Habitat Connectivity Prioritisation Plan

for the

Upper Lachlan Local Government Area

Report prepared for

Upper Lachlan Landcare
and
South East Local Land Services

Report prepared May 2022
by
Merops Services Pty Ltd

Contents

1. Glossary of Acronyms and Initialisms

ABARES	Australian Bureau of Agriculture and Resource Economics and Sciences
AHIMS	Aboriginal Heritage Information Management System
ALA	Atlas of Living Australia
ALCA	Australian Land and Conservation Alliance
AWE	Department of Agriculture, Water and Environment
BCT	Biodiversity Conservation Trust
BGGW	Box-Gum Grassy Woodland
BSAL	Biophysical Strategic Agricultural Land
CEN	Community Environmental Network
DCP	Development Control Plan
DECC	Department of Environment and Climate Change
DPIE	Department of Primary Industries and the Environment
EEC	Endangered Ecological Community
GER	Great Eastern Ranges
GIS	Geographic Information Systems
HCLG	Hovells Creek Landcare Group
IBA	Important Biodiversity Area
IBRA	Interim Bioregions of Australia
LEP	Local Environment Plan
LfW	Land for Wildlife
OEH	Office of Environment and Heritage
SEED	Sharing and Enabling Environmental Data
SE LLS	South East Local Land Services
TBF	Tablelands Basalt Forest
TSG	Tablelands Snow Gum Woodland
TSR	Travelling Stock Reserve
ULL	Upper Lachlan Landcare
UL LGA	Upper Lachlan Local Government Area
ULS	Upper Lachlan Shire
ULSC	Upper Lachlan Shire Council

2. Introduction

It has been recognised that national parks, reserves and protected areas are not able, on their own, to sustain biodiversity at global, national, state nor at the local government area levels, and that private land conservation is critical to the prevention of further biodiversity loss and to improve resilience and connectivity in the landscape (Figgis 2004, Kamal *et al.* 2015, OEH 2018, EDO 2021, AWE 2022 and ALCA 2022). Efforts to apply conservation on private land have increased over the last few decades and there are many options available along with many government and non-government organisations that are able to provide assistance and funding.

The Upper Lachlan Shire (ULS) is home to 93 plant community types (PCTs), 1854 plant species (105 of them threatened species), eight endangered ecological communities (EECs), and 549 vertebrate species of which 102 are threatened. The Shire is also within two bioregions, contains some land within two important biodiversity areas and also contains areas that are within the Great Eastern Ranges. The significant biodiversity within the Shire relates to the diverse geology and soils, the large altitude range, the influence of north meeting south and west meeting east as well as the Shire being a drought refuge for faunal species from further west.

Although some forest habitat in the eastern and northeastern parts of the UL LGA is protected within the national parks and reserve system much of the Shire has been cleared for agriculture and much of the remaining natural vegetation has become very fragmented and somewhat degraded.

The conservation efforts on private lands within the Shire have been significant with over 1000 conservation agreements in place (see details further into this report). Some of these agreements have targeted higher priority areas. Examples of this include the Environment Australia's Box-Gum Grassy Woodland Stewardship Program and the Biodiversity Conservation Trust's (BCT) Priority Investment Areas (PIA) (OEH 2018) targeting areas of high environmental value and connectivity potential. However, these make up only a small proportion of all the agreements within the Shire. Most of the agreements are between the South East Local Land Services (SE LLS) and landholders, while there are also a large number of Land for Wildlife (LfW) agreements. These are generally voluntary agreements that relate to landholders who are keen to do their bit to help foster conservation in their area, rather than targeting high priority areas, but they are making a significant contribution to promoting conservation within the Shire. In addition to this, there are many local Landcare Groups within the Upper Lachlan Landcare (ULL) and in the surrounding area that are actively engaged in habitat management and habitat enhancement programs and are involved in pest species management, providing educational workshops and preparing local area management plans (e.g Hovells Creek Landcare Group 2014).

There has been some planning work towards recognising high priority conservation areas within the Shire. The BCTs PIA mentioned above is state-based, although it does describe the land within the Shire (see details further into this report). The Upper Lachlan Shire Council's (ULSC) Biodiversity Planning Framework (2008) recommends strategic measures to protect and enhance biodiversity values and has mapped areas of high and moderate conservation value and mapped potential regional corridors (discussed further into this report). The Framework also recognises that there are disruptions to connectivity that require changed management practices and revegetation in order to realise potential links between biodiverse areas. The bulk of the report concentrates on detailed vegetation mapping around towns and villages within the Shire in order to inform Local Environment Plans and Development Control Plans. In comparison, this current report uses more up-to-date information from a wide variety of sources and includes data on threatened species and EECs and provides more detail for the Shire as a whole.

The current report uses mapping information across over 23 different criteria and aims to identify areas where revegetation projects may provide maximum conservation benefit so that those areas may be preferentially targeted for further habitat enhancement within the Shire. Ten of the mapped criteria are used to develop a habitat enhancement prioritisation map for the Shire.

In preparing this report, we acknowledge and pay respect to Aboriginal Elders past, present and future. We acknowledge caring for country traditions and practices to improving biodiversity on this land.

3. Purpose

The purpose of this habitat connectivity priority plan is to bring together much of the environmental information currently available and to use this to provide an overall picture of the current state of the environment and biodiversity within the UL LGA. This information is then used to map areas where habitat connectivity work is of a higher priority. This will provide organisers with a plan that will allow them to target these areas for revegetation work. The Plan should be made available to any organisations and persons engaged in restoration works. It is recognised that these high priority areas will not necessarily coincide with the areas of interest of local landholders and that work may be undertaken in lower priority areas if that is where there is a greater interest in revegetation work. However, where there are limited resources available and where there is the ability to target certain areas then the Plan can provide a guide to help with the selection of areas for revegetation work.

4. Methods

4.1 Sourcing Data

Environmental data was sourced from two main sources. Most of the data on location of records of threatened species came from the Atlas of Living Australia (ALA), while vegetation and land use patterns came from the Department of Primary Industries and the Environment (DPIE) via the data portal Sharing and Enabling Environmental Data (SEED). The Community Environment Network (CEN) provided rough locations for LfW agreements. The Geographic Information Systems (GIS) unit within SE LLS provided shape files for the distribution of EECs and LLS agreements within the UL LGA. The BCT provided locations for their agreements and the BCT PIA Map of the UL LGA.

4.2 Presentation of Data

Each environmental criterion was plotted onto a map when maps were not directly sourced from the data suppliers listed above. Twenty-four maps are provided in this report. For each map and associated key there is a description of the data and what the data reveals about the state of the Shire, as well as the relevance to the final map of habitat enhancement priorities. The first 13 maps provide background information on the state of the environment as revealed by each criterion, while the next 10 maps provide the environmental information that was used to compile the final map of habitat enhancement and connectivity prioritisation.

5. Environmental features of UL LGA relevant to this assessment

5.1 Vegetation Cover via Satellite within the UL LGA

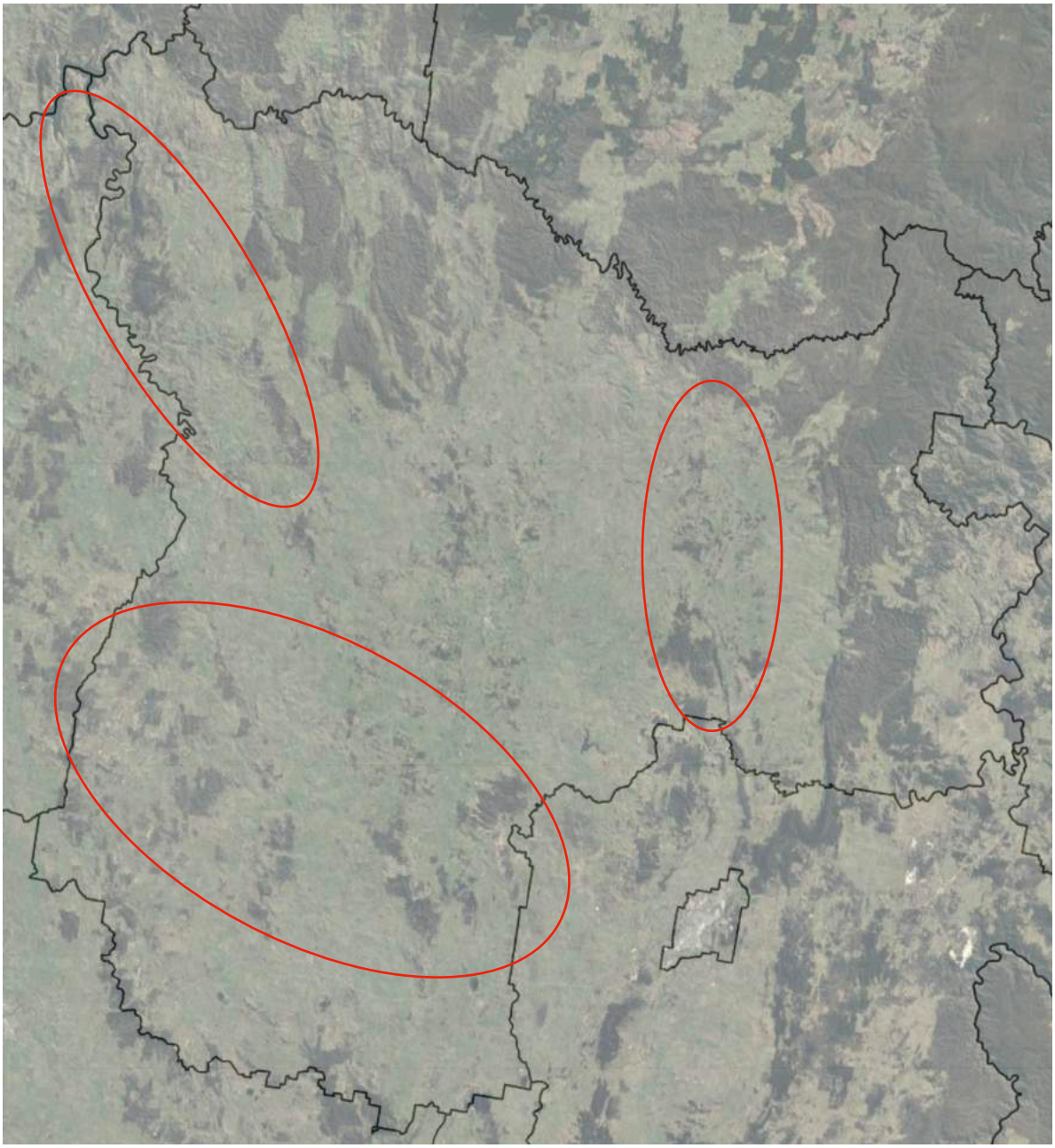

Figure 5.1 Satellite view of vegetation cover within the UL LGA (sourced from ALA).

At this scale only larger areas of forested habitat are visible. Very small fragments and other native vegetation types are present and scattered over the Shire, but are not visible at this scale. The large tracts of forest in the east and central north of the Shire are mostly in protected national reserves and have a relatively high level of connectivity. The three indicated areas show where there are large fragments that are outside of the reserve system and which are likely to provide important core habitat areas but have relatively poor connectivity through the landscape.

5.2 Extent of Vegetation Cover Types within the UL LGA

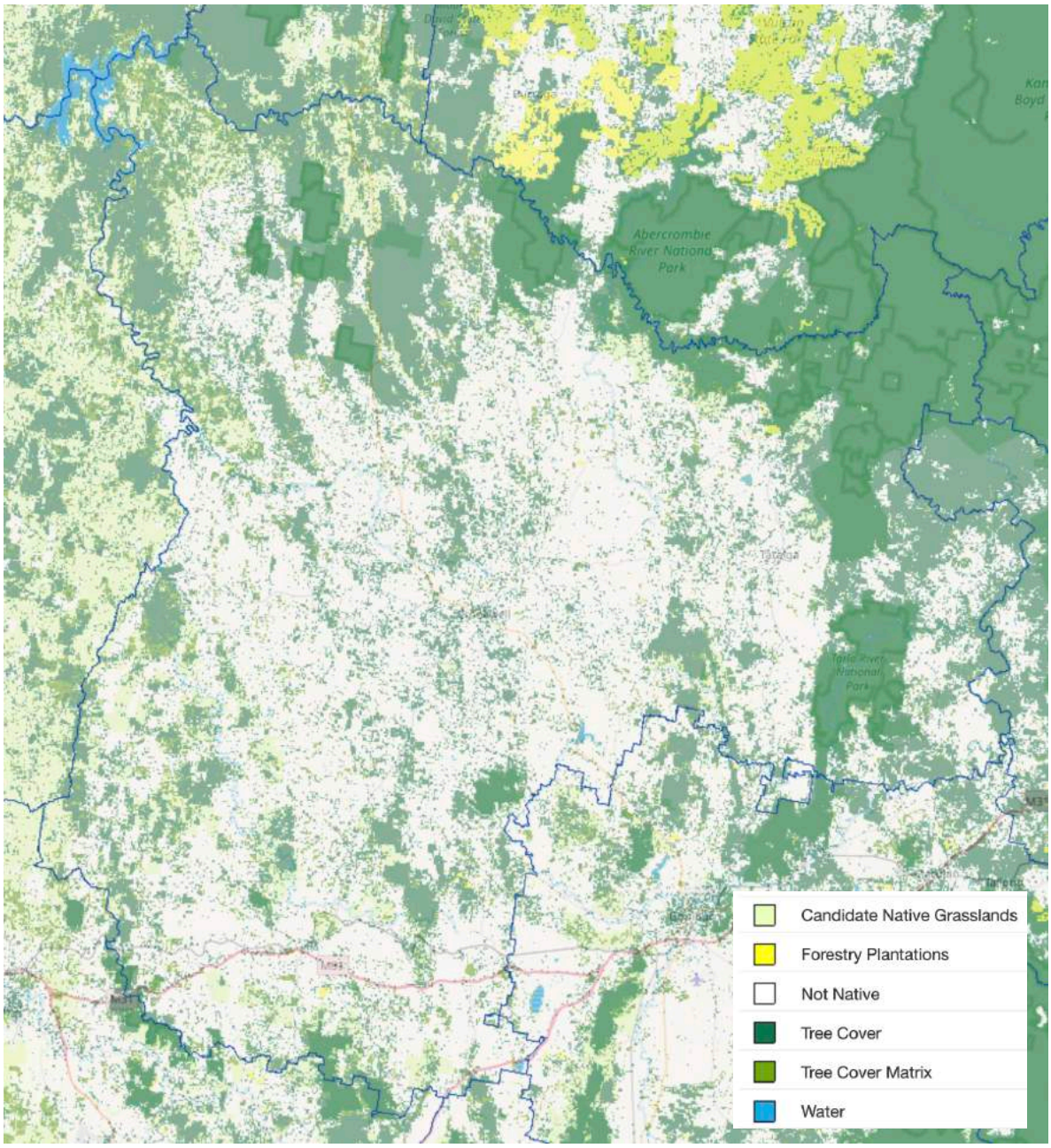

Figure 5.2. Extent of native vegetation cover within the UL LGA (sourced from SEED portal).

The plot of native vegetation shows more detail than was visible from an aerial satellite view of the Shire, as can be seen from the scatter of very small remnants of tree cover and tree cover matrix. The areas of tree cover are areas where there has been very little clearing of habitat. Tree cover matrix describes areas where there has been various degrees of clearing from light thinning to more extensive opening up of forest habitat. Candidate native grasslands are derived grasslands produced by extensive clearing of trees and which still have a cover of native grasses. Such areas are used for grazing and are areas where there has been no pasture improvement. The 'Not Native' area describes areas where native vegetation has been mostly removed and replaced with exotic pasture grasses. Note that the three clusters from the previous map have a higher proportion of derived native grassland around them. They are generally more hilly areas and on less productive shallow soils. These areas are easier to revegetate than the non-native pasture areas within the Shire.

5.3 Location of Plant Community Types within the UL LGA

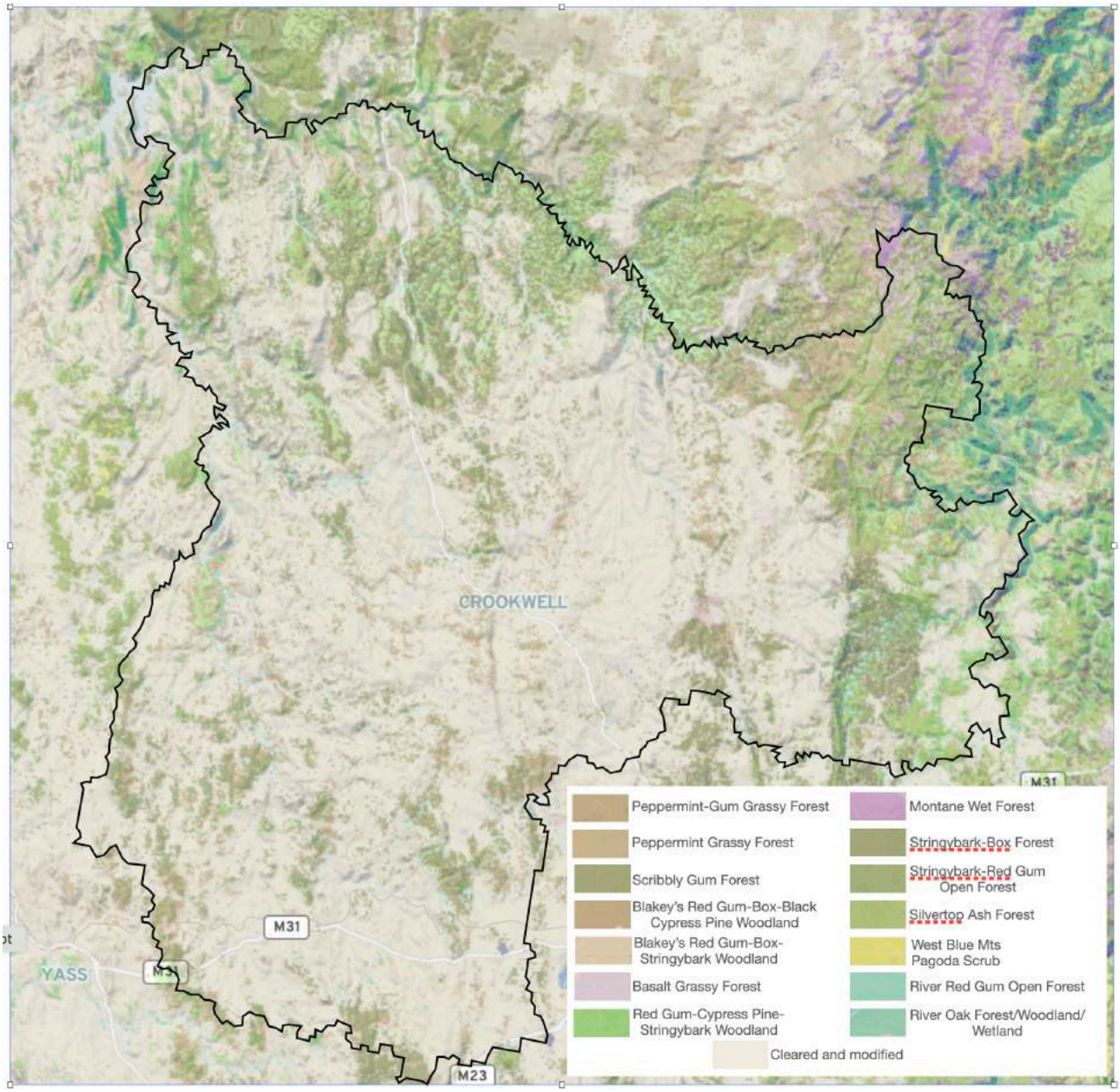

Figure 5.3 Distribution of PCTs within the UL LGA (key shows the more prominent types in order from most to least common, sourced from DPIE website.test.treesnearme.app accessed 16-04-2022).

There are 93 PCTs within the UL LGA. The most common 14 types are shown in the key. Many of the other PCTs are found in isolated pockets in the eastern section of the Shire. Peppermint-Gum and Peppermint Grassy Forests and Basalt Grassy Forest are found in the more elevated and undulating tableland areas. Basalt Grassy Forest is an EEC and has been largely cleared for cropping and grazing. Most of the remnant Red Gum, Stringybark and Box combinations are found on steeper slopes where areas have escaped tree thinning. Scribbly Gum Forest remnants are more extensive as they occur on poorer shallow stony soils. The River Red Gum Open Forest is mainly confined to the Abercrombie and Lachlan River river flats. Revegetation is required in areas where Basalt Grassy Forest and Box-Gum Woodlands occur as these were far more extensive within the Shire pre-European settlement and are preserved only in very small fragments.

5.4 Location of Bioregions within the UL LGA

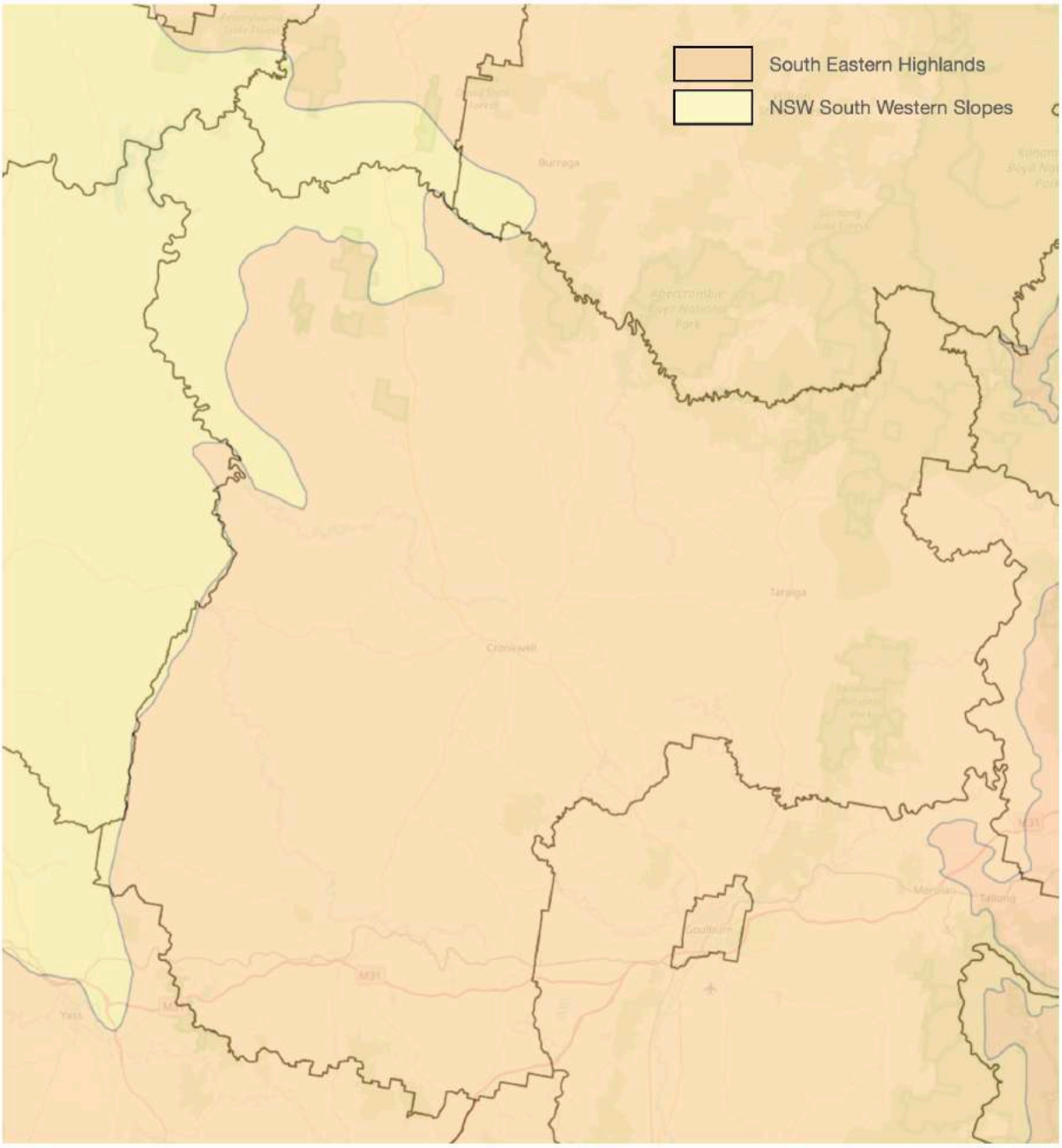

Figure 5.4. Distribution of South Eastern Highlands and NSW South Western Slopes Bioregions within the Upper Lachlan LGA (source ALA).

The majority of the Shire is within the South Eastern Highlands Bioregion which occupies the more elevated areas. The northwest corner of the Shire contains a small area that is within the NSW South Western Slopes Bioregion. The climate, vegetation communities and faunal species found in this area are different to the rest of the Shire and so increase the overall biodiversity within the Shire. As the area within the Shire is small revegetation programs could be weighted to protect and extend remnant vegetation in this bioregion.

5.5 Land Use within the UL LGA

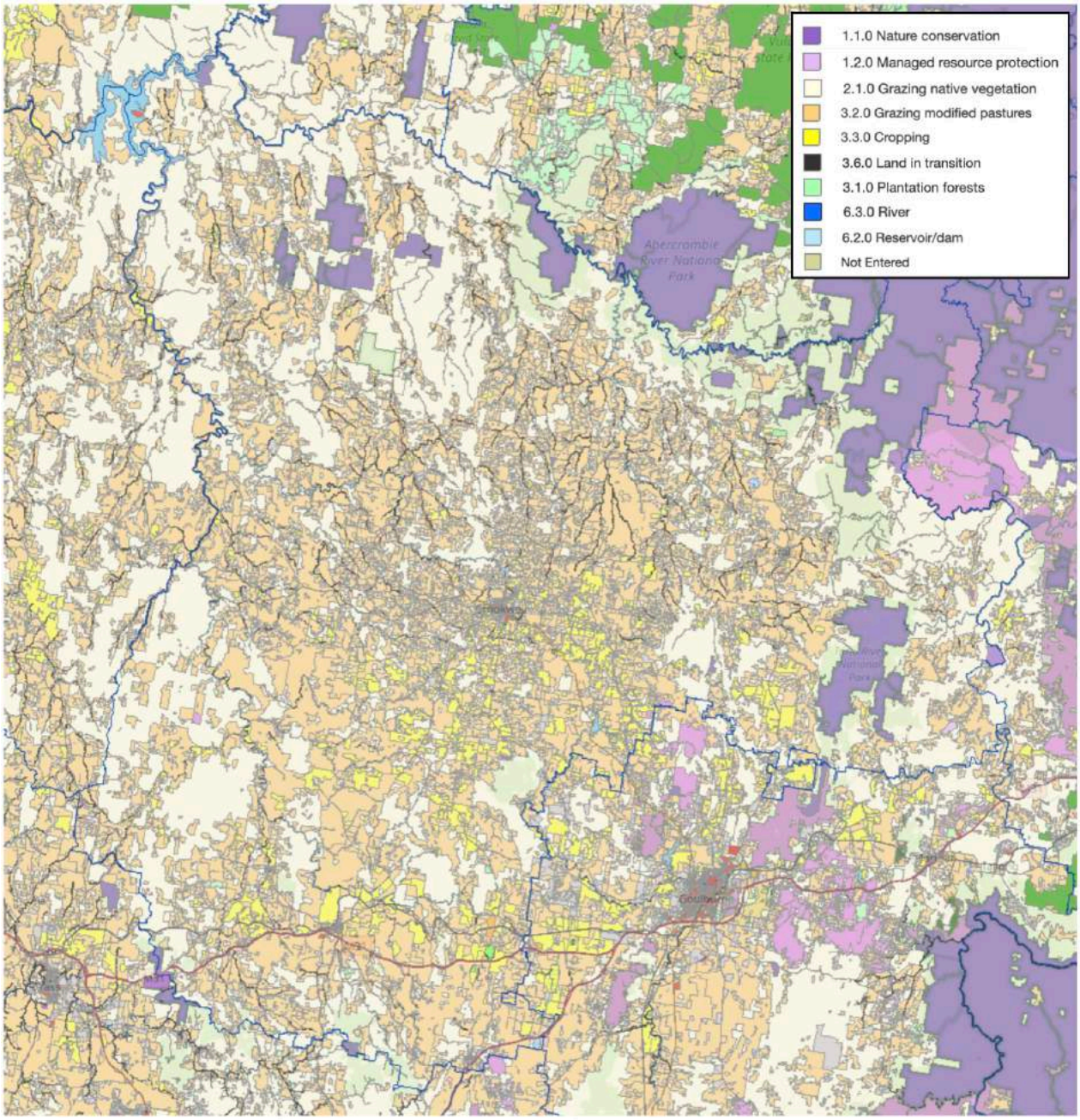

Figure 5.5. Land Use Classes (2017) within the Upper Lachlan LGA. (Sourced from SEED portal accessed 29-03-2022)

Grazing on modified pastures is the most common land use within the Shire. These areas have been identified as having greater than 50% exotic pasture species with significant modification or replacement of the initial vegetation (ABARES 2016). Grazing of native vegetation is the second most common form of land use, followed by cropping. Areas of Grazing on modified pastures and cropping are more difficult to revegetate as they are highly modified and are less likely to have land management regimes applied that would increase their biodiversity value (ULSC 2008). The areas of 'Land in transition' refer to water courses where erosion is present and they are found mainly in the steeper landscapes in the northern half of the Shire.

5.6 Land and Soil Capability within the UL LGA

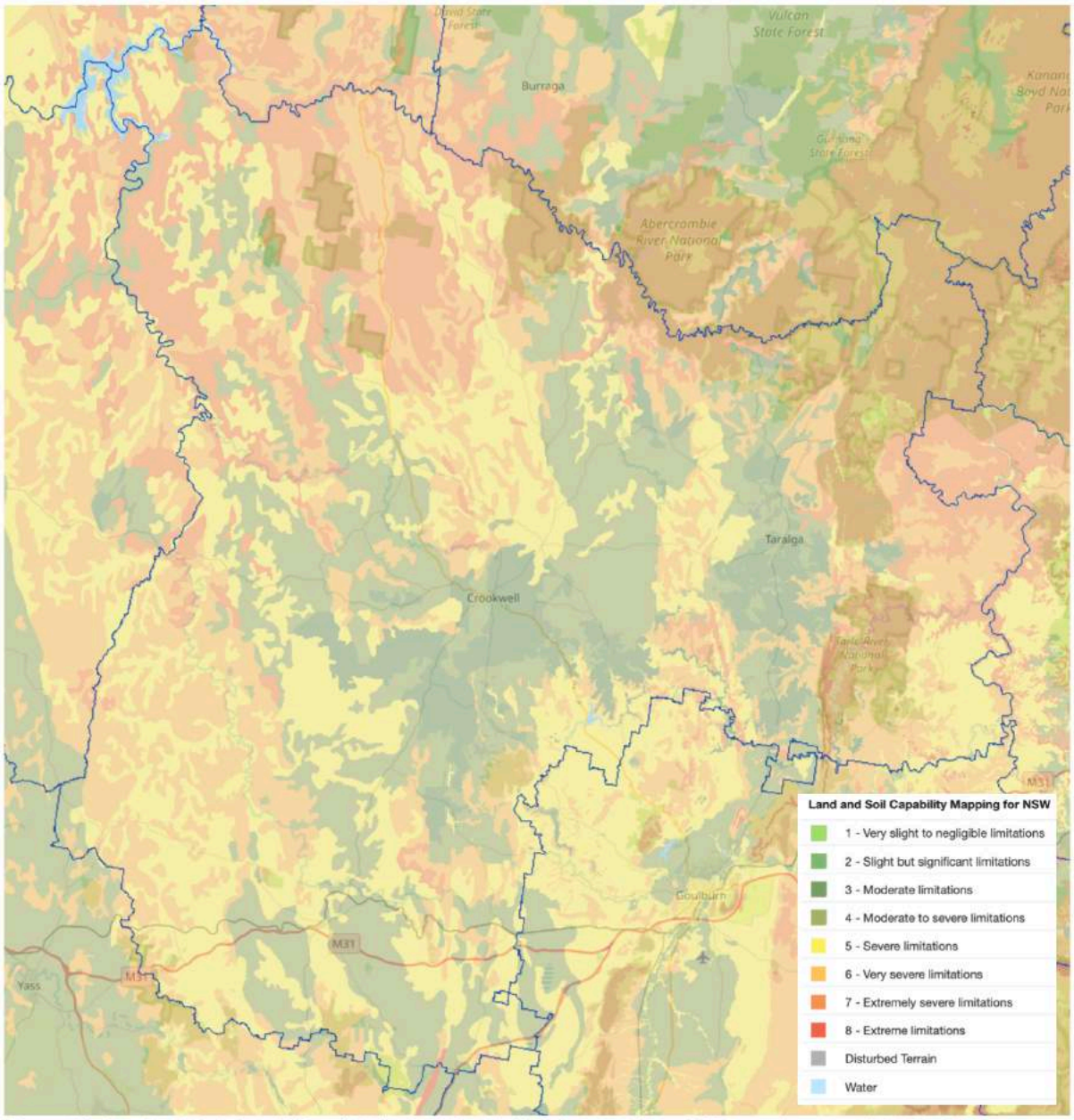

Figure 5.6. Land and Soil Capabilities (2012) within the UL LGA (sourced from SEED portal accessed 28-03-2022.

Knowledge of the land and soil capabilities provides input into the sustainable use and management of land and soil resources (OEH 2012). The more elevated plains and tableland areas are classed as 3 and 4, and are areas of cropping and pasture improvement and include the basalt areas of the Shire. They have moderate to severe limitations on land management where they require careful and specialised management practices to avoid land and environment degradation. Most of the rest of the Shire is within Classes 5 to 7. Areas of Class 5 require careful management to prevent long-term degradation. Areas of Class 6 are restricted to low-impact land use such as grazing, forestry and nature conservation. Areas within Class 7 are areas where there should be minimal disturbance of native vegetation. They are generally on steeper country and have shallow stony soils and are where much of the native vegetation has been retained. Comparing this map with the previous map of land use types you can see that Class 5 and 6 areas are generally used for low impact grazing on native pasture grasses. Revegetation programs could be more profitably applied to Classes 5 to 7.

5.7 Biophysical Strategic Agricultural Land within the UL LGA

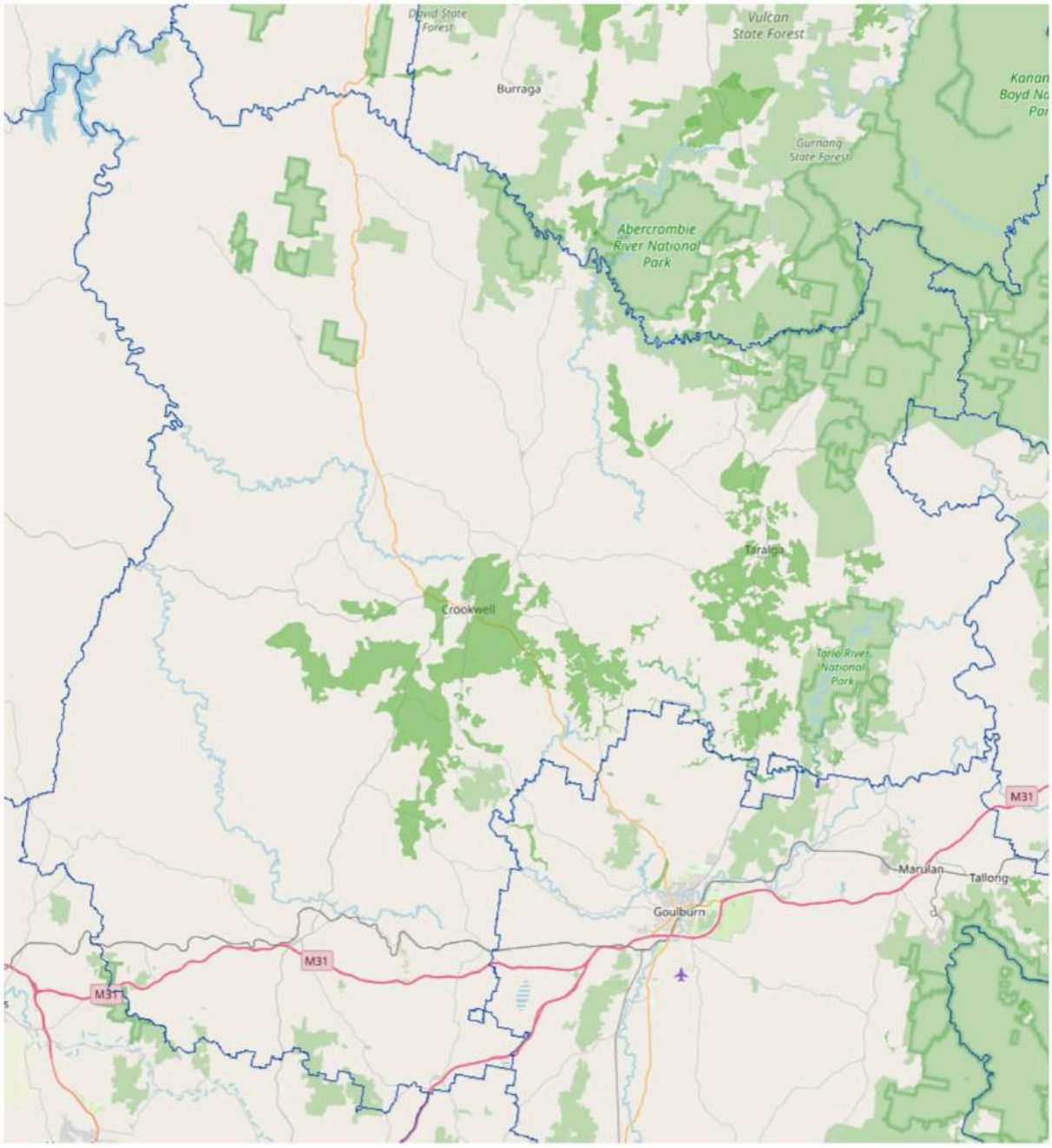

Figure 5.7. Distribution of Biophysical Strategic Agricultural Land (BSAL shown in green, but not including national conservation estate lands) within the Upper Lachlan LGA (sourced from DPIE via SEED portal). BSAL is land with high quality soil and water resources capable of sustaining high levels of agricultural productivity and which require minimal management practices to maintain this high quality. These are concentrated around the Crookwell and Taralga areas.

The BSAL areas coincide with Classes 3 and 4 of Land and Soil Capabilities and also with the basalt areas around Crookwell and Taralga. These are the cropping and improved pasture areas of the Shire. It is also where there was extensive Tableland Basalt Forest EEC prior to clearing. It would be desirable to revegetate some of these areas. However, areas with high agricultural value are also highly modified and are less likely to have land management regimes applied that would increase their biodiversity value (ULSC 2008).

5.8 Location of National Conservation Reserves within the UL LGA

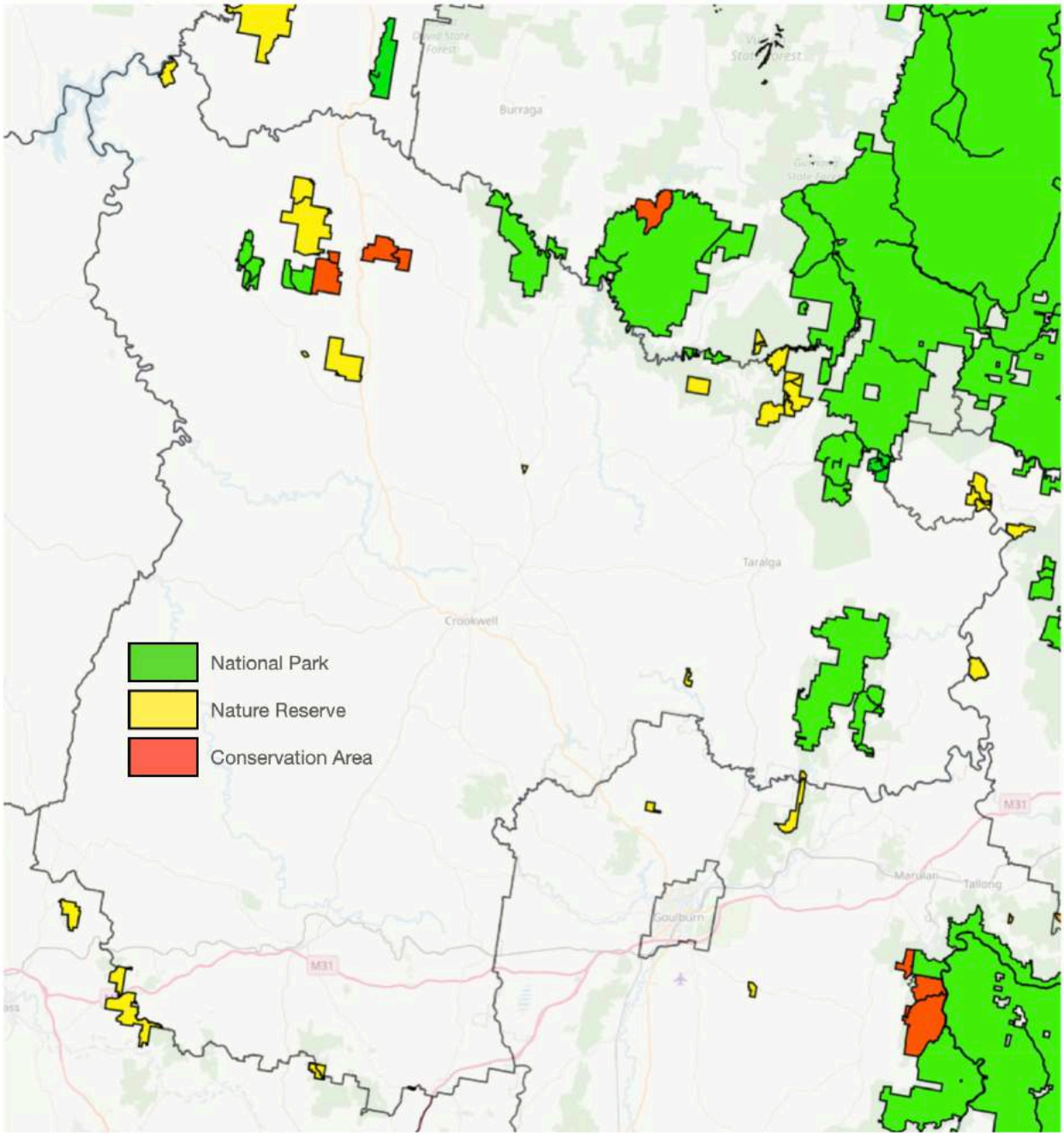

Figure 5.8. Location and type of reserve within the Upper Lachlan LGA (sourced from ALA - Collaborative Australian Protected Areas Database CAPAD 2020 Terrestrial Classes).

All national reserves are in areas where there are very large remnants of contiguous forest and/or woodland, but they make up only a very small proportion of the Shire. They are found mostly in the eastern and northern areas with a small section of the Mundoonan Nature Reserve in the southwest corner of the Shire. The national parks include the Blue Mts., Tarlo River, Abercrombie and Keverstone. The nature reserves are Mundoonan, Keverstone and Gillindich. The conservation areas are Keverstone and Nuggetty. The locations of these reserves in relation to each other suggest that it may be considerably worthwhile building connectivity between Tarlo River and the Blue Mts National Parks and also between the Abercrombie and Blue Mts National Parks. The cluster of reserves in the northwestern section of the Shire could also be targeted for improved connectivity. Areas with reserves have a much higher level of vegetation protection than other areas of the Shire, so the locations of national reserves within the Shire is considered to be less important in identifying high priority areas for connectivity revegetation programs.

5.9 Location of Travelling Stock Reserves within the UL LGA

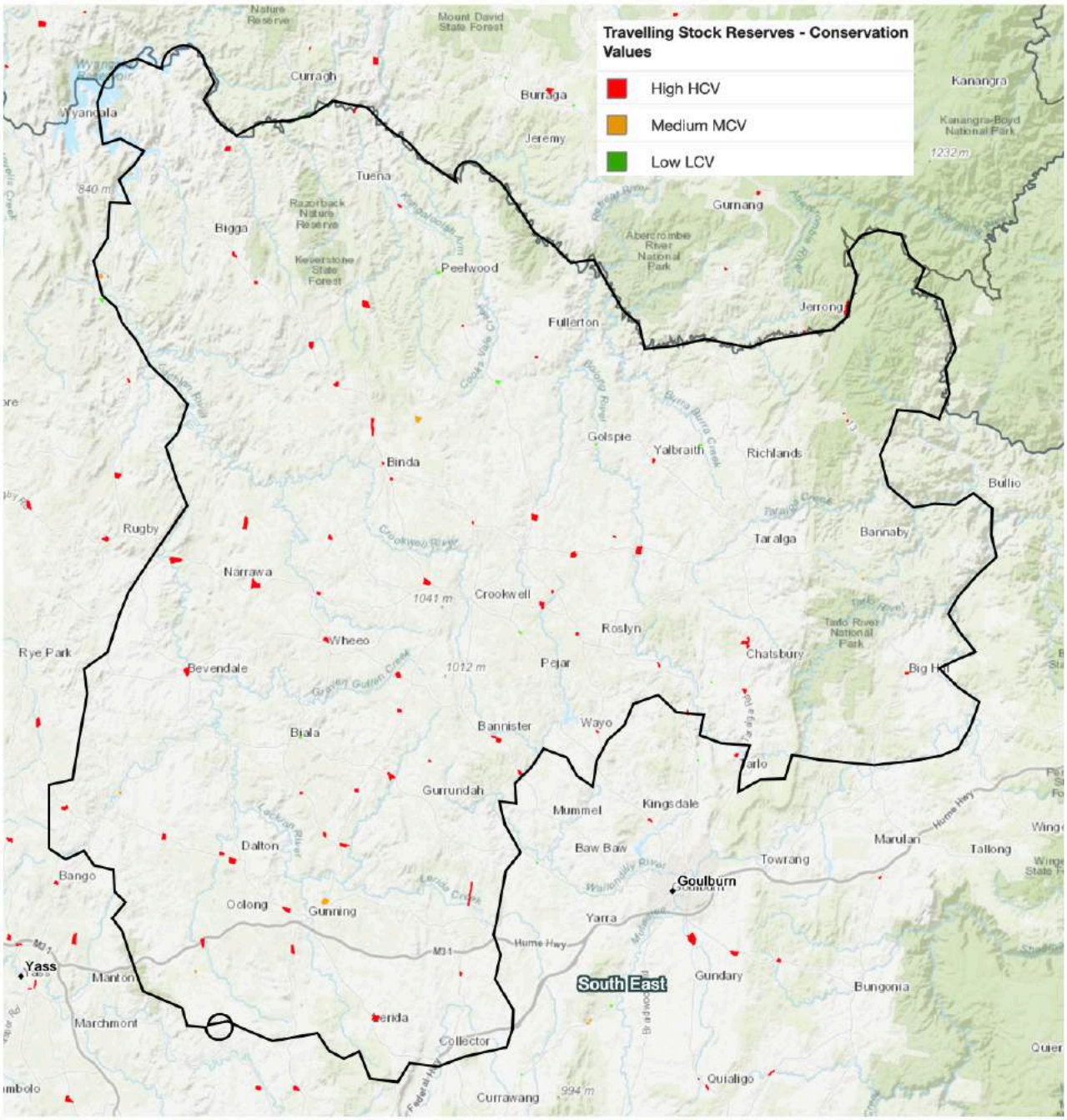

Figure 5.9. Distribution of Travelling Stock Reserves and their Conservation Value within the Upper Lachlan LGA (sourced from LLS TSR Conservation).

Travelling Stock Reserves (TSRs) are small and scattered through the southwestern two thirds of the Shire. They are often important areas for biodiversity as they often contain natural regenerating threatened woodlands and grasslands. They are isolated from each other and there are no concentrations of reserves that highlight areas where connectivity between them should be given a higher priority over other areas of the Shire.

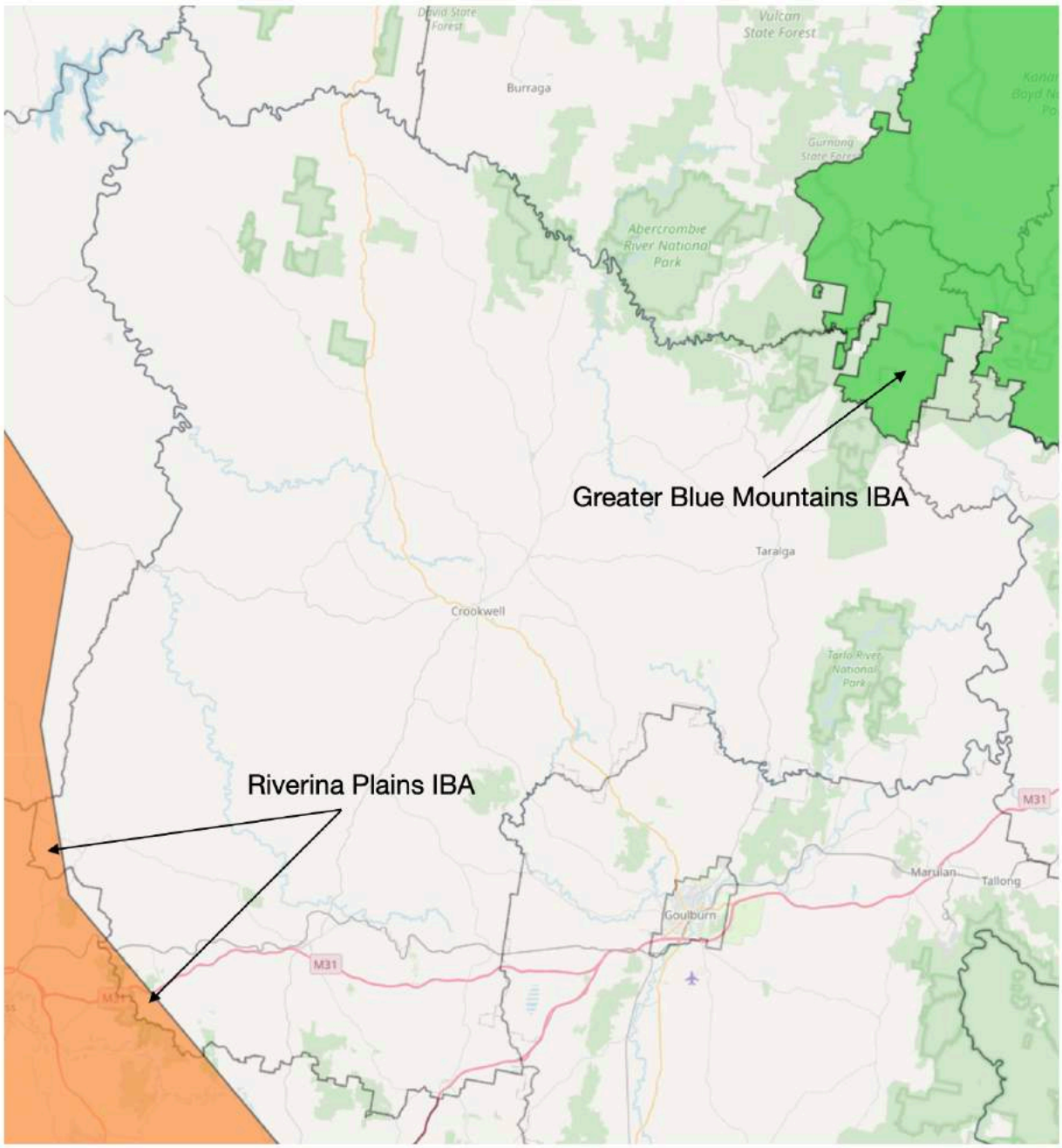

Figure 5.10. Location of Important Biodiversity Areas (IBA) within the Upper Lachlan LGA (sourced from ALA).

5.10 Nationally Important Biodiversity Areas within the UL LGA

There are two nationally recognised important biodiversity areas within the Shire as shown above, but only small parts of them intersect with the Shire boundaries. Most of the Greater Blue Mountains IBA within the Shire is in national parks, while the Riverina Plains IBA is found in a small southwestern section the Shire. These two small areas do not contain reserves and comprise private landholdings. Any conservation work in these two areas are not likely to have a significant impact on the IBA as a whole, but may contribute to maintaining and improving biodiversity within the Shire.

5.11 Biodiversity Planning Framework Conservation Values within the UL LGA

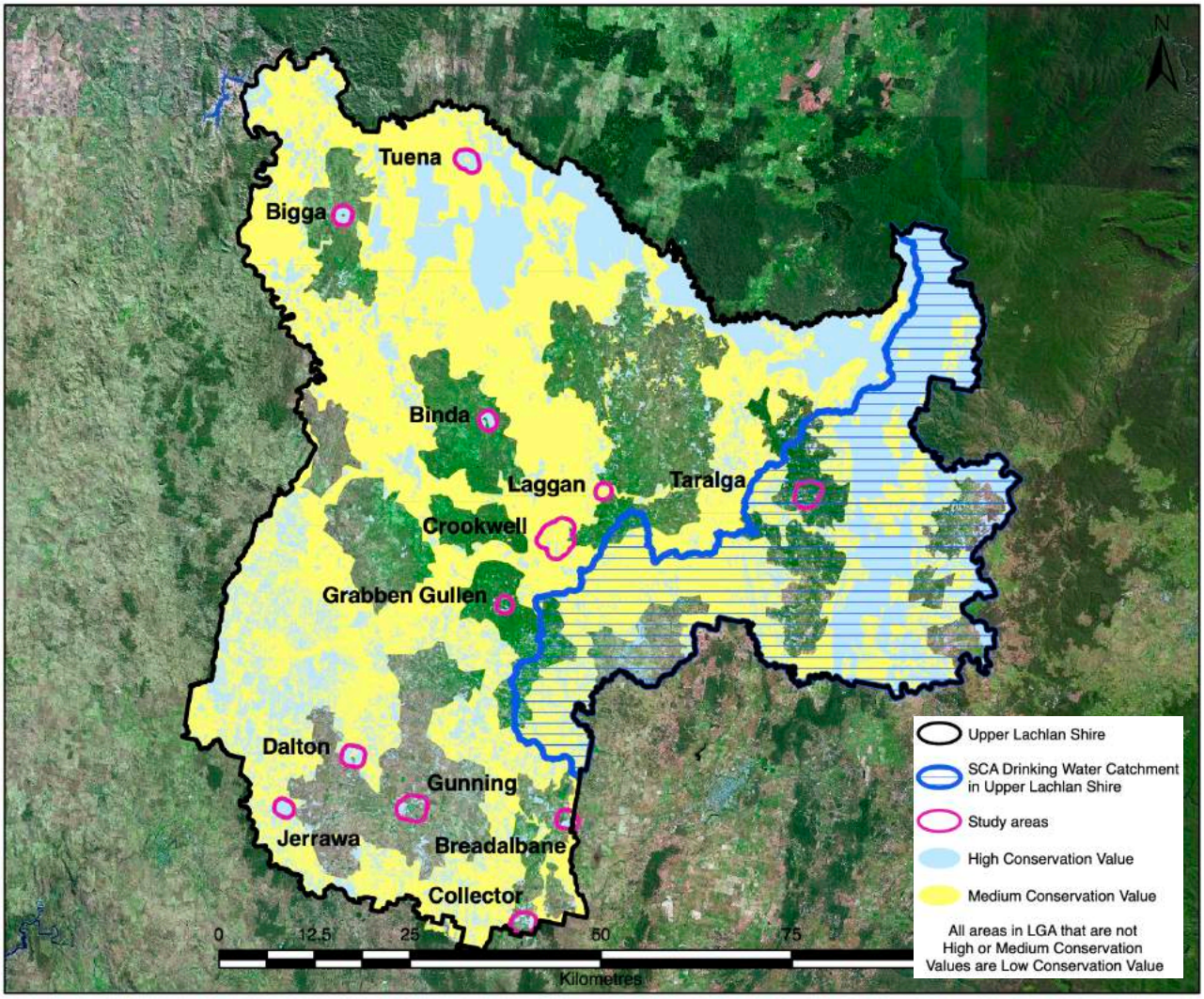

Figure 5.11. Distribution of high and medium conservation value areas within the UL LGA (ULSC 2008)

Much of the Shire contains areas of high or medium conservation value. The areas of high conservation value in the northeast and eastern sections of the Shire are mostly within extensive forested areas and are largely within the reserve system. However, there are scattered small high conservation value areas in the western third of the Shire that are not within the reserve system and which are far more fragmented. These smaller remnants are of higher quality habitat compared with the surrounding area, but there is poor connectivity between them.

5.12 Biodiversity Planning Framework Potential Corridors within the UL LGA

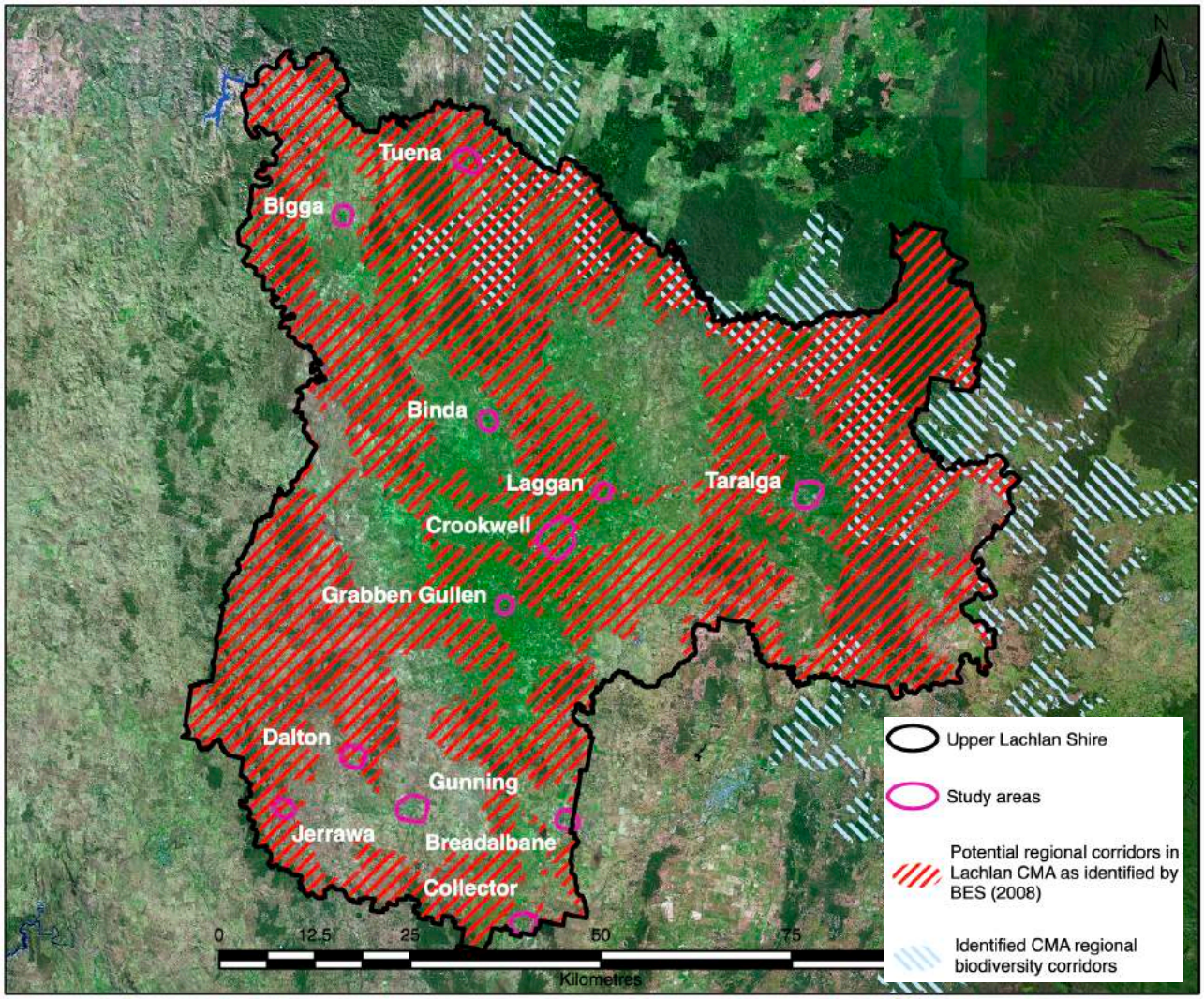

Figure 5.12. Distribution of potential corridors areas within the UL LGA (ULSC 2008)

This map identifies areas where there are patches of habitat with high biodiversity values that have the potential to be interconnected to provide wildlife corridors. They contain areas with large habitat remnants that are interspersed with smaller fragments that once connected could see improvements in corridor function.

5.13 Biodiversity Planning Framework Revegetation Plantings within the UL LGA

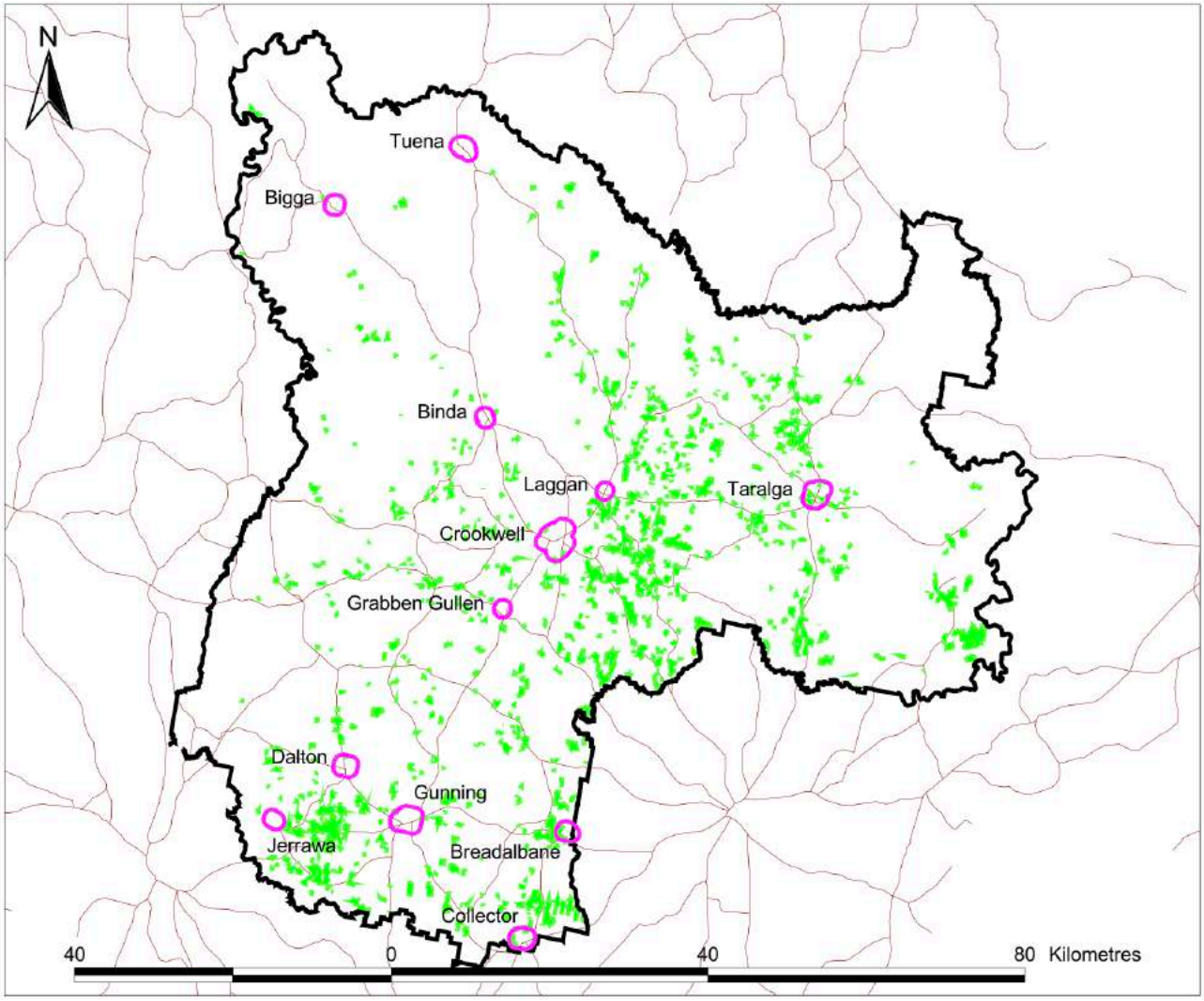

Figure 5.13. Distribution of revegetation plantings within the UL LGA (ULSC 2008)

This map shows the distribution of properties where revegetation works have occurred up till 2008. It does not represent the whole area of planting but shows the distribution of properties with those plantings. Comparing this map with Figures 5.11 and 5.12 you can see that areas of high conservation value and high corridor potential are mostly outside the areas where much of the planting has occurred. Although all revegetation plantings improve local habitat for wildlife it appears that there has been little effort to target the higher priority areas in Figures 5.11 and 5.12.

6. Environmental information used to produce map of high priority connectivity values

The environmental information within the Upper Lachlan Shire is depicted in the following ten maps which include information on the following:

- The distribution of seven selected sedentary threatened faunal species
- The distribution of endangered ecological communities within the Shire
- The distribution of three main endangered ecological communities within the Shire
- The distribution frequency of all threatened floral and faunal species combined
- The distribution of conservation agreements
- The location of Great Eastern Ranges areas of interest
- The location of core habitat areas and linking corridors from the South East and Tablelands Regional Plan (2017)
- The distribution of Priority Investment Areas for the Biodiversity Conservation Trust (OEH 2018)

The maps in section 5 illustrate some of this information from earlier analyses and/or provide relevant background on the local environment. Earlier work from other reports e.g. ULSC 2008 has produced some similar maps, but the maps in this section provide more up to date material and access additional information. The criteria described in each of the maps of this section were considered to be more relevant to the determination of which areas of the Shire should have higher priority for habitat connectivity works. Each criterion was given equal weight towards producing the final map in section 7 (Figure 7).

Priority was determined from a consideration of the distribution of fragmented endangered ecological communities and their overlap with the distribution of selected threatened sedentary faunal species. Extending and protecting these remnants and the threatened species they contain is essential for securing biodiversity into the future.

6.1 Location of Threatened Ecological Communities within the UL LGA

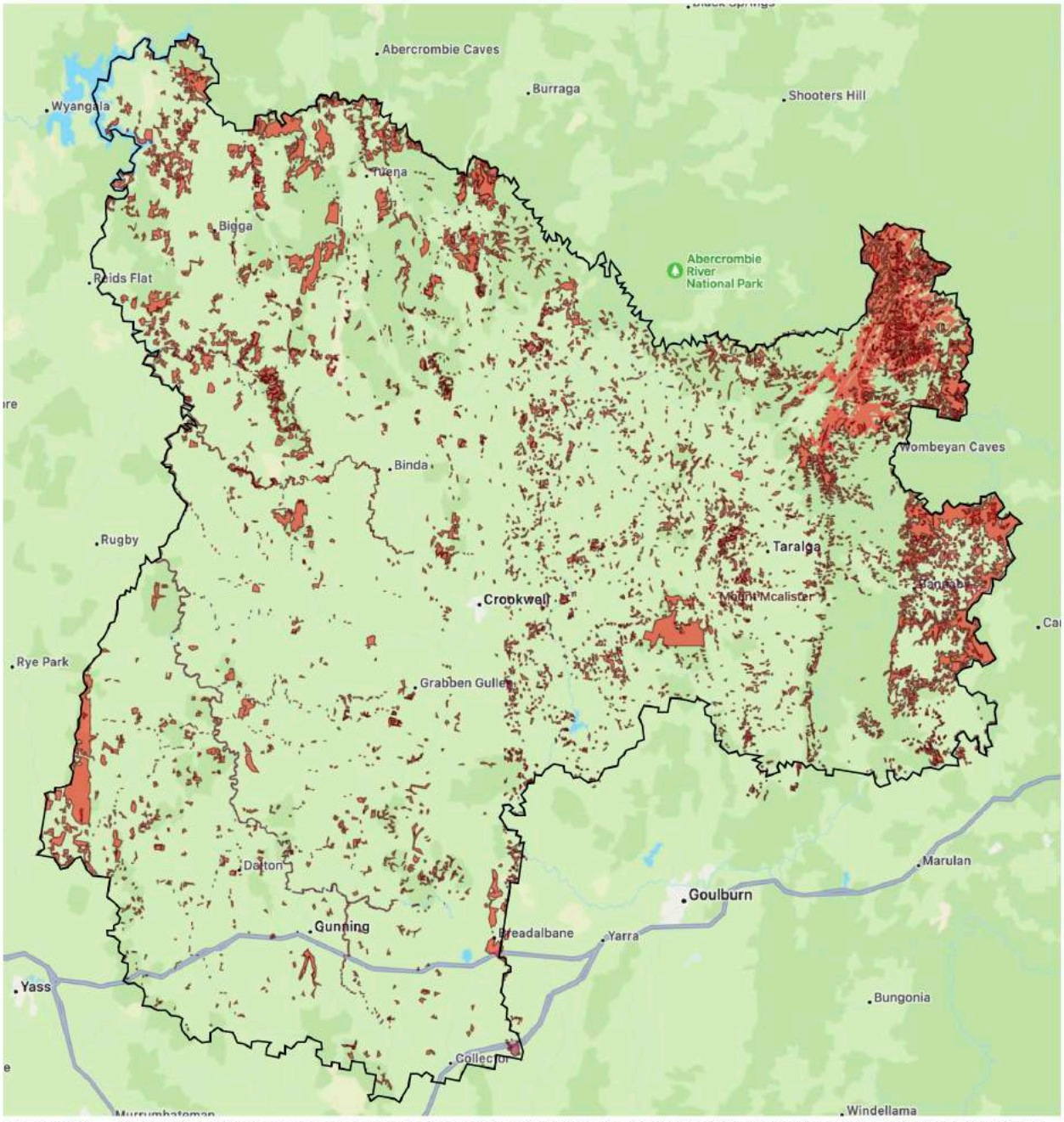

Figure 6.1. Distribution of all endangered ecological community remnants within the Upper Lachlan LGA (sourced from SE LLS).

Figure 6.1 shows the distribution of all fourteen endangered ecological communities within the Shire. Their status within the Shire vary greatly. Some such as Lowland Rainforest, Western Sydney Dry Rainforest, Montane Peatlands and Swamps, Robertson Basalt, Inland Grey Box Woodland, Fuzzy Box Woodland, Coolac - Tumut Serpentine Shrubby Woodland, and the Monaro and Werriwa Tablelands Cool Temperate Grassy Woodlands have very small distribution and occurrences within the Shire. At the other end of the scale, Tablelands Basalt Forest, Tablelands Snow Gum, and WhiteBox - Yellow Box - Blakely's Red Gum Grassy Woodland were far more extensive within the Shire and large areas have been cleared or left largely fragmented. The latter 3 EECs are considered here to have higher priority and so separate distribution maps of each of these follow. The higher priority areas for habitat connectivity are the SW and NW corners and the N-S band between Crookwell and Taralga.

6.2 Distribution of Box-Gum Grassy Woodland within the UL LGA

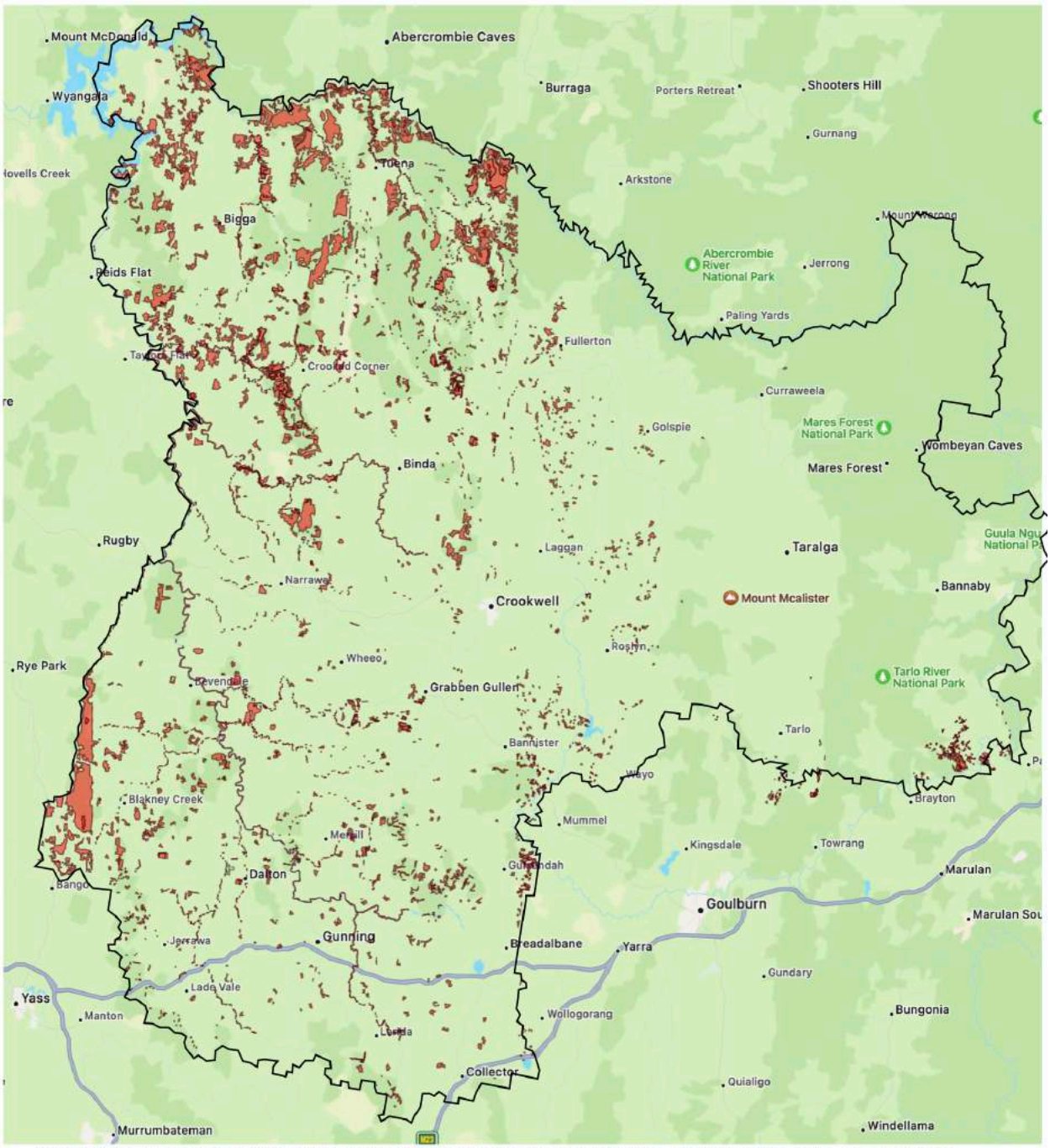

Figure 6.2. Distribution of Box-Gum Grassy Woodland remnants within the Upper Lachlan LGA (sourced from LLS TSR Conservation).

Most of the Box-Gum Grassy Woodland remnants are found within the western two-thirds of the Shire. This EEC is one of the most threatened EECs within NSW and is considered to be a high priority for restoration at both Commonwealth and State levels. Although there are some large remnants in the NW corner and on the western edge of the Shire near Blakney Creek most of the EEC is represented by small scattered fragments. Connecting and increasing the size of these smaller remnants with the larger areas of habitat is considered in this report to be a high priority.

6.3 Distribution of Tableland Basalt Forest within the UL LGA

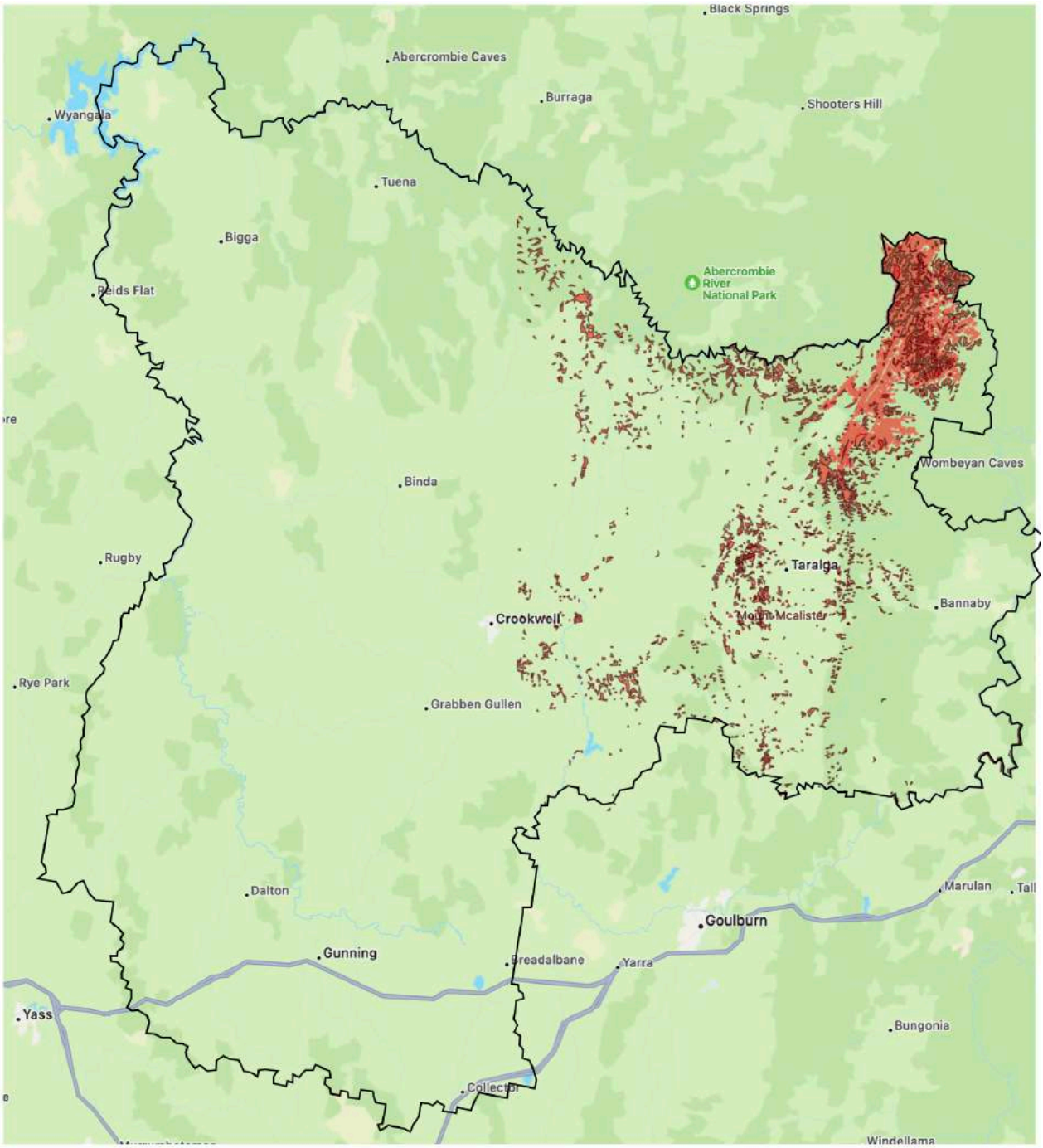

Figure 6.3. Distribution of Tableland Basalt Forest remnants within the Upper Lachlan LGA (sourced from SE LLS).

Tableland Basalt Forest is found mainly within the eastern third of the Shire. The habitat in the extreme northeast corner is protected within the Reserve system. This EEC extended over a much broader area in a band running N-S between Crookwell and Taralga, but it is retained in only small isolated fragments. Extending the size and connectivity between these fragments is considered to be a high priority in this report.

6.4 Distribution of Tableland Snow Gum Woodland within the UL LGA

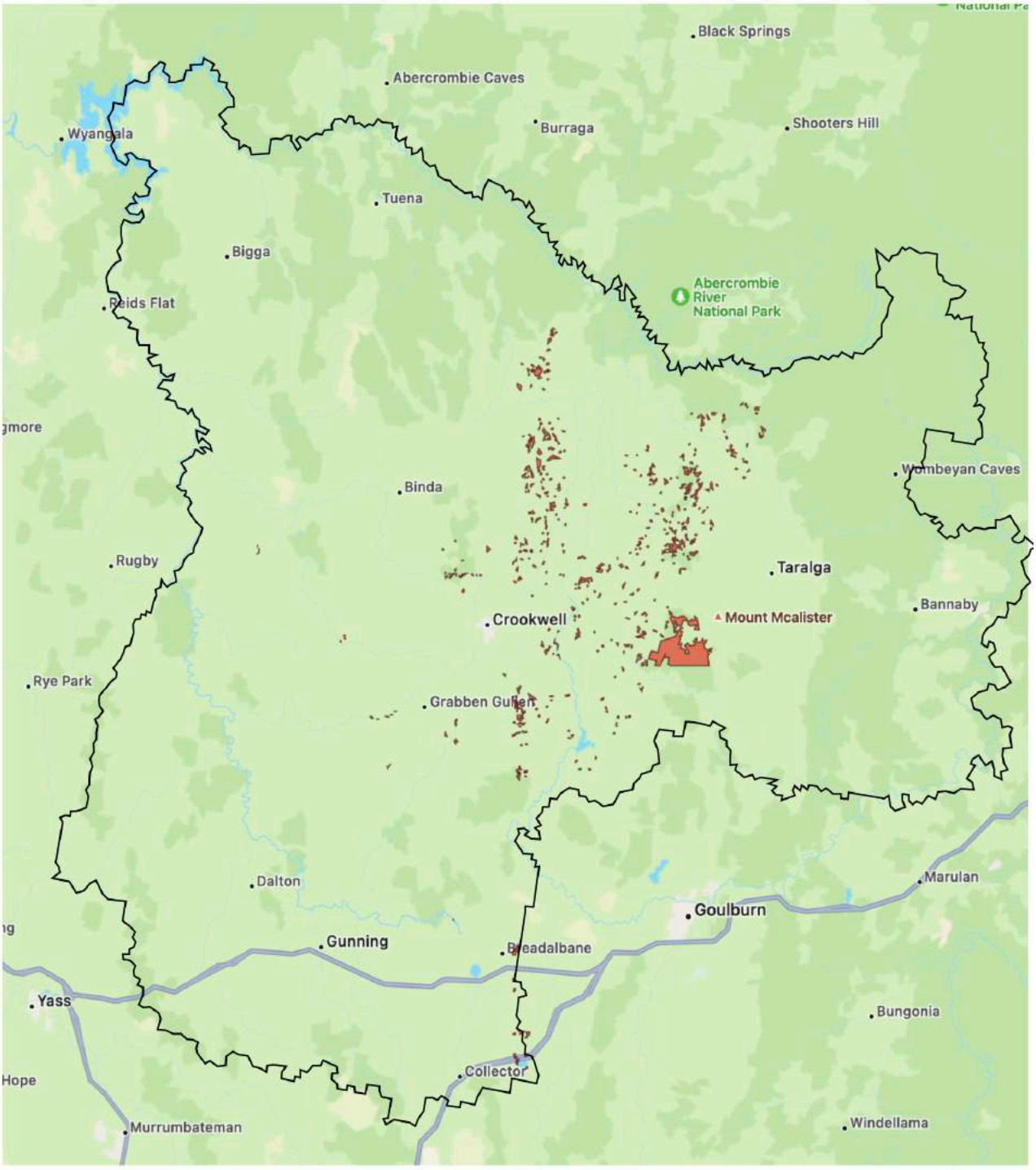

Figure 6.4. Distribution of Tablelands Snow Gum remnants within the Upper Lachlan LGA (sourced from SE LLS).

Tablelands Snow Gum EEC is confined mainly to the central high tableland area of the Shire. Much of this habitat type has been cleared for grazing and cropping and the remnants are small and scattered. The area in a band between Crookwell and Taralga contains two ear-like extensions to the north of Crookwell and Taralga where the remnants are closer together and so this area is considered to be a high priority area for extending habitat area and increasing connectivity.

6.5 Distribution of selected Threatened Fauna Species within the UL LGA

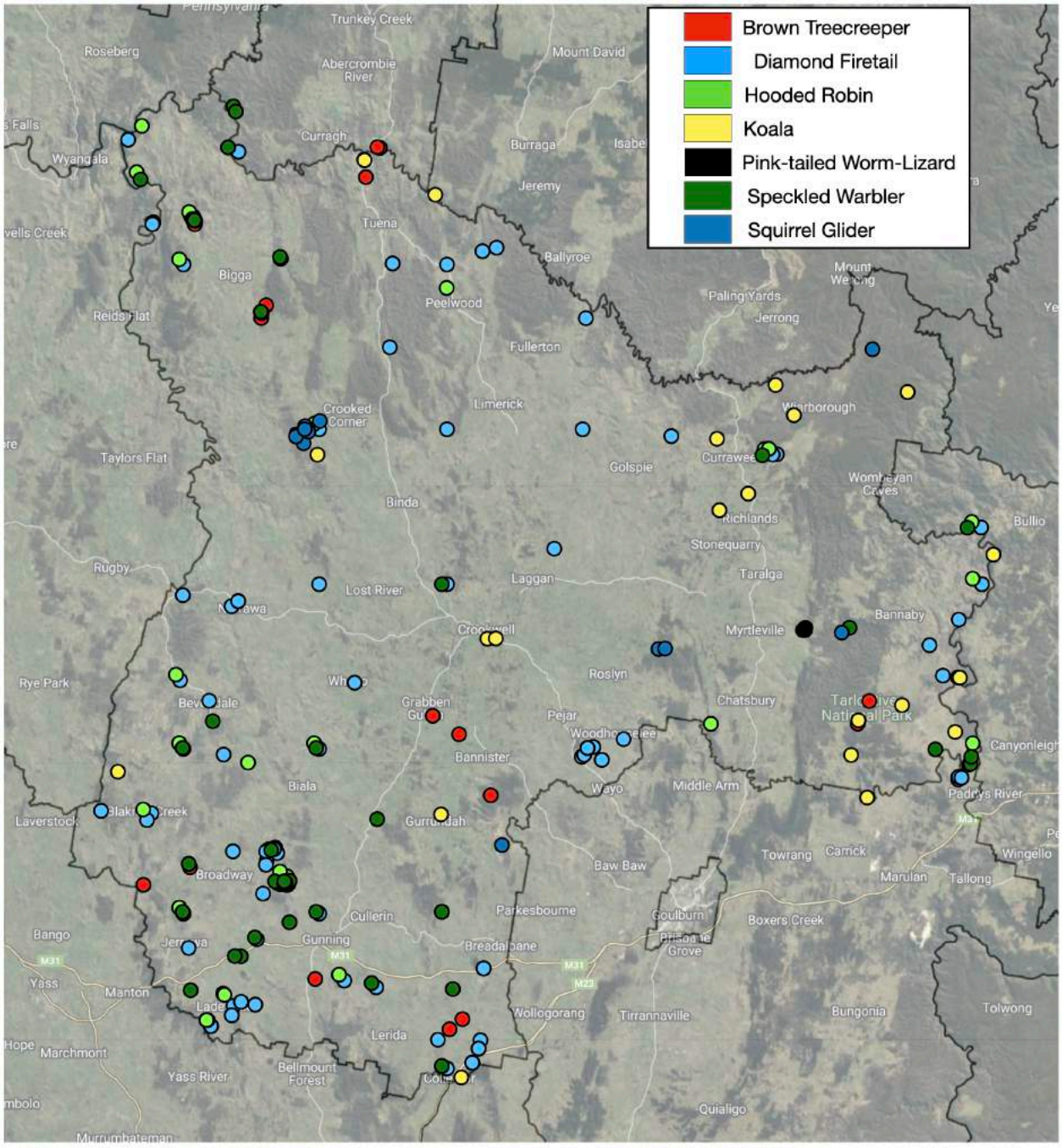

Figure 6.5. Distribution of threatened species records within the Upper Lachlan LGA (records sourced from ALA).

These species were chosen because they are not migratory and because they may often be found in remnant habitat areas of sufficient size and quality. Migratory and nomadic species are also dependent on these same habitat remnants, but can often move between them and can move greater distances between scattered remnants. The selected species are often unable to move between remnants and are at more risk if conditions within their habitat patch change, compared with migratory or nomadic species. The records for each of these species are shown in Appendix 1. Many of the records for the species shown in the map are from outside the protected area system and emphasise the importance of caring for habitat within private land holdings and their importance in maintaining biodiversity. The greatest concentration of records within the fragmented landscape are in the SW corner of the Shire, with lower but still significant concentrations in the far east and NW corner.

6.6 Threatened Species Frequencies Map of the UL LGA

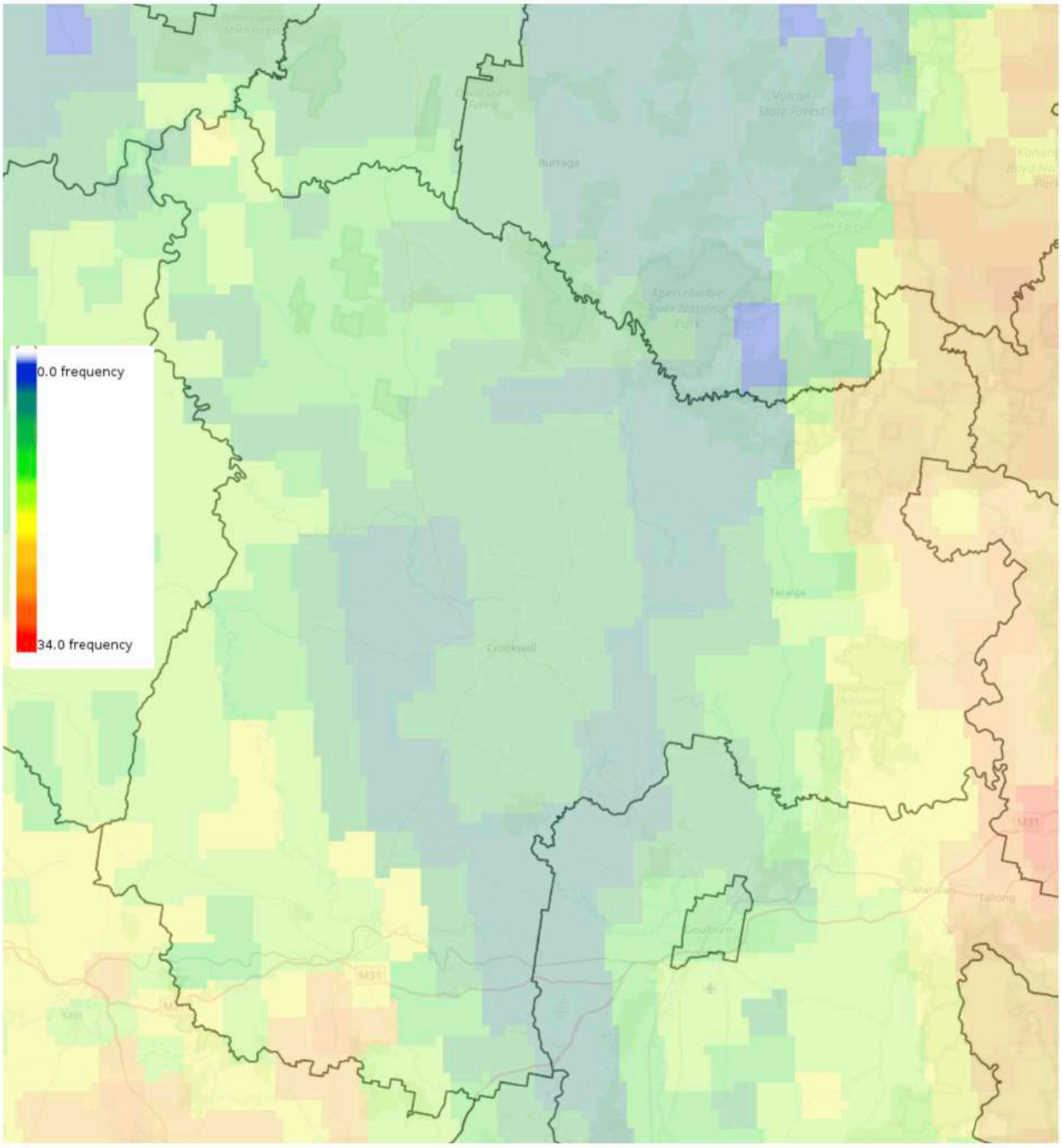

Figure 6.6. Threatened species frequencies for the Upper Lachlan LGA (source ALA).

The species frequencies shown here are for all threatened species records combined, which includes all floral and faunal species. The area of highest concentration within the Shire are in the far east and the small area south of Gunning. These areas are given a higher priority value as areas for potential habitat enhancement and connectivity improvements.

6.7 Density Distribution of Conservation Agreements within the UL LGA

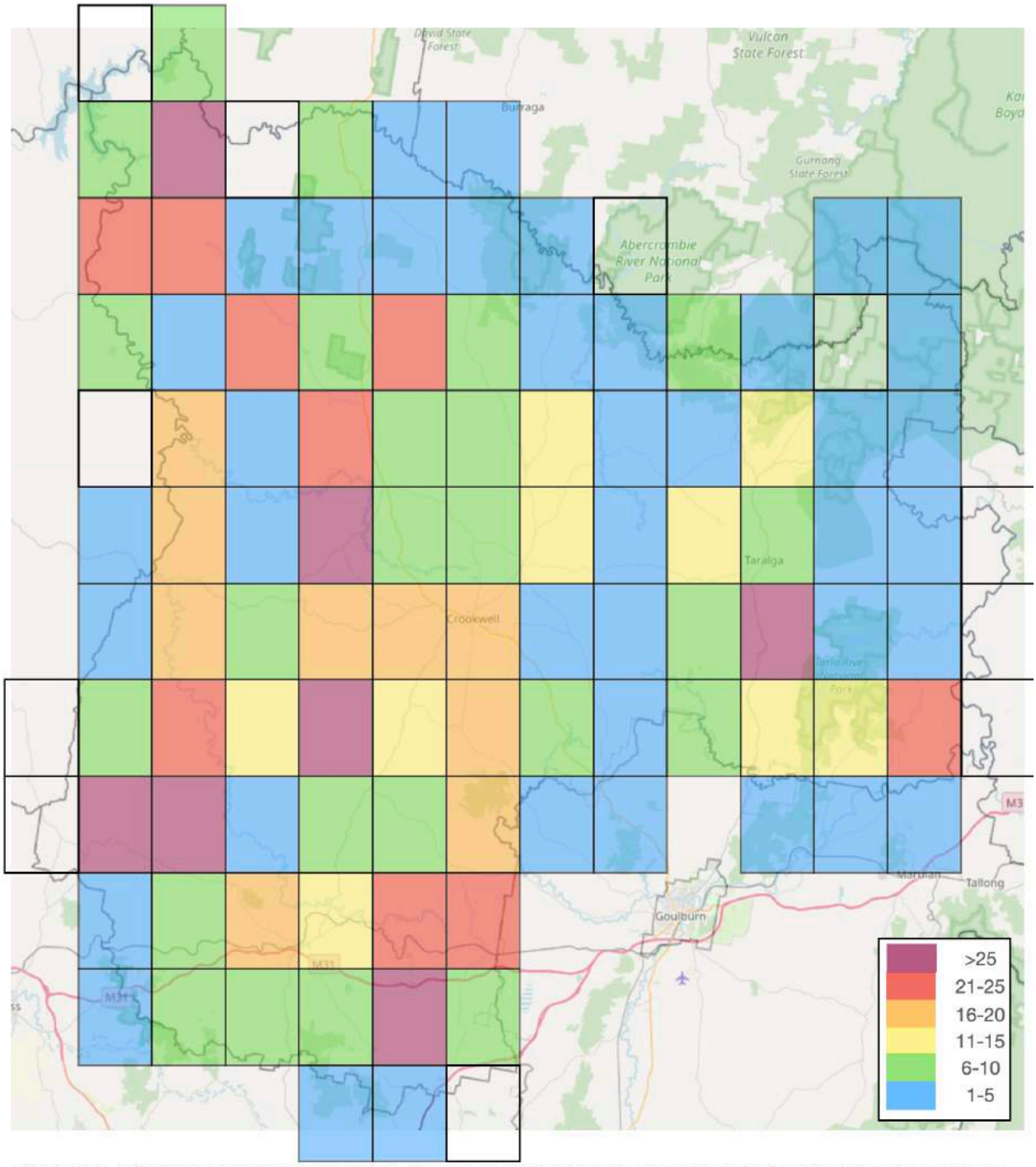

Figure 6.7. Distribution of 1019 conservation agreements within the Upper Lachlan LGA (per 0.1º grid, data sourced from Biodiversity Conservation Trust NSW (n=16), Land for Wildlife Conservancy (n=53), Box-Gum Grassy Woodland Stewardship Program (n=13) South East Local Land Services Agreements (n=937)).

There appears to be no visible connection between the density of agreements and higher priority areas discussed in the preceding maps. The conservation agreements that target threatened ecological communities are fewer in number compared with other agreement types. The distribution instead is more likely to reflect the willingness of landholders to take part in conservation measures. While this is still very important there may be opportunities to target areas where there are fragmented EECs and threatened flora and fauna species. The areas of tree plantings shown in Figure 5.13 also do not appear to correlate with the distribution of conservation agreements and this suggests that tree planting also occurs outside areas managed under conservation agreements. Areas with less than 10 agreements per grid are prioritised.

6.8 Location of Great Eastern Ranges Regions within the UL LGA

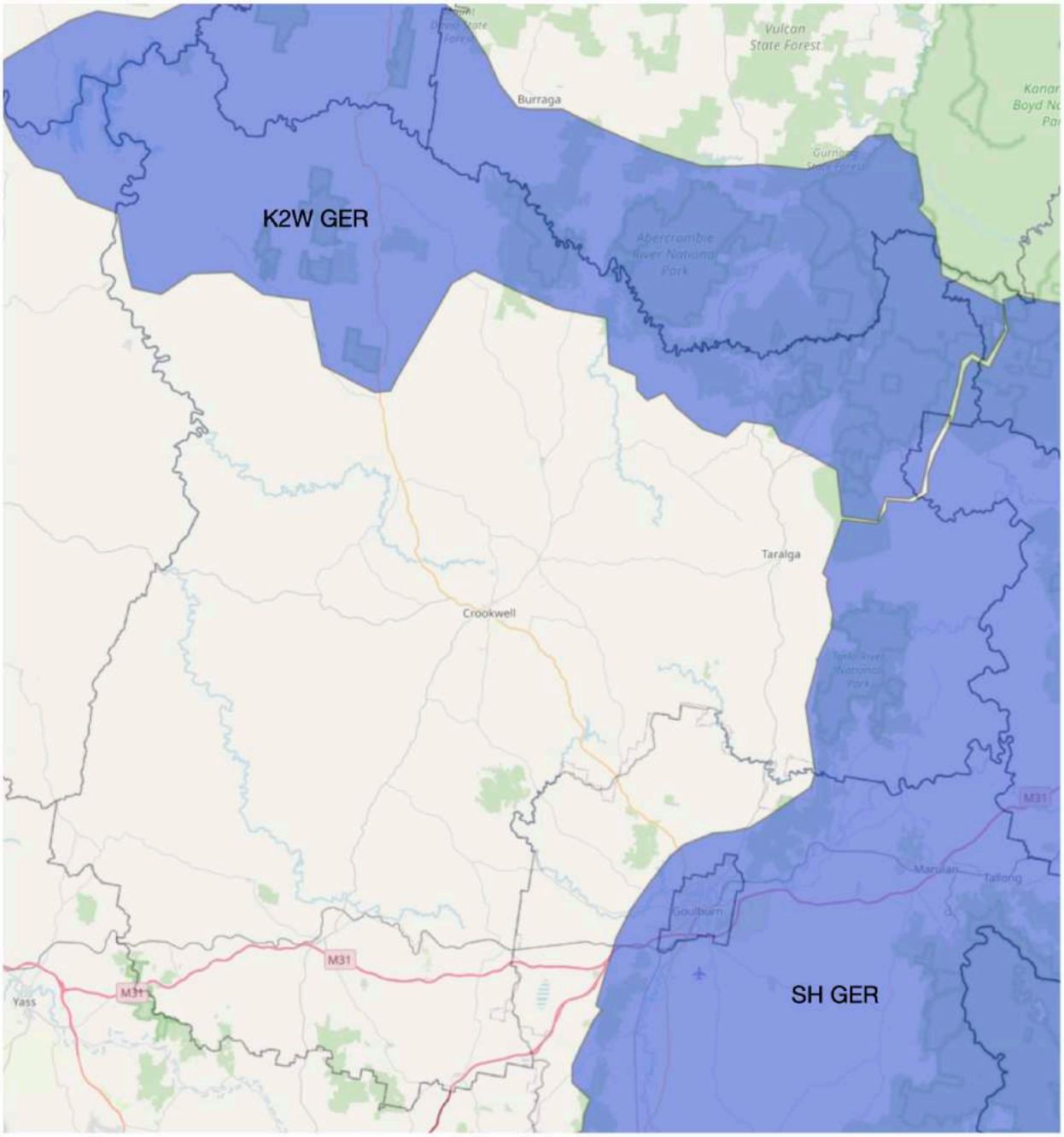

Figure 6.8. Location of Kanangra to Wyangala (K2W GER) and Southern Highlands (SH GER) Great Eastern Ranges Management Areas.

The Great Eastern Ranges initiative aims to prioritise areas recognised as important for enhancing connectivity to aid migration, maintain biodiversity and facilitate dispersal of species under changing climatic regimes along the east coast and ranges of Australia which is the largest area of forested habitat on the continent. Its relevance here is to recognise the role the Shire plays in supporting conservation work within the GER and these areas are hence given a higher priority towards enhancing connectivity works within the Shire.

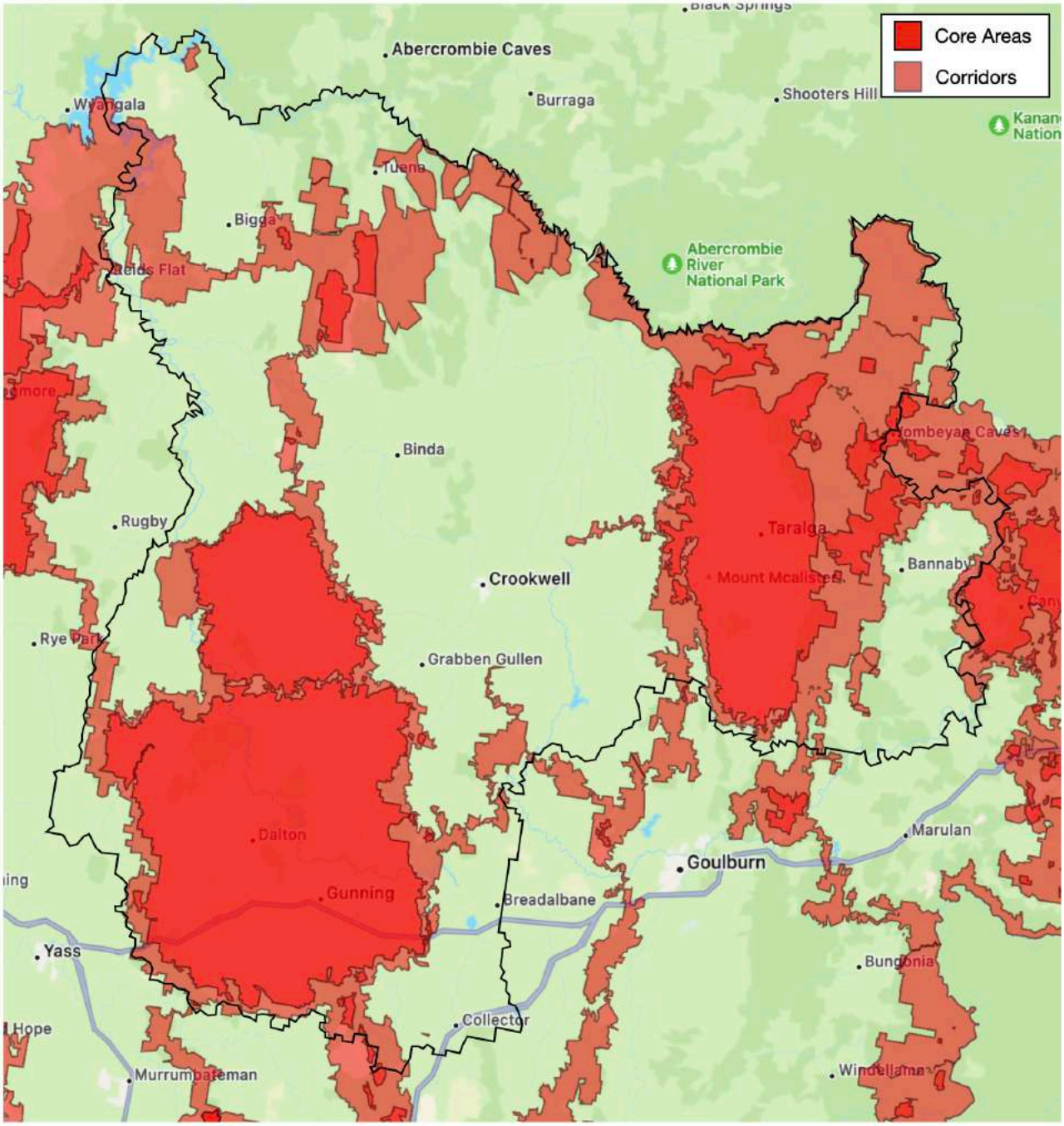

Figure 6.9. Biodiversity corridors identified for consideration in the South East and Tablelands Regional Plan 2017. These corridors were mapped by refining connectivity models for a range of fauna species, through a process of on ground validation and local knowledge. Contributed by local experts from Upper Lachlan Shire Council, South East Local Land Services and Department of Primary Industries and the Environment (sourced from SEED).

6.9 Biodiversity Corridors Plan for areas within the UL LGA

This map provides an update to the map shown in Figure 5.12 from the report prepared by the Upper Lachlan Shire Council in 2008 (ULSC 2008). The two very large core areas, one centred on the Gunning-Dalton area and the other centred around Taralga, should be targeted for connectivity revegetation as well as the corridor areas linking them north and south. The areas recognised by the Regional Plan are similar to those recognised in previous maps in Figures 6.2 through to 6.5 and so they are given a high priority in this report.

6.10 Biodiversity Conservation Trust Priority Investment Areas within the UL LGA

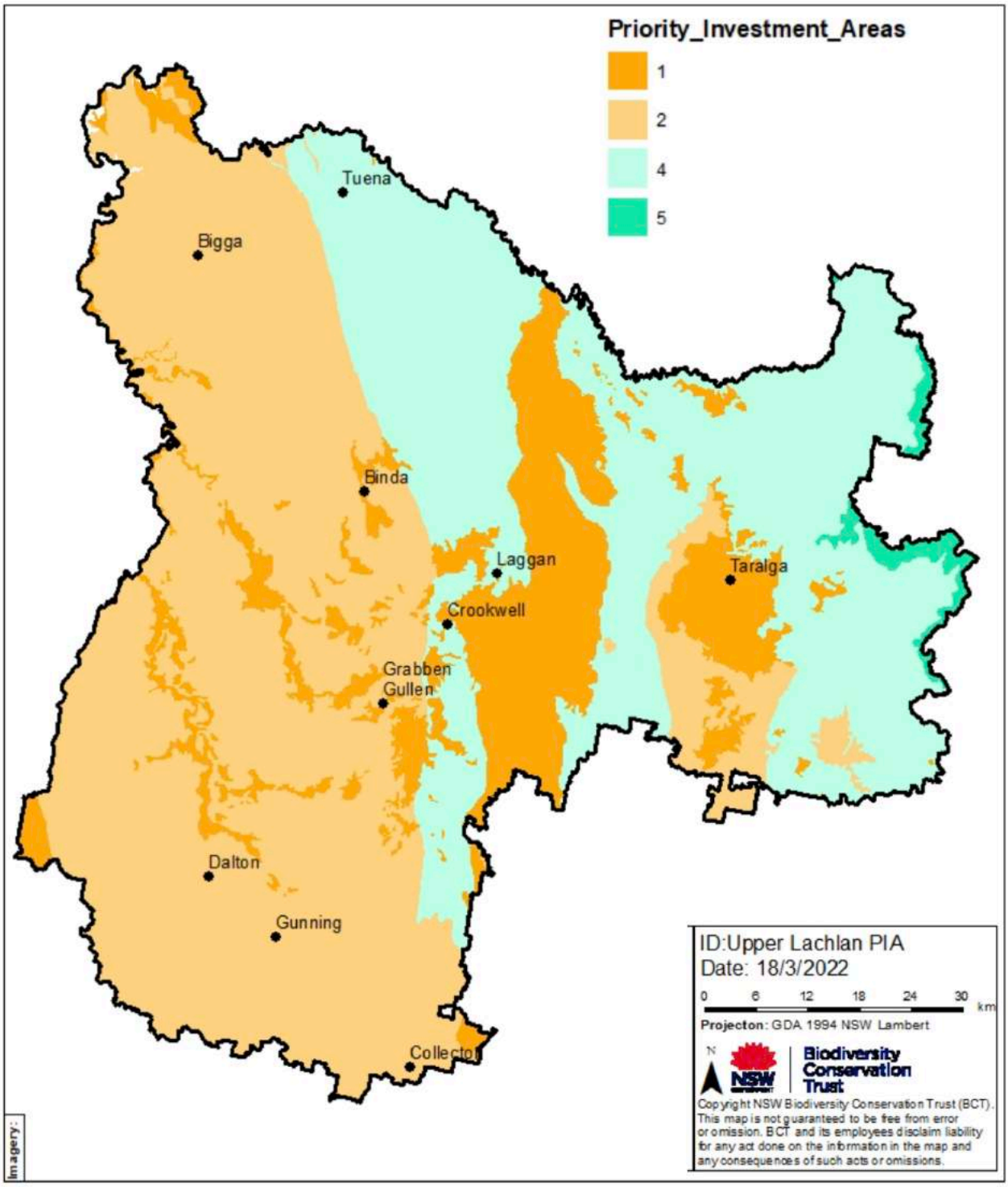

Figure 6.10. Distribution of priority investment areas within the Upper Lachlan LGA. High priority areas 1 and lower priority areas 5 (courtesy of NSW Biodiversity Conservation Trust)

The Biodiversity Conservation Trust invests in private land conservation in areas of greatest conservation benefits (OEH 2018). Priority 1 areas are in the sheep-wheat belt and in tableland areas where there has been extensive clearing, there is a relatively low proportion of land in the protected area system and where connectivity and resilience to climate change are critical to preventing further biodiversity loss (OEH 2018). These areas coincide with Box-Gum Grassy Woodland, Tableland Basalt Forest and Tablelands Snow Gum endangered ecological communities within the Shire. Priority 1 and 2 areas are factored into the final map of habitat connectivity priority areas.

7. Map of high priority habitat enhancement and connectivity values

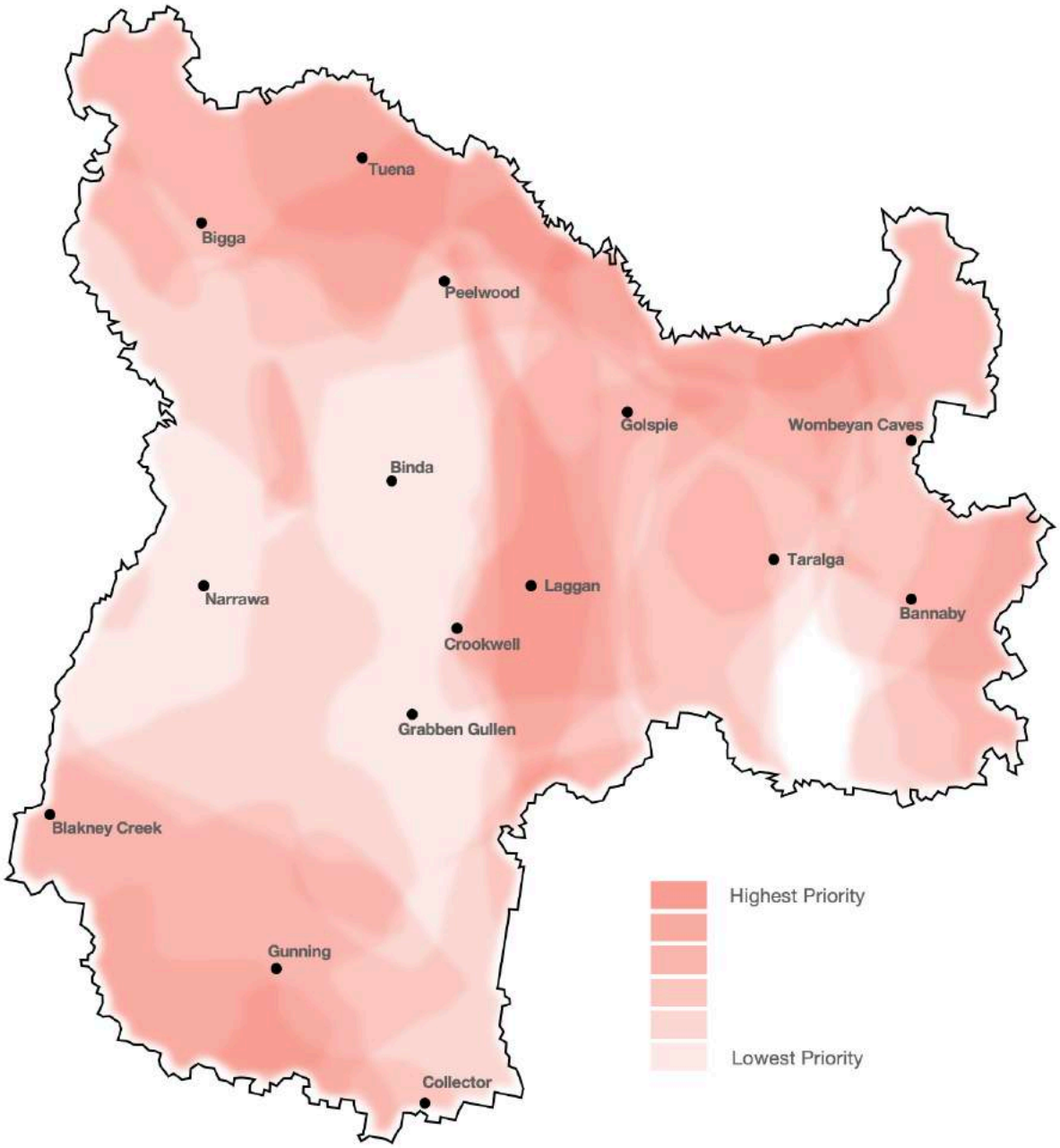

Figure 7. Overlapping distribution of all ten criteria used to identify relative priority for enhancing habitat connectivity within the UL LGA.

Figure 7 combines all of the priorities recognised in section 6 (maps 6.1 to 6.10). For the purpose of this assessment each criterion was given the same weight in producing the final map. The greater the overlap of these areas the higher the priority.

The following areas are recommended as high priority areas for habitat connectivity and enhancement works:

1. Crookwell-Laggan-Peelwood north-south band through the middle of the Shire.
2. Bigga to Wombeyan Caves north-northeast edge of the Shire.
3. Blakney Creek-Gunning-Collector southwest section of the Shire.

The area east of Bannaby is also a moderately high priority area, while the area through Grabben Gullen and Binda is a lower priority area.

8. Suggested habitat enhancement methods

Once an area for habitat restoration works has been identified and a landholder indicates a willingness to undertake a habitat enhancement and planting program, a plan for the proposed works needs to be developed. Each plan will need to take into consideration the size of existing remnants, existing habitat condition, degree of connectivity within the property and within the broader landscape, condition of areas to be restored, land-use and the landholder's property management plan. Each plan will need to match that particular property and so each plan could be very different from plans for other properties. The list of suggestions below describes the aspects that need to be considered when putting a plan together.

- Small patches of habitat generally have limited biodiversity as edge-effects thin the vegetation, allow loss of moisture, and support edge specialist fauna which often restrict habitat access for other species. A small area may also not contain enough habitat area to support some species. Increasing the size of remnant patches should be a very high priority.

- Building corridors between close patches is preferable to trying to connect distant patches. If there are only sufficient resources to plant a small area, then joining two close patches means that the connection can be broader and the two small patches can now become a much larger patch. In contrast, connecting two distant patches will mean that the corridor will be thin and will not function well for many faunal species.

- Ideally corridors should be planted to be at least 80 metres wide to cater for the movement of a wide diversity of faunal species. It will also then be wide enough to support populations of some species that can live within the corridor full-time. There is often concern that planting such a broad area will reduce the available land for agricultural use. However, once established these areas can be used for periodic short-term grazing and for sheltering livestock e.g. during sheep grazier alerts. These can also be placed in areas that will complement existing areas to increase their size to an 80 metre width without having to plant a large area and can also be placed in areas where grazing or cropping have very marginal returns. They may also be placed along riparian zones where grazing has impacted erosion and exclusion of livestock is desirable. It should also be pointed-out that in many cases, where up to 30% of a property's area has been restored as wildlife habitat, that there is also a corresponding increase in productivity for the remaining area because of improved shelter, better moisture retention and improved soil condition. On smaller holdings such wide corridors may not be practicable and each restoration plan will need to take all these factors into consideration.

- Restoration areas should be planted to produce diversity of structure so that it can cater for as many species as possible. Plant choice should include a mixture of trees, shrubs, forbs and grasses. The plant species choice should be as similar as possible to the closest Plant Community Type species on similar soils and aspect.

- Trees should be spaced to allow for their typical crown diameter so that they can develop a more natural shape, develop large limbs that diverge from the main trunk and then develop hollows that are suitable for hollow-nesting birds and roosting mammals. If trees are planted too close together the limbs stay thin and parallel to the trunk and they are less able to support the diversity of life that natural trees generally support. In addition, the ground underneath is unable to support grasses, forbs and shrubs as there is insufficient light and moisture available to them, and is often left bare with only leaf litter. Replanted habitat areas should be designed to contain a mosaic of different tree densities and open areas of grasses and shrubs. The varied structure is then able to support a greater diversity of wildlife.

- Where large open areas are to be left for farm production and connectivity planting is desirable, individual paddock trees or small plots are a useful compromise as they allow some wildlife to move through the landscape, provide some habitat and provide shelter for livestock. Paddock trees and plots should be about 50 metres apart to provide 'stepping stones' for species moving through the landscape. Small plots of around 20 m x 20 m can be planted to contain 2 to 3 tress and several shrubs. They will need to be fenced to exclude feral animals like rabbits which are likely to also use any plots. This is more expensive than planting individual trees with tree guards, but they will cater for a greater diversity of wildlife and the trees have better

protection for their roots from livestock causing soil compaction and fertiliser overload from faeces from resting animals. This affects existing paddock trees and will affect the long term health of planted paddock trees. Where stocking rates are low or cell grazing is practiced, and scattered paddock trees are numerous, the impacts of livestock can be spread over the site and thus paddock trees may be a better option under such conditions.

- Along with taking into consideration the enhancement of existing vegetation, a restoration plan will also need to consider any existing property management plan. For example, planting areas can also be positioned to provide more shelter for livestock. Suggested works should be prioritised and the plan should be flexible enough to allow for some choice as to which parts of the restoration work will be acceptable. A landholder can then choose which parts of the restoration plan to put into practice and can spread the work over a manageable time span.

- In addition, a restoration plan will also need to consider the location of any Aboriginal objects that are known to occur onsite or may be encountered during works. All Aboriginal places and objects are protected under the National Parks and Wildlife Act 1974 and it is an offence to knowingly destroy, damage or deface them without the prior consent of the Heritage NSW https://www.heritage.nsw.gov.au/ Known locations of such places and objects are stored in the Aboriginal Heritage Information Management System (AHIMS). AHIMS does not represent a comprehensive list of all Aboriginal objects or Aboriginal places in a specified area. A report lists recorded sites only. In any given area there may be a number of undiscovered and/or unrecorded Aboriginal objects. In the event that any Aboriginal objects are found where project work is occurring or planned to occur, work will cease immediately and you must contact the Local Aboriginal Land Council (LALC) or Local Land Services (LLS).

- A restoration plan will also need to account for additional fencing and ongoing control of weeds and feral animals.

9. Conclusions and recommendations

There is a high level of biodiversity within the Upper Lachlan Shire, despite the level of vegetation clearing for agriculture and that there is only a small proportion of remaining vegetation contained within the national reserve system. Much of the biodiversity is contained within small scattered remnants across private landholdings. It is well recognised that landholders are crucial for maintaining and enhancing biodiversity within the Shire. This is supported by the extensive planting of trees that has occurred within the Shire and the numerous conservation agreements that are in place across the Shire. Most of the Endangered Ecological Communities and their threatened faunal species are found as small remnant patches on private landholdings and it is these vegetation types that have been mostly cleared and which are not preserved within the national reserve system. These areas should be the focus of vegetation restoration work and hence they should have higher priority over other areas.

This Habitat Connectivity Priority Plan has brought together much of the environmental information currently available and has been used to provide an overall picture of the current state of the environment and biodiversity within the Shire. The Plan identifies high priority areas for habitat connectivity work.

The Plan provides land managers at all levels with the information that will allow them to target these areas for revegetation work. It is recognised that these high priority areas will not necessarily coincide with the areas of interest of local landholders and that work may be undertaken in lower priority areas if that is where there is a greater interest in revegetation work. However, where there are limited resources available and where there is the ability to target certain areas then the Plan can provide a guide to help with the selection of areas for revegetation work.

10. Acknowledgements

Most of the information that was used to prepare this Habitat Connectivity Plan came from a desktop search of the Atlas of Living Australia and DPIE's Sharing and Enabling Environmental

Data websites. However some of the information was more difficult to source and I would like to thank Alex Sherley from SE LLS GIS Unit for providing shape files for the locations of EECs and locations of BCT and LLS conservation agreements, Adam Hook from NSW BCT for the map of BCT PIAs shown in Figure 6.10, John Asquith from LfW for the locations of LfW agreements within the Shire and Danielle Murphy from NSW DPIE for links to information on vegetation types and related material.

I would also like to thank John Anderson, Ruth Aveyard, Sonya Duus, Glenda Flint, Janet Heffernan, Melissa Henry, Sam Morris, Sean Proudman and John Storey, as the steering committee for this project, for their support and helpful suggestions in preparing this report.

11. References

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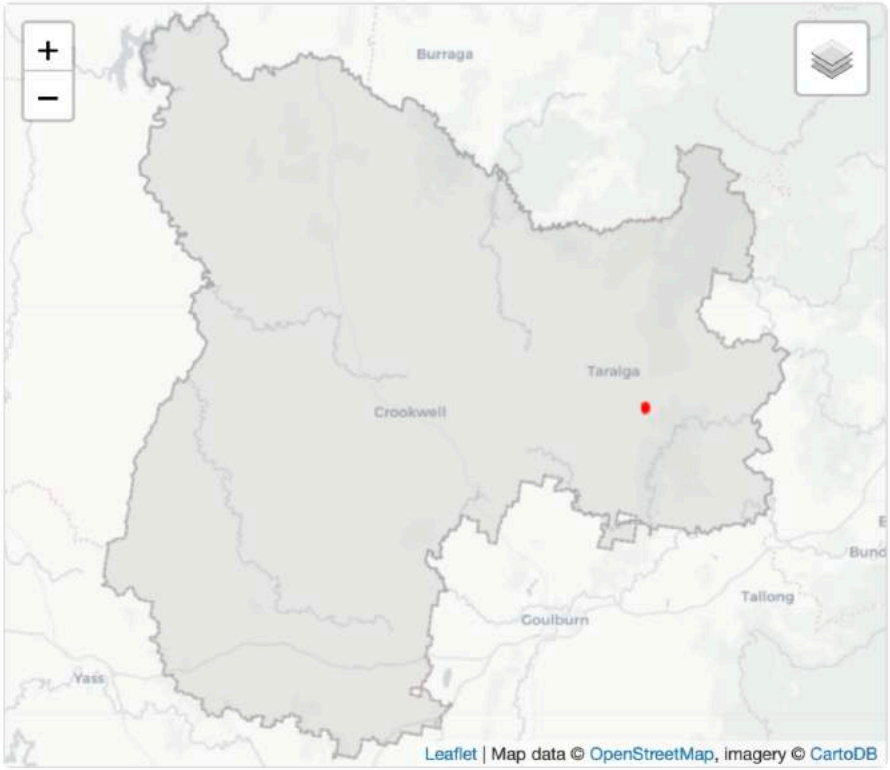
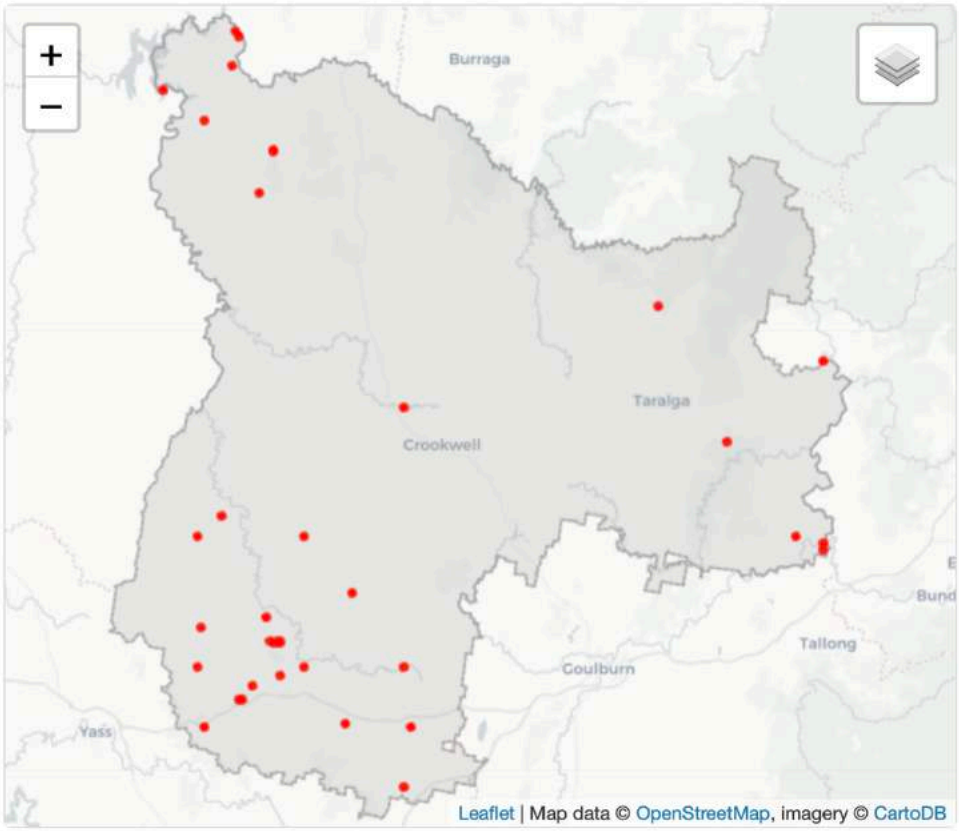
Appendix 1. Distribution of selected threatened faunal species within the Upper Lachlan LGA



Appendix 1.1. Distribution of records of Pink-tailed Worm-Lizard within the Upper Lachlan LGA (n=3).

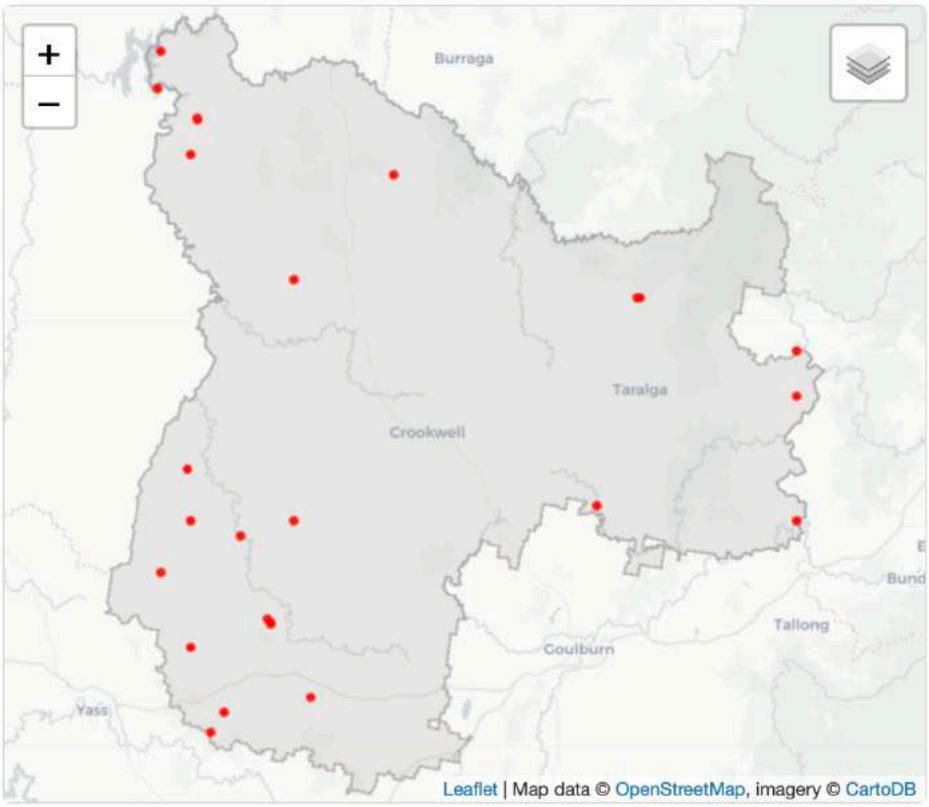
Year	Month	Day	Latitude	Longitude	Count	Source
2017	10	16	-34.454763418	149.879917223	1	BioNet Atlas of NSW Wildlife
2017	10	16	-34.452255598	149.880571016	1	BioNet Atlas of NSW Wildlife
2017	10	15	-34.454697089	149.877491525	1	BioNet Atlas of NSW Wildlife



Appendix 1.3. Distribution of records of Speckled Warbler within the Upper Lachlan LGA (n=55).

Year	Month	Day	Latitude	Longitude	Count	Source
1977	3	12	-34.91	149.41		Birds Australia
1978	9	3	-34.75	149.41		Birds Australia
1978	1	12	-34.91	149.41		Birds Australia
1978	4	9	-34.75	149.25		Birds Australia
1978	11	23	-34.75	149.08		Birds Australia
1978	8	13	-34.58	149.25		Birds Australia
1978	5	14	-34.58	149.08		Birds Australia
1979	3	28	-34.75	149.41		Birds Australia
1979	10	24	-34.75	149.41		Birds Australia
1980	12	15	-34.75	149.41		Birds Australia
1980	9	24	-34.75	149.41		Birds Australia
1980	7	9	-34.75	149.41		Birds Australia
1981	4	19	-34.41	149.41		Birds Australia
1981	11	18	-34.75	149.41		Birds Australia
1993	4	13	-34.455143714	149.928832941		BioNet Atlas of NSW Wildlife
1993	4	7	-34.653796612	149.327639485	2	BioNet Atlas of NSW Wildlife
2000	8	21	-34.70028	149.08780		Birds Australia
2001	3	15	-34.35139	150.07890		Birds Australia
2001	3	12	-34.55222	149.11830		Birds Australia
2001	9	22	-34.71778	149.21610		Birds Australia
2001	11	1	-34.70028	149.08780		Birds Australia
2001	6	16	-34.72000	149.21110		Birds Australia
2001	2	24	-34.71972	149.20170		Birds Australia
2001	2	22	-34.70028	149.08780		Birds Australia

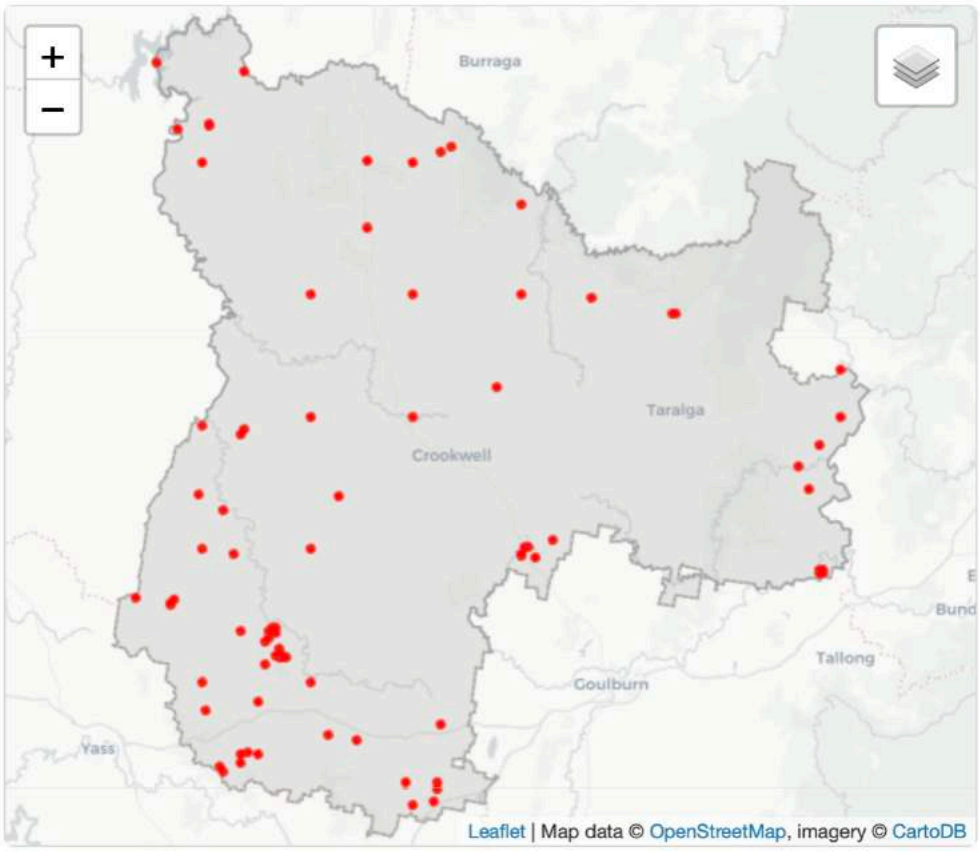
2003	10	10	-34.71833	149.19750		Birds Australia
2004	1	27	-34.03111	149.09250		Birds Australia
2006	3	25	-34.72055	149.20890		Birds Australia
2006	12	27	-34.03111	149.09250		Birds Australia
2007	11	11	-34.76083	149.21610		Birds Australia
2007	11	10	-34.71833	149.20940		Birds Australia
2008	9	17	-34.27611	149.81780		Birds Australia
2008	6	14	-34.71833	149.20940		Birds Australia
2008	3	27	-34.072251002	149.204893533	2	BioNet Atlas of NSW Wildlife
2008	3	27	-34.070381812	149.20397799	1	BioNet Atlas of NSW Wildlife
2009	4	1	-34.686002133	149.192839067	1	BioNet Atlas of NSW Wildlife
2011	10	4	-34.776604	149.17189		eBird Australia
2011	4	6	-34.83139038	149.0902863		Birds Australia
2012	11	26	-33.91416931	149.1447144		Birds Australia
2012	11	2	-34.03221893	149.0950012		Birds Australia
2012	10	6	-34.82395	149.32058	1	BioNet Atlas of NSW Wildlife
2013	6	22	-34.03221893	149.0950012		Birds Australia
2013	10	18	-34.12728	149.17967	1	BioNet Atlas of NSW Wildlife
2014	4	1	-34.79616	149.154	3	BioNet Atlas of NSW Wildlife
2014	4	1	-34.79594	149.14649	3	BioNet Atlas of NSW Wildlife
2015	4	19	-34.58139	150.03810	1	Birds Australia
2018	3	17	-34.596947	150.0813	1	eBird Australia
2018	3	17	-34.596825	150.08127	2	eBird Australia
2018	9	26	-34.596825	150.08127	2	eBird Australia
2018	3	17	-34.59642	150.08276	2	Birds Australia
2019	10	10	-34.58911	150.08374	1	eBird Australia
2020	8	21	-33.989944	149.02632	2	eBird Australia
2020	9	17	-33.919437	149.14772	2	eBird Australia
2020	12	8	-33.956673	149.13782	2	eBird Australia
2020	7	17	-34.83014	149.42397	4	BioNet Atlas of NSW Wildlife
2020	7	22	-34.83014	149.42397	2	BioNet Atlas of NSW Wildlife
2009	11	12	[illegible]	[illegible]		[illegible]
2010	3	5	-33.956163	149.32486		BioNet Atlas of NSW Wildlife
2011	10	31	-34.71763155	149.031531561		BioNet Atlas of NSW Wildlife
2011	5	23	-34.625263099	149.467027655	2	BioNet Atlas of NSW Wildlife
2012	10	10	-34.12728	149.17967	2	BioNet Atlas of NSW Wildlife
2012	10	10	-34.13256	149.17921	2	BioNet Atlas of NSW Wildlife
2012	10	10	-34.11937	149.18541	1	BioNet Atlas of NSW Wildlife
2013	10	18	-34.12728	149.17967	1	BioNet Atlas of NSW Wildlife
2015	10	28	-33.987046468	149.31047919		BioNet Atlas of NSW Wildlife
2017	12	22	-34.562294	149.427254	1	BioNet Atlas of NSW Wildlife
2017	12	21	-34.54313	149.39435		BioNet Atlas of NSW Wildlife
2020	7	17	-34.85628	149.43154	1	BioNet Atlas of NSW Wildlife



Appendix 1.4. Distribution of records of Hooded Robin within the Upper Lachlan LGA (n=56).

Year	Month	Day	Latitude	Longitude	Count	Source
1976	4	14	-34.56	149.75		Birds Australia
1977	9	4	-34.6	149.1667		CSIRO
1978	5	14	-34.58	149.08		Birds Australia
1978	8	6	-34.75	149.08		Birds Australia
1978	10	29	-34.58	149.08		Birds Australia
1978	5	21	-34.75	149.08		Birds Australia
1978	8	13	-34.58	149.25		Birds Australia
1979	3	26	-34.25	149.25		Birds Australia
1979	7	21	-34.41	150.08		Birds Australia
1979	4	16	-34.08	149.08		Birds Australia
1979	3	25	-34.41	150.08		Birds Australia
1979	4	21	-34.41	150.08		Birds Australia
1981	6	6	-34.58	150.08		Birds Australia
1981	6	6	-34.58	150.08		Birds Australia
1992	4	17	-34.648438966	149.034528022		BioNet Atlas of NSW Wildlife
1999	4	25	-34.83861	149.13530		Birds Australia
2000	11	4	-34.81917	149.28140		Birds Australia
2001	9	22	-34.71778	149.21610		Birds Australia
2001	6	30	-34.81916	149.28140		Birds Australia
2001	3	15	-34.35139	150.07890		Birds Australia
2001	6	16	-34.72000	149.21110		Birds Australia
2001	3	28	-34.81916	149.28140		Birds Australia
2001	2	25	-34.50917	149.07580		Birds Australia

2003	12	14	-34.03111	149.09250		Birds Australia
2003	6	26	-34.03111	149.09250		Birds Australia
2003	5	27	-34.03472	149.09450		Birds Australia
2003	7	12	-34.03111	149.09250		Birds Australia
2003	9	28	-34.03111	149.09250		Birds Australia
2003	4	22	-34.03111	149.09250		Birds Australia
2003	10	1	-34.03111	149.09250		Birds Australia
2003	10	28	-34.03111	149.09250		Birds Australia
2003	4	12	-34.03111	149.09250		Birds Australia
2003	8	12	-34.03111	149.09250		Birds Australia
2004	9	1	-34.03111	149.09250		Birds Australia
2004	7	2	-34.03111	149.09250		Birds Australia
2004	3	5	-34.03111	149.09250		Birds Australia
2004	11	5	-34.03111	149.09250		Birds Australia
2005	11	11	-34.03111	149.09250		Birds Australia
2005	12	1	-34.03111	149.09250		Birds Australia
2005	5	16	-34.03111	149.09250		Birds Australia
2006	12	27	-34.03111	149.09250		Birds Australia
2006	11	10	-34.03111	149.09250		Birds Australia
2007	1	10	-34.03111	149.09250		Birds Australia
2007	4	7	-34.03111	149.09250		Birds Australia
2007	7	1	-34.86611	149.11440		Birds Australia
2008	9	17	-34.27611	149.81780		Birds Australia
2008	3	1	-34.86611	149.11440		Birds Australia
2008	9	17	-34.27583	149.82310		Birds Australia
2008	9	1	-34.86611	149.11440		Birds Australia
2009	4	1	-34.86611	149.11440		Birds Australia
2010	1	16	-34.10957903	149.417038647	1	BioNet Atlas of NSW Wildlife
2011	4	1	-34.86611176	149.1144409		Birds Australia
2012	10	5	-34.71252	149.20703	1	BioNet Atlas of NSW Wildlife
2018	12	4	-34.839972452	149.136906588	1	BioNet Atlas of NSW Wildlife
2020	8	21	-33.989944	149.02632	2	eBird Australia
2020	8	21	-33.94214	149.0328	1	eBird Australia



Appendix 1.5. Distribution of Diamond Firetail within the Upper Lachlan LGA (n=194).

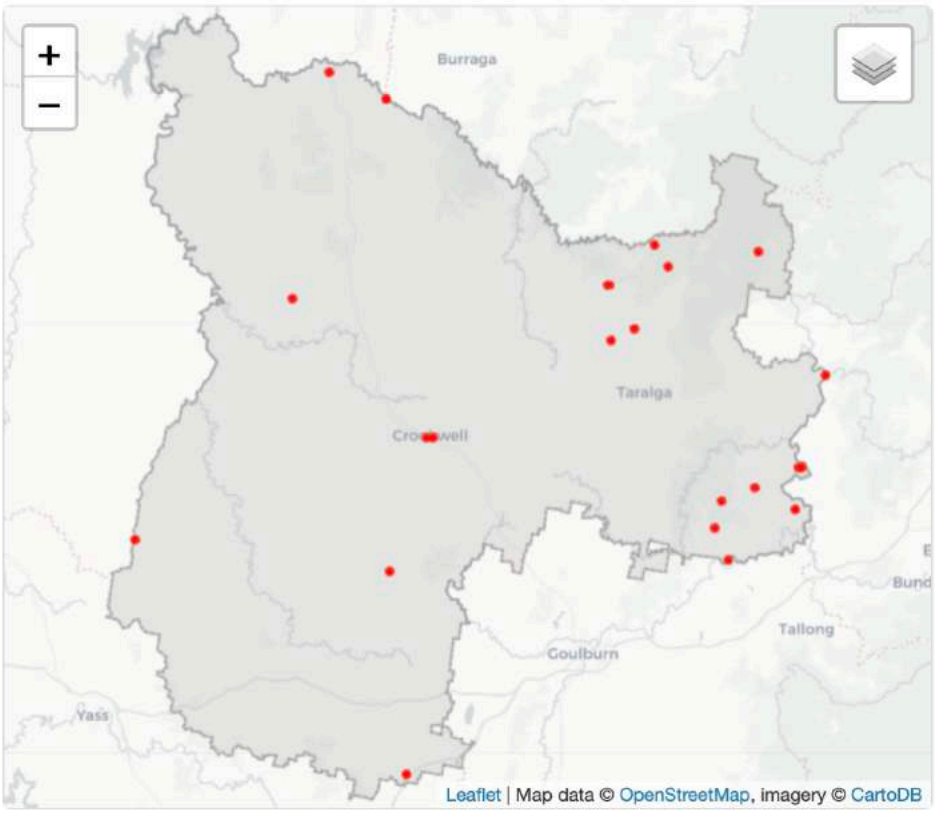
Year	Month	Day	Latitude	Longitude	Count	Source
1978	4	9	-34.75	149.25		Birds Australia
1978	3	13	-34.91	149.41		Birds Australia
1978	12	30	-34.41	150.08		Birds Australia
1978	8	13	-34.58	149.25		Birds Australia
1978	5	21	-34.75	149.08		Birds Australia
1978	5	14	-34.58	149.08		Birds Australia
1978	8	6	-34.75	149.08		Birds Australia
1979	3	26	-34.25	149.25		Birds Australia
1979	3	25	-34.08	149.08		Birds Australia
1979	4	16	-34.08	149.08		Birds Australia
1979	1	13	-34.08	149.41		Birds Australia
1979	1	13	-34.41	149.25		Birds Australia
1979	1	14	-34.41	150.08		Birds Australia
1979	1	13	-34.25	149.41		Birds Australia
1979	1	13	-34.25	149.58		Birds Australia
1981	4	19	-34.41	149.41		Birds Australia
1992	4	17	-34.648438966	149.034528022		BioNet Atlas of NSW Wildlife
1998	2	14	-34.511655847	149.294426023	4	BioNet Atlas of NSW Wildlife
1998	2	14	-34.785491488	149.086498524	1	BioNet Atlas of NSW Wildlife
1999	12	2	-34.37333	149.54440		Birds Australia

2001	6	30	-34.81916	149.28140		Birds Australia
2001	6	16	-34.72000	149.21110		Birds Australia
2001	12	10	-34.35139	150.07890		Birds Australia
2001	6	27	-34.81916	149.28140		Birds Australia
2001	12	3	-34.35139	150.07890		Birds Australia
2001	3	15	-34.35139	150.07890		Birds Australia
2001	2	25	-34.53028	149.11220		Birds Australia
2001	2	25	-34.58583	149.13030		Birds Australia
2001	2	25	-34.50917	149.07580		Birds Australia
2001	2	25	-34.42139	149.07920		Birds Australia
2001	2	24	-34.71972	149.20170		Birds Australia
2003	3	16	-34.03111	149.09250		Birds Australia
2003	10	10	-34.71833	149.19750		Birds Australia
2003	7	14	-33.95111	149.01080		Birds Australia
2003	9	28	-34.03111	149.09250		Birds Australia
2003	4	22	-34.03111	149.09250		Birds Australia
2003	4	12	-34.03111	149.09250		Birds Australia
2003	7	12	-34.03111	149.09250		Birds Australia
2003	8	12	-34.03111	149.09250		Birds Australia
2003	5	27	-34.03472	149.09450		Birds Australia
2004	1	27	-34.03111	149.09250		Birds Australia
2004	2	22	-34.58805	149.57880		Birds Australia
2005	5	16	-34.03111	149.09250		Birds Australia
2005	4	20	-34.646374528	149.039910523	3	BioNet Atlas of NSW Wildlife
2005	4	20	-34.685797882	149.142022797	7	BioNet Atlas of NSW Wildlife
2005	7	4	-34.569922655	149.631204578	1	BioNet Atlas of NSW Wildlife
2005	8	7	-34.472989824	150.014319065	2	BioNet Atlas of NSW Wildlife
2006	12	27	-34.03111	149.09250		Birds Australia
2006	9	15	-34.72055	149.20890		Birds Australia
2006	3	25	-34.72055	149.20890		Birds Australia
2006	7	1	-34.86611	149.11440		Birds Australia
2006	12	1	-34.86611	149.11440		Birds Australia
2006	8	1	-34.86611	149.11440		Birds Australia
2006	4	17	-34.03111	149.09250		Birds Australia
2006	11	1	-34.86611	149.11440		Birds Australia
2006	1	31	-34.07889	149.34190		Birds Australia
2006	11	10	-34.03111	149.09250		Birds Australia
2006	1	17	-34.165370725	149.338428321	2	BioNet Atlas of NSW Wildlife
2006	10	4	-34.611827753	150.050423374		BioNet Atlas of NSW Wildlife
2007	3	8	-34.13539	149.584		eBird Australia
2007	3	1	-34.86611	149.11440		Birds Australia
2007	12	1	-34.86611	149.11440		Birds Australia
2007	1	1	-34.86611	149.11440		Birds Australia
2007	7	1	-34.86611	149.11440		Birds Australia
2007	10	1	-34.86611	149.11440		Birds Australia
2007	1	10	-34.03111	149.09250		Birds Australia
2007	10	20	-34.03111	149.09250		Birds Australia
2007	11	1	-34.86611	149.11440		Birds Australia
2007	5	1	-34.86611	149.11440		Birds Australia
2007	2	1	-34.86611	149.11440		Birds Australia

2008	9	17	-34.27583	149.82310		Birds Australia
2008	9	17	-34.27611	149.81780		Birds Australia
2008	5	14	-34.71833	149.20940		Birds Australia
2008	12	1	-34.86611	149.11440		Birds Australia
2008	1	1	-34.86611	149.11440		Birds Australia
2008	3	1	-34.86611	149.11440		Birds Australia
2008	7	1	-34.86611	149.11440		Birds Australia
2008	9	1	-34.86611	149.11440		Birds Australia
2008	4	1	-34.86611	149.11440		Birds Australia
2008	11	9	-34.03833	149.04111		Birds Australia
2008	8	1	-34.86611	149.11440		Birds Australia
2008	12	2	-34.609561783	150.05402437	9	BioNet Atlas of NSW Wildlife
2008	12	2	-34.608318195	150.052971516	1	BioNet Atlas of NSW Wildlife
2008	12	2	-34.608318195	150.052971516	1	BioNet Atlas of NSW Wildlife
2008	12	2	-34.608993419	150.050560671	1	BioNet Atlas of NSW Wildlife
2008	12	2	-34.609729828	150.054283768	5	BioNet Atlas of NSW Wildlife
2008	12	2	-34.608993419	150.050560671	1	BioNet Atlas of NSW Wildlife
2008	12	2	-34.609729828	150.054283768	5	BioNet Atlas of NSW Wildlife
2008	12	2	-34.609561783	150.05402437	9	BioNet Atlas of NSW Wildlife
2009	12	1	-34.86611	149.11440		Birds Australia
2009	3	1	-34.86611	149.11440		Birds Australia
2009	1	1	-34.86611	149.11440		Birds Australia
2009	8	1	-34.86611	149.11440		Birds Australia
2009	11	1	-34.86611	149.11440		Birds Australia
2009	11	12	-34.880259951	149.398643655		BioNet Atlas of NSW Wildlife
2009	11	10	-34.257118598	149.691007897		BioNet Atlas of NSW Wildlife
2010	12	1	-34.86	149.11		Birds Australia
2010	9	1	-34.86	149.11		Birds Australia
2010	6	1	-34.86	149.11		Birds Australia
2010	3	1	-34.86611	149.11440		Birds Australia
2010	10	1	-34.86	149.11		Birds Australia
2010	11	1	-34.86	149.11		Birds Australia
2010	4	1	-34.86	149.11		Birds Australia
2010	1	1	-34.86611	149.11440		Birds Australia
2010	8	1	-34.86	149.11		Birds Australia
2010	2	20	-34.86611	149.11440		Birds Australia
2010	5	1	-34.86	149.11		Birds Australia
2011	12	20	-34.57909	149.58606		eBird Australia
2011	10	4	-34.776604	149.17189		eBird Australia
2011	9	1	-34.86611	149.11444		Birds Australia
2011	6	1	-34.86611176	149.1144409		Birds Australia
2011	3	1	-34.86611176	149.1144409		Birds Australia
2011	4	1	-34.86611176	149.1144409		Birds Australia
2011	10	1	-34.86611	149.11444		Birds Australia
2011	2	1	-34.86611176	149.1144409		Birds Australia
2011	11	1	-34.86611	149.11444		Birds Australia
2011	8	1	-34.86611	149.11444		Birds Australia
2011	5	1	-34.86611176	149.1144409		Birds Australia
2011	1	1	-34.86	149.11		Birds Australia
2011	10	31	-34.643877596	148.976929503		BioNet Atlas of NSW Wildlife

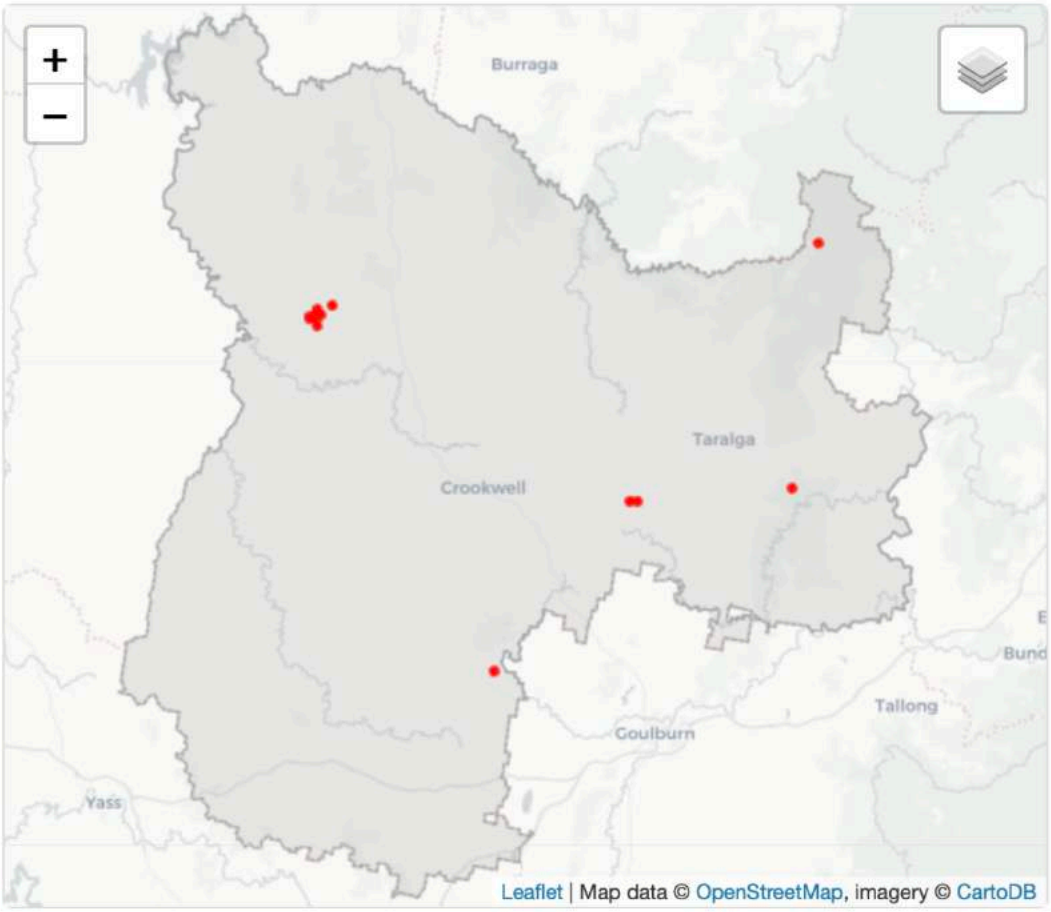
2011	4	14	-34.446556	150.050926	1	BioNet Atlas of NSW Wildlife
2011	1	11	-34.504421094	150.031166936	1	BioNet Atlas of NSW Wildlife
2011	6	21	-34.695320067	149.184314932	1	BioNet Atlas of NSW Wildlife
2011	11	3	-34.681852	149.194937	1	BioNet Atlas of NSW Wildlife
2011	6	6	-34.687620293	149.197419246	10	BioNet Atlas of NSW Wildlife
2011	2	21	-34.685923818	149.183647138	1	BioNet Atlas of NSW Wildlife
2011	2	21	-34.68350989	149.193559134	1	BioNet Atlas of NSW Wildlife
2011	2	21	-34.699642176	149.18333083	1	BioNet Atlas of NSW Wildlife
2012	3	29	-34.57909	149.58606	1	eBird Australia
2012	1	21	-34.57909	149.58606		eBird Australia
2012	6	29	-34.75	149.25	1	eBird Australia
2012	4	19	-34.42748	149.14857		eBird Australia
2012	4	19	-34.43278	149.14030	4	Birds Australia
2012	10	2	-34.70925	149.20187	1	BioNet Atlas of NSW Wildlife
2013	10	25	-34.57909	149.58606		eBird Australia
2013	8	31	-34.880728	149.451942	1	BioNet Atlas of NSW Wildlife
2014	3	17	-34.57909	149.58606	3	eBird Australia
2014	3	23	-34.57909	149.58606	6	eBird Australia
2014	8	16	-34.80659	149.456	1	eBird Australia
2014	11	7	-34.82612	149.32144	1	BioNet Atlas of NSW Wildlife
2015	3	19	-34.903954	149.44177	1	eBird Australia
2015	1	22	-34.903954	149.44177	2	eBird Australia
2015	9	22	-34.57909	149.58606	1	eBird Australia
2015	1	22	-34.903954	149.44177	2	eBird Australia
2015	10	29	-34.80659	149.456	1	eBird Australia
2015	2	21	-34.903954	149.44177	4	eBird Australia
2015	5	27	-34.80659	149.456	8	eBird Australia
2015	12	5	-34.653454297	149.034360758	1	BioNet Atlas of NSW Wildlife
2016	6	13	-34.88938	149.4496	6	eBird Australia
2016	12	5	-34.57808	149.59328	1	eBird Australia
2016	9	4	-34.80659	149.456	5	eBird Australia
2016	12	5	-34.57808	149.59328	1	eBird Australia
2016	9	24	-34.903954	149.44177	2	eBird Australia
2016	2	9	-34.57909	149.58606	3	eBird Australia
2016	3	28	-34.42748	149.14857	4	eBird Australia
2016	2	9	-34.57909	149.58606	3	eBird Australia
2016	10	5	-34.80659	149.456	2	eBird Australia
2017	6	4	-34.88938	149.4496	3	eBird Australia
2017	10	17	-34.57909	149.58606	2	eBird Australia
2017	8	13	-34.80659	149.456	4	eBird Australia
2017	10	23	-34.58606	149.58189	1	Birds Australia
2018	6	29	-34.80659	149.456	2	eBird Australia
2018	8	26	-34.59132	149.604	12	eBird Australia
2018	8	26	-34.57808	149.59328	2	eBird Australia
2018	8	17	-34.59132	149.604	6	eBird Australia
2018	8	10	-34.59132	149.604	8	eBird Australia
2018	11	2	-34.845224981	149.142739793	2	BioNet Atlas of NSW Wildlife
2019	9	9	-34.57909	149.58606	6	eBird Australia
2019	3	21	-34.57909	149.58606	12	eBird Australia

2019	11	6	-34.903954	149.44177	1	eBird Australia
2019	4	16	-34.42748	149.14857	6	eBird Australia
2019	4	27	-34.42748	149.14857	6	eBird Australia
2019	2	6	-34.42748	149.14857	3	eBird Australia
2020	12	14	-34.903954	149.44177	1	eBird Australia
2020	12	16	-34.57909	149.58606	1	eBird Australia
2020	12	14	-34.903954	149.44177	1	eBird Australia
2020	10	16	-34.57909	149.58606	2	eBird Australia
2020	9	23	-34.57909	149.58606	1	eBird Australia
2020	12	1	-34.57909	149.58606	2	eBird Australia
2020	3	7	-34.57909	149.58606	1	eBird Australia
2020	12	10	-33.96356	149.14894	2	eBird Australia
2020	7	16	-34.57909	149.58606	1	eBird Australia
2020	12	12	-34.57909	149.58606	1	eBird Australia
2020	12	3	-34.57909	149.58606	1	eBird Australia
2020	7	17	-34.844	149.17	1	eBird Australia
2020	8	3	-34.855003	149.14053	10	eBird Australia
2020	7	17	-34.844	149.17	1	eBird Australia
2020	8	15	-34.841167	149.1521	1	eBird Australia
2020	8	3	-34.855003	149.14053	10	eBird Australia
2020	8	3	-34.855003	149.14053	10	eBird Australia
2020	1	13	-34.729446	149.17987	1	eBird Australia
2020	8	15	-34.841167	149.1521	1	eBird Australia
2021	3	13	-34.066235	149.4545216667		Atlas of Living Australia
2021	3	9	-34.0626433333	149.472155		Atlas of Living Australia



Appendix 1.6. Distribution of Koala Records within Upper Lachlan LGA (n=25).

Year	Month	Day	Latitude	Longitude	Count	Source
1948	1	1	-34.005087647	149.399638249		BioNet Atlas of NSW Wildlife
1964	8	9	-34.9167	149.4333		Mammals
1967	9	20	-34.645042236	149.407026703	1	BioNet Atlas of NSW Wildlife
1967	9	20	-34.645042236	149.407026703		BioNet Atlas of NSW Wildlife
1976	2	24	-34.463538796	149.467110866		BioNet Atlas of NSW Wildlife
1976	2	24	-34.463318652	149.477988907		BioNet Atlas of NSW Wildlife
1980	1	1	-34.31379635	149.804826833		BioNet Atlas of NSW Wildlife
1980	1	1	-34.600995405	148.988668485		BioNet Atlas of NSW Wildlife
1980	1	1	-34.257165519	149.764375921	1	BioNet Atlas of NSW Wildlife
1985	1	1	-34.330900498	149.767490684		BioNet Atlas of NSW Wildlife
2003	11	20	-34.376795225	150.122239317	1	BioNet Atlas of NSW Wildlife
2004	7	1	-34.627657501	149.958882903		BioNet Atlas of NSW Wildlife
2004	7	1	-33.969371512	149.307993732	1	BioNet Atlas of NSW Wildlife
2011	4	18	-34.201516956	149.840283752	1	BioNet Atlas of NSW Wildlife
2011	3	22	-34.55985	150.072804	1	BioNet Atlas of NSW Wildlife
2011	5	20	-34.232704466	149.864004233	1	BioNet Atlas of NSW Wildlife
2013	10	20	-34.583675237	149.938103339	2	BioNet Atlas of NSW Wildlife
2014	5	11	-34.208850022	150.011179978		BioNet Atlas of NSW Wildlife
2014	5	11	-34.208850022	150.011179978		BioNet Atlas of NSW Wildlife
2014	7	28	-34.503599615	150.076307603		BioNet Atlas of NSW Wildlife
2014	5	10	-34.503858961	150.078857278	1	BioNet Atlas of NSW Wildlife
2014	5	11	-34.208850022	150.011179978		BioNet Atlas of NSW Wildlife
2015	3	25	-34.53226	150.00397		BioNet Atlas of NSW Wildlife
2016	8	17	-34.547949512	149.947576106	1	BioNet Atlas of NSW Wildlife
2017	12	15	-34.273497148	149.247074166	1	BioNet Atlas of NSW Wildlife



Appendix 1.7. Distribution of Squirrel Glider within the Upper Lachlan LGA (n=14).

Year	Month	Day	Latitude	Longitude	Count	Source
1993	4	13	-34.460227501	149.92356936	1	BioNet Atlas of NSW Wildlife
2002	4	20	-34.166194085	149.963118561		BioNet Atlas of NSW Wildlife
2007	3	29	-34.680686042	149.486118916	1	BioNet Atlas of NSW Wildlife
2008	1	26	-34.477186964	149.687649819	1	BioNet Atlas of NSW Wildlife
2008	2	1	-34.476728463	149.69610253	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.252317071	149.231832374	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.256620788	149.229484485	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.263680244	149.230727442	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.254548813	149.221448012	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.251651927	149.236961356	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.245988811	149.232718359	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.240629223	149.251715285	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.256678036	149.220970857	1	BioNet Atlas of NSW Wildlife
2017	3	28	-34.249105461	149.232233953	1	BioNet Atlas of NSW Wildlife