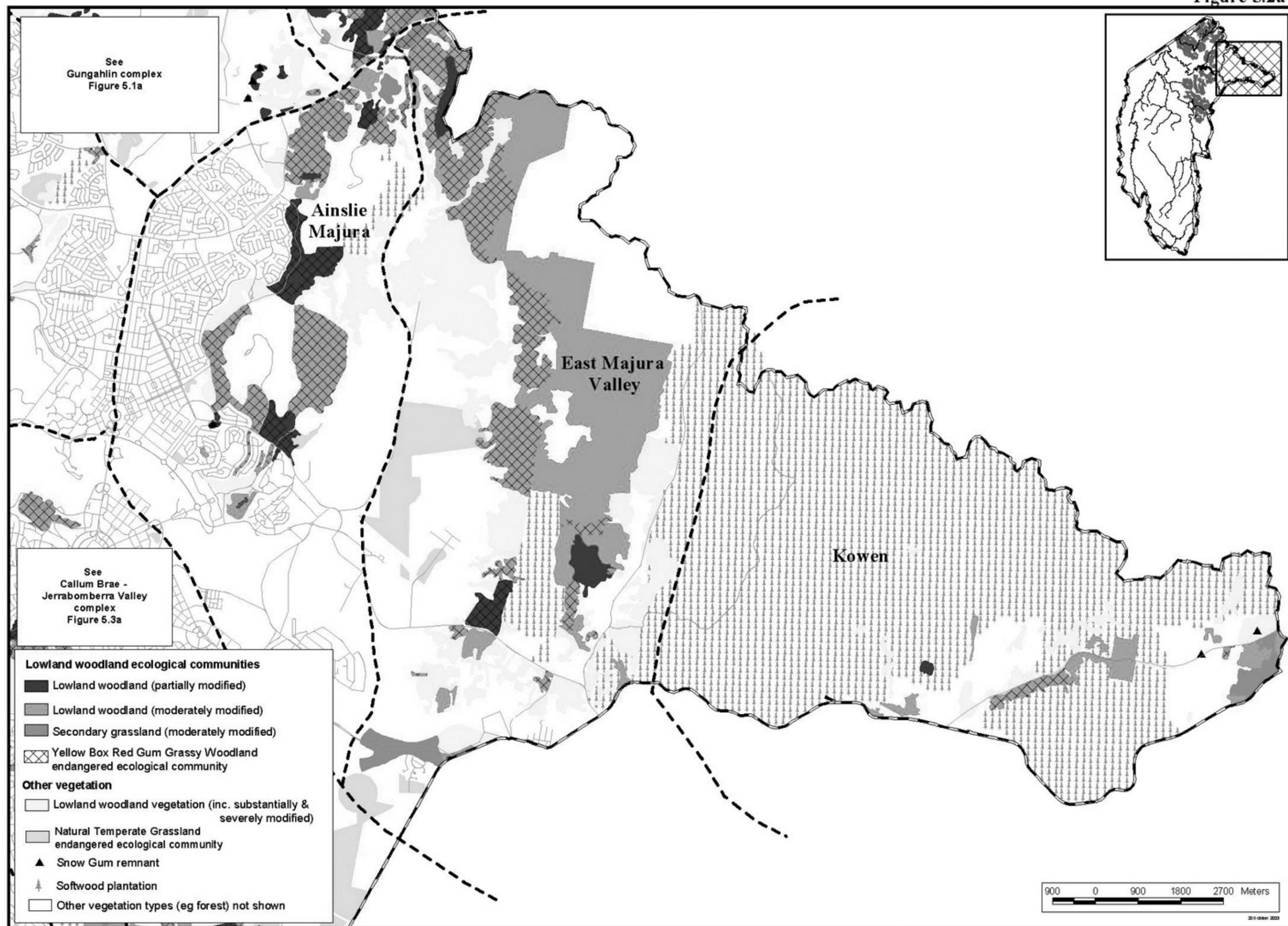


Figure 5.2a

Majura complex



See Gungahlin complex Figure 5.1a

Ainslie Majura

East Majura Valley

Kowen

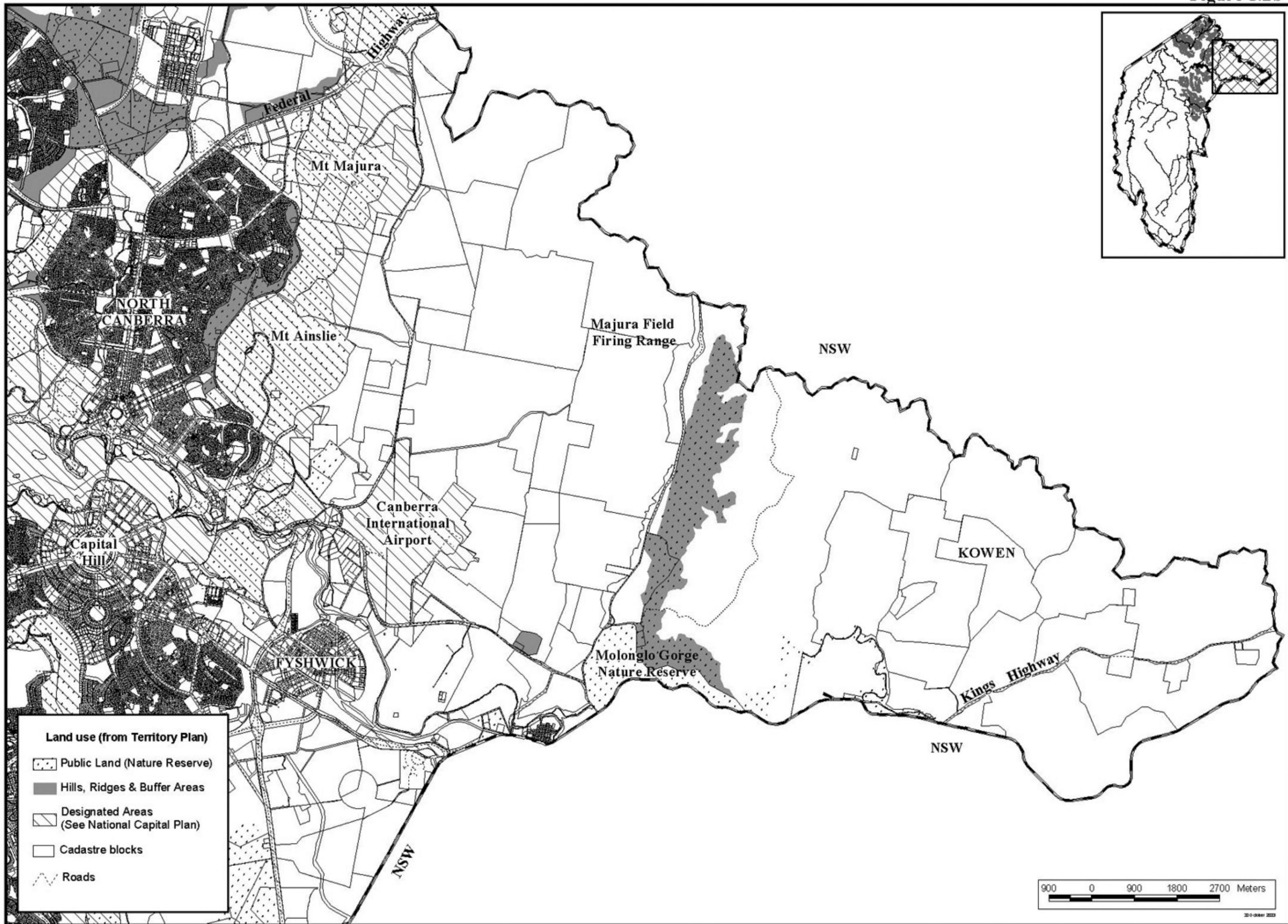
See Callum Brae - Jerrabomberra Valley complex Figure 5.3a

- Lowland woodland ecological communities**
- Lowland woodland (partially modified)
 - Lowland woodland (moderately modified)
 - Secondary grassland (moderately modified)
 - ▨ Yellow Box Red Gum Grassy Woodland endangered ecological community
- Other vegetation**
- Lowland woodland vegetation (inc. substantially & severely modified)
 - Natural Temperate Grassland endangered ecological community
 - ▲ Snow Gum remnant
 - 🌲 Softwood plantation
 - Other vegetation types (eg forest) not shown

900 0 900 1800 2700 Meters

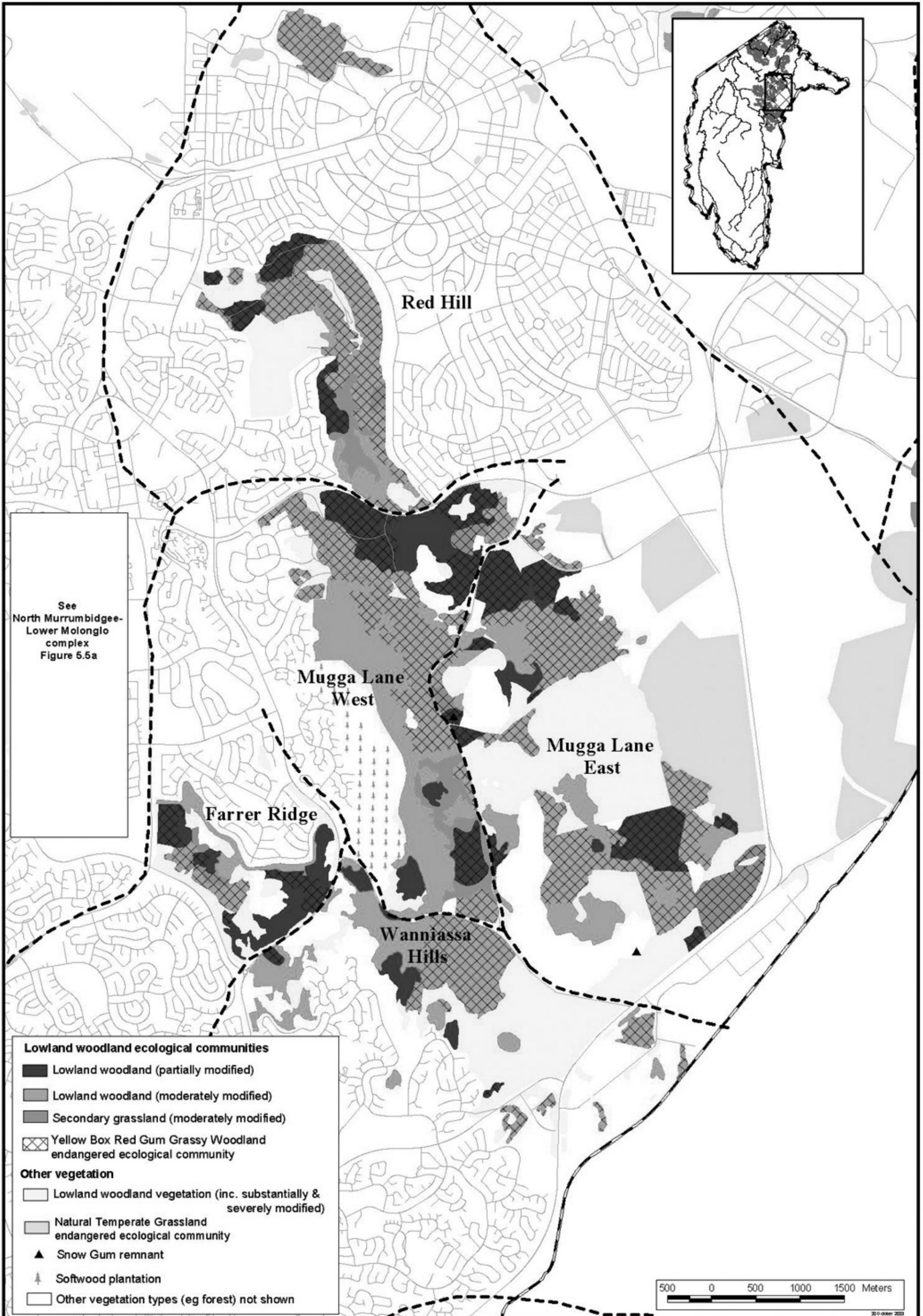
Figure 5.2b

Majura Landuse



Callum Brae - Jerrabomberra Valley complex

Figure 5.3a

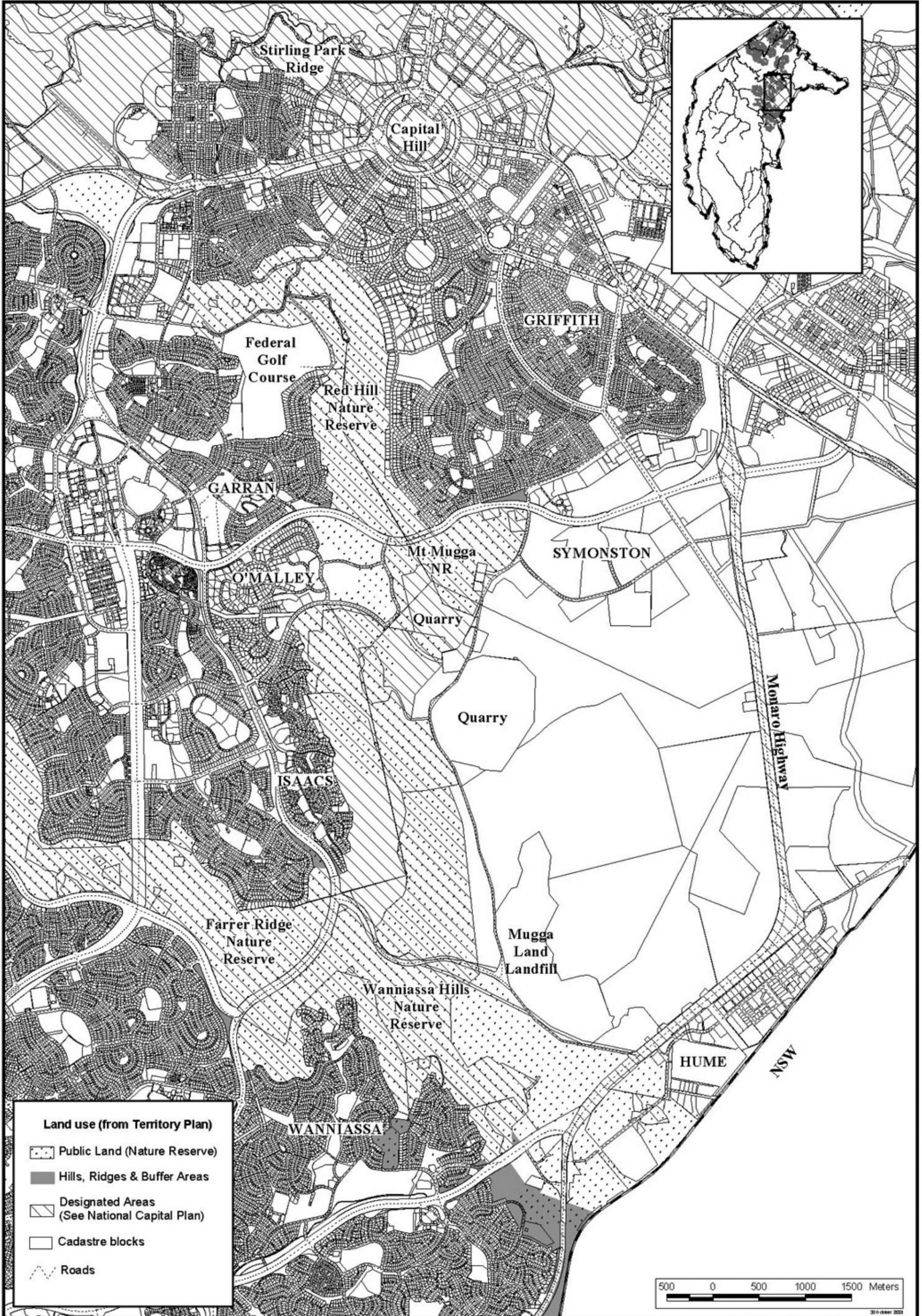


See North Murrumbidgee-Lower Molonglo complex Figure 5.5a

500 0 500 1000 1500 Meters

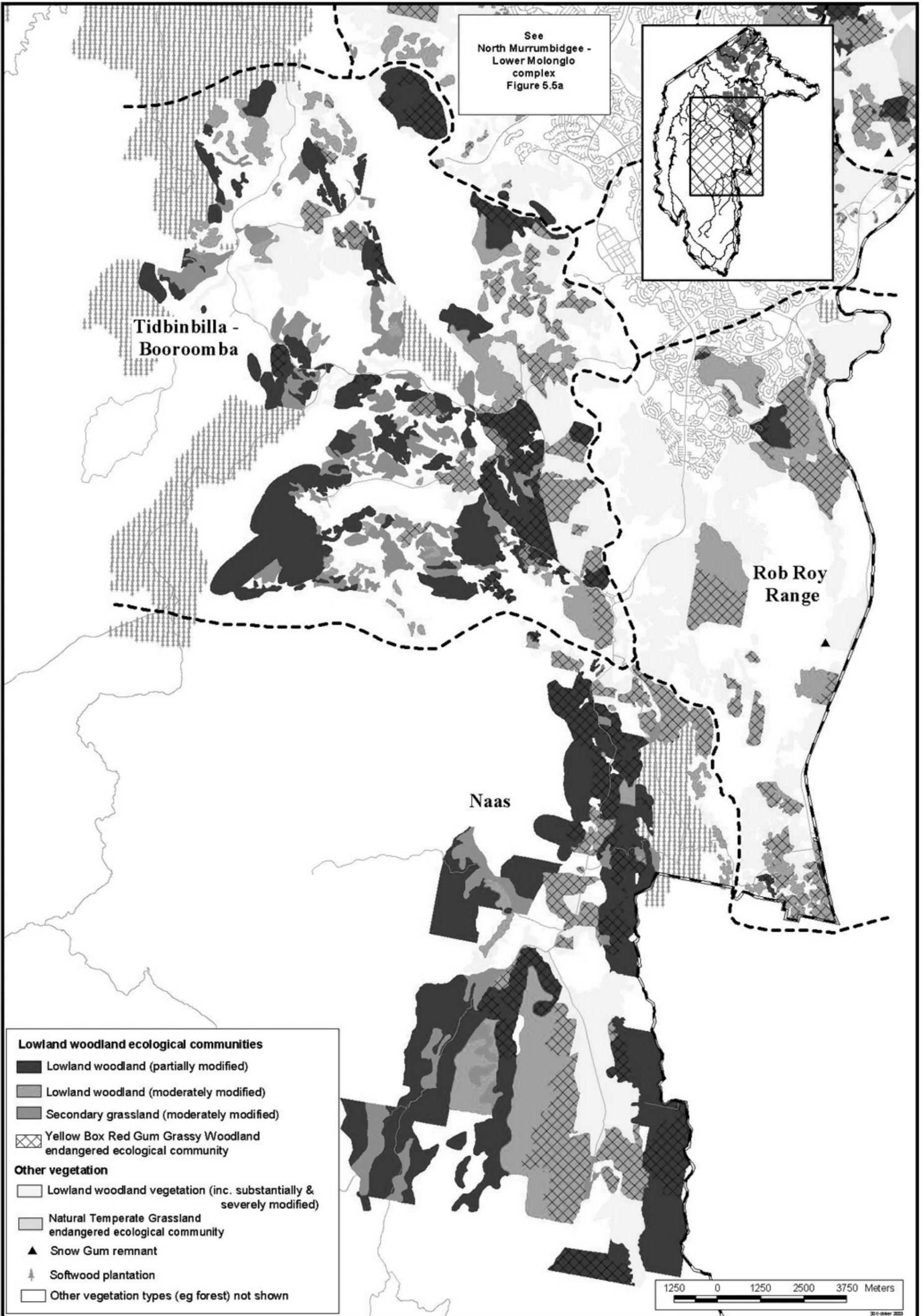
Callum Brae - Jerrabomberra Valley landuse

Figure 5.3b



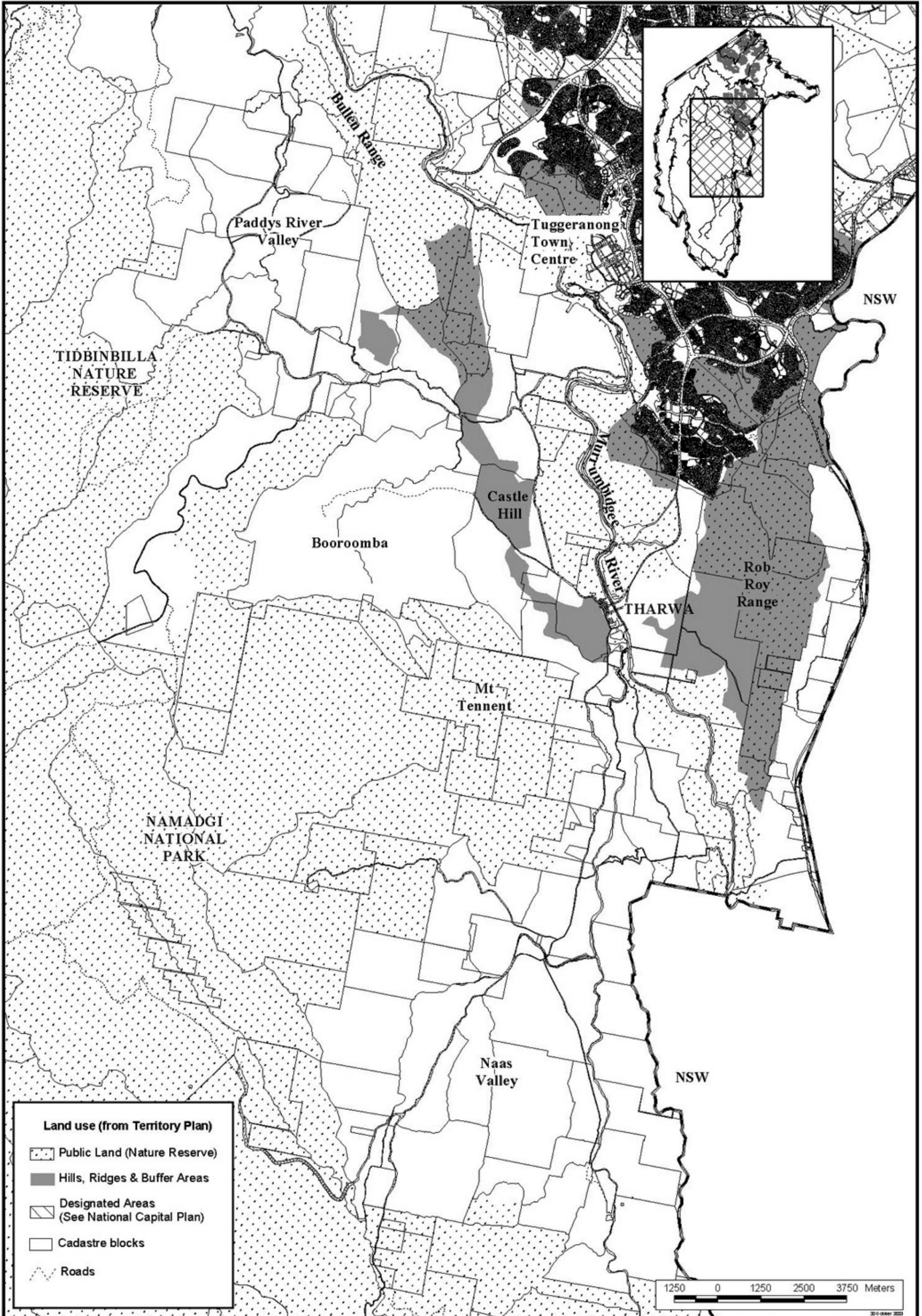
Tuggeranong - Naas complex

Figure 5.4a



Tuggeranong - Naas landuse

Figure 5.4b

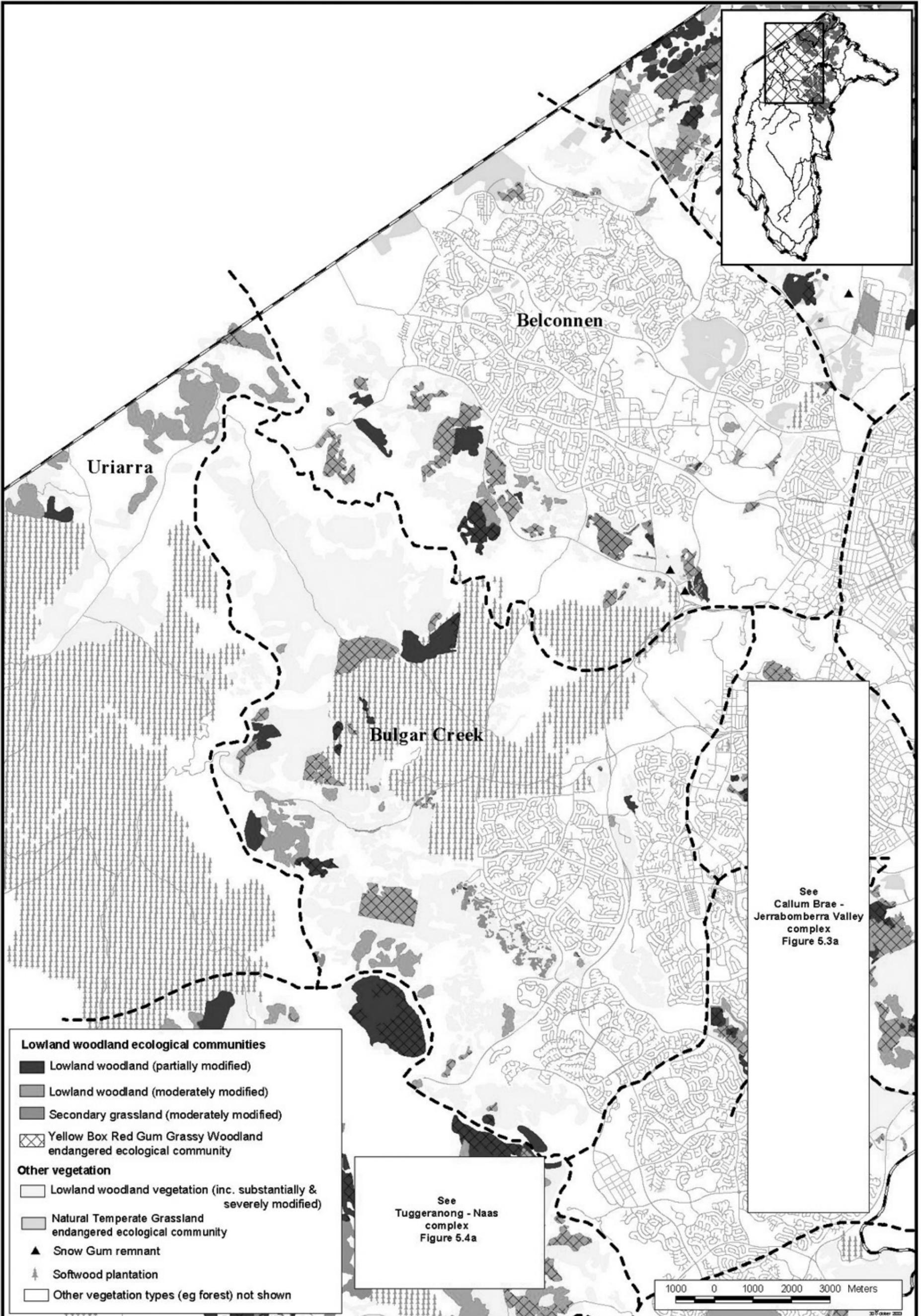


- Land use (from Territory Plan)**
-  Public Land (Nature Reserve)
 -  Hills, Ridges & Buffer Areas
 -  Designated Areas (See National Capital Plan)
 -  Cadastre blocks
 -  Roads

1250 0 1250 2500 3750 Meters

North Murrumbidgee - Lower Molonglo complex

Figure 5.5a



North Murrumbidgee - Lower Molonglo landuse

Figure 5.5b

