Northern Rivers

Regional Koala Conservation Strategy
Protect – Restore – Create

Strategy March 2023

Photo: Byron Shire Council

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Acknowledgment of Country

We acknowledge the Traditional Custodians of the Northern Rivers region. We recognise their continuing connection to the land and waters and acknowledge their long history of caring for and managing the land, its plants, and animals. We pay our respects to Elders past and present and extend that respect to all Indigenous Australians. We acknowledge the koala or boorabi, burabi, boodahbee as an important cultural feature of the northern New South Wales landscape and aspire to include Aboriginal cultural knowledge in all aspects of koala conservation and management.

Acknowledgments

Thank you to the wonderful Steering Committee and the hard work that was completed by the Regional Working Group in the previous decade and ongoing. Funding for the development of the Strategy was provided by the NSW Government's Koala Strategy.

Earthscapes Consulting worked with all stakeholders to deliver this document and the associated mapping.

Why a Regional Strategy and what does it do?

The Northern Rivers Regional Koala Conservation Strategy (hereafter referred to as the Regional Strategy) guides actions and investment on a regional scale. The Regional Strategy fills the gap between the NSW Koala Strategy, LGA Comprehensive Koala Plans of Management (CKPoM), and local site-specific management plans.

What the Strategy does not do

The Regional Strategy is not intended to operate at a local level or define specific local projects. All sites are different, and it is best practice to engage qualified professionals with local knowledge to deliver meaningful and effective koala projects.

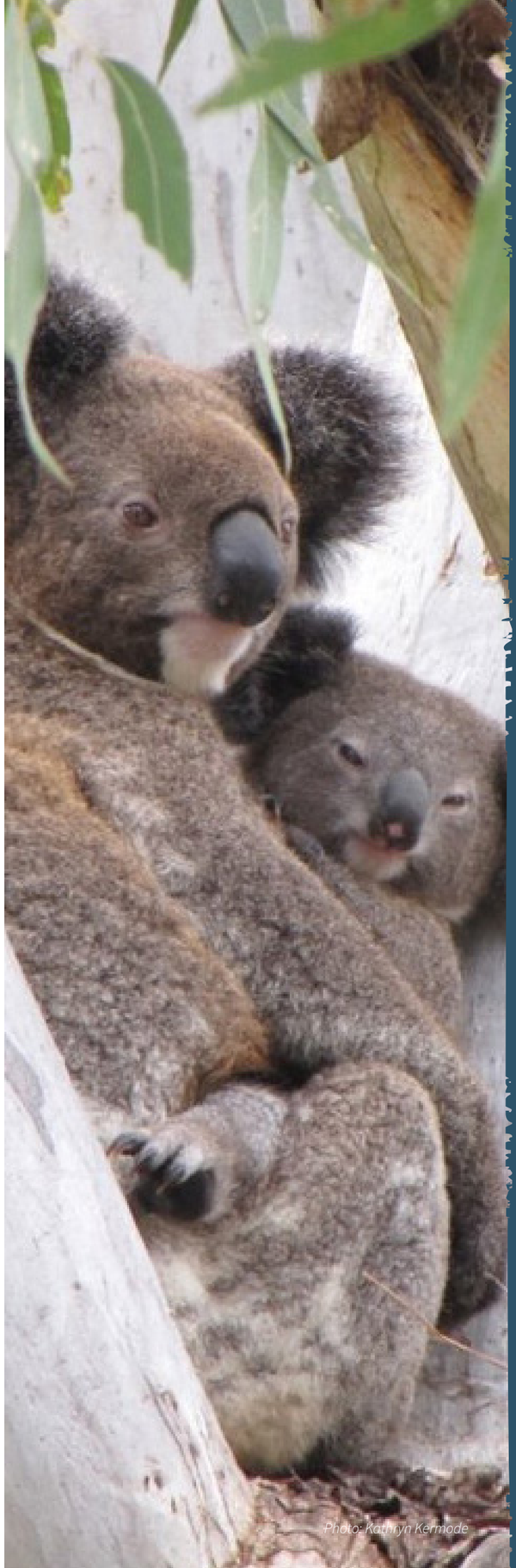


Photo: Kathryn Kermode

Structure of this strategy

The Regional Strategy has been divided into three sections to allow for the updating of the strategy over time.

PART 1

The Regional Strategy is a resource for land management practitioners working with koalas and in habitat restoration. It has the important links to detailed information and reasons for action. This section also contains the links to the Northern Rivers Koala Habitat Strategic Map and can be updated through an adaptive framework over time.

PART 2

Actions and Implementation Table lists the priority actions for the implementation of the Regional Strategy. This section provides support for all grant writers, educators, managers, and actions for the Northern Rivers Koala Network (NRKN).

PART 3

Foundations of the Strategy provides details of the many decades of research and work that provide the scientific basis for this Strategy.

Part 1 – The Regional Strategy

1.0 Introduction and background

The Northern Rivers Regional Koala Conservation Strategy was developed for the conservation of Koalas (*Phascolarctos cinereus*) and their habitat on the Far North Coast of New South Wales (NSW). The Northern Rivers region includes Tweed, Byron, Ballina, Lismore, Kyogle, and Richmond Valley local government areas and is all in the lands of the Bundjalung nation.

Figure 1: The Northern Rivers region with local government area boundaries (Source NPWS and LGA's).

Photo: Friends of the Koala

Area included in

- CKPOMs = 64,429 ha = 6.25% of the region
- Total area = 1,030,143 ha
- Area not covered byCKPOMs = 1,021,683 ha = 93.75%

Dry Sclerophyll Forest Photo: Andy Baker

In 2020, a NSW Parliamentary Committee found that:

- Given the scale of loss to koala populations across New South Wales as a result of the 2019- 2020 bushfires and without urgent government intervention to protect habitat and address all other threats, the koala will become extinct in New South Wales before 2050.
- Logging in public native forests in New South Wales has had cumulative impacts on koalas over many years because it has reduced the maturity, size and availability of preferred food and shelter trees.
- The fragmentation and loss of habitat poses the most serious threat to koala populations in New South Wales.
- The future of koalas in the wild in New South Wales cannot be guaranteed unless the NSW Government takes stronger action to prevent further loss of koala habitat.
- Climate change is having a severe impact on koala populations by affecting the quality of their food and habitat.
- Climate change is compounding the severity and impact of other threats, such as drought and bushfires, on koala populations.
- Local koala populations face different threats of varying severity, depending on the region that they are located in.

Koala populations and habitat in New South Wales click here

Figure 2 shows the National and State picture, what is now needed are local plans, such as this Regional Strategy for the Northern Rivers.

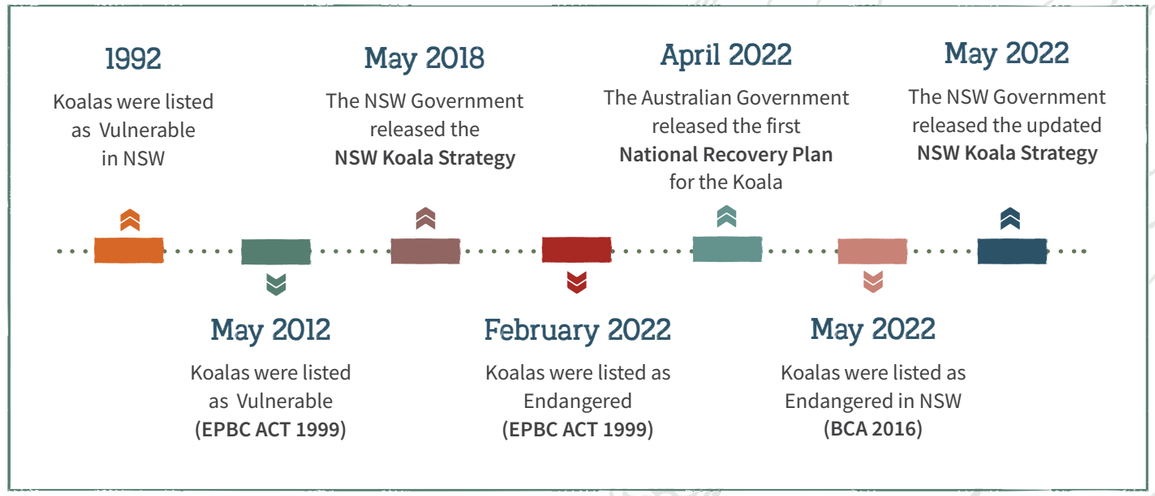


Figure 2: Timeline of changes in government legislation relating to koalas

This Regional Strategy was initiated following a four-year collaborative study led by a research team from the University of Queensland in partnership with Councils, FOK, and other Universities. That study was called "Conserving and recovering the koala population on the NSW Far North Coast" and was supported by ARC Linkage funding. The study focused on the Tweed, Byron, Ballina, and Lismore LGAs.

The ARC Linkage Project has confirmed that the Northern Rivers region of NSW continues to support a largely healthy and comparatively stable koala population and that there is strong community support for measures to conserve and recover this population.

The Regional Strategy is designed to guide habitat restoration and koala management across the Northern Rivers.

1.1 The people behind the Strategy

The Regional Strategy has been developed through a collaborative partnership of six regional councils (Byron, Ballina, Kyogle, Lismore, Richmond Valley, and Tweed) and Friends of the Koala (FOK), supported by the NSW Government. Facilitating this partnership and the delivery of the Regional Strategy is the Regional Koala Officer, a position which is hosted by FOK and supported by the Department of Planning and Environment (DPE).

The Regional Strategy partnership exists within a wide network of agencies, community organisations, Traditional Owners, and practitioners which have important and well-established roles and responsibilities for koala rescue and rehabilitation, community education and awareness, koala habitat restoration and management, research, and advocacy.

Some members of the Northern Rivers Koala Network (NRKN)

FOK is a long-term key player in koala conservation. Established in 1986, it has been convening regional inter-organisational communication meetings since 2016. These meetings evolved into the Northern Rivers Koala Network (NRKN) - a group of representatives from key stakeholders working on koala projects in the Northern Rivers. Core members include representation from regional councils, NSW Government, and Non-Government Organisations, with a broad range of additional collaborators attending opportunistically. Examples include Traditional Owner groups and out of region organisations such as Koala Conservation Australia and Currumbin Wildlife Hospital. The group meets bi-monthly, with an aim of working strategically and collaboratively across our region for the benefit of koalas.

Figure 3: Organisational diagram for Northern Rivers Regional Koala Conservation Strategy

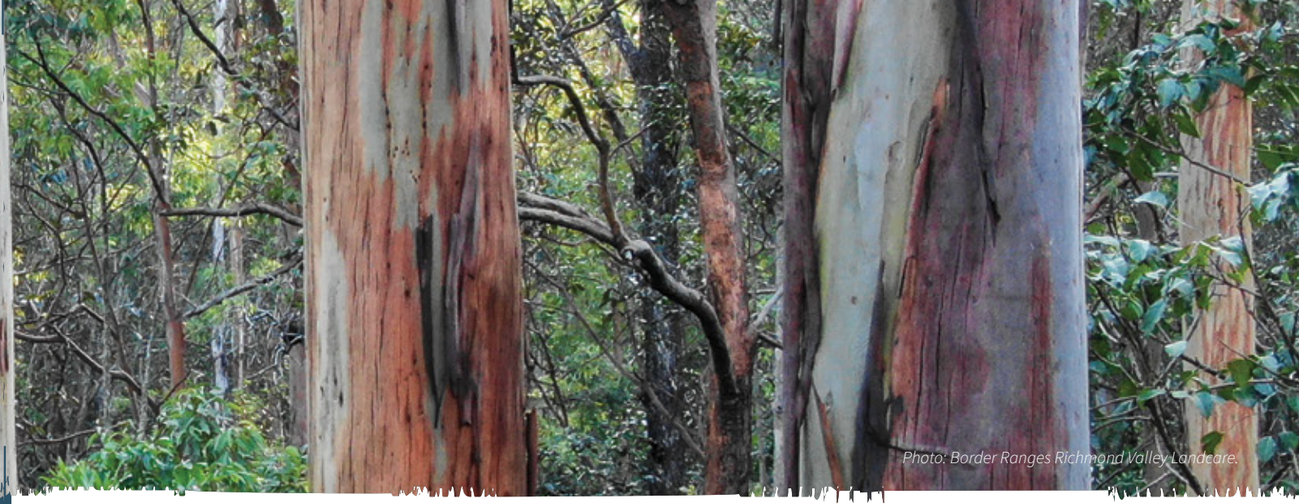


Photo: Border Ranges Richmond Valley Landcare.

1.2 Aboriginal people in the region

The role and guidance of Traditional Owners and First Nations peoples is recognised as being highly important to the Regional Strategy and the conservation of koalas. It is hoped that the actions guided through this document will promote enduring partnerships, and support Caring for Country.

The cultural significance of Burabi (koala) is recognised across the region.

The people of the Bundjalung nation are the Traditional Owners of this Country, with clans including Ngandowal, Minyungbal, Goodjinburra, Tulgi-gin, Moorung-moobah, Arakwal, Minjungbal, Widjabul Wia-bal, Nyangbul, Banyan Baigham, Gulli-bul, Bandjalang, Birhn, Wahlubal, Gidhabal, and Githabul (Roberts, n.d.).

First Nations people play a critical role in caring for koalas, through enduring Kinship networks, Cultural Lore and Indigenous Knowledge systems existing across all space and time, and through the implementation of Caring for Country practices throughout the landscape. The ongoing awarding of legal Land Rights via the Native Title process in the region will continue to ensure the recognition of Bundjalung people's connection to Country and improve outcomes for koalas and their habitat.

Aunty Kaly McBride (Marcia Brooks) Gulli-bul elder of the Bundjalung Nation with dumplin bundjalung the borrabee (koala). Photo: Jo Green.

1.3 Consultation

Expert local knowledge has been incorporated into the Regional Strategy through community consultation. One to one interviews with key people and organisations working in the koala conservation field were held over a period of 6 months. Local Government officers and Landcare Coordinators provided input into local issues, community engagement and habitat restoration initiatives. A workshop in world café style to understand landowner priorities in the region was held at the Kyogle Koala Symposium in September 2022.

Consultation was important to understand the role of the Regional Strategy for all NRKN participants and how the actions would be undertaken. Key stakeholder input to the strategic map provided detailed local knowledge.

Discussions with some Aboriginal people provided clear examples of suitable projects currently underway and the importance of Aboriginal led initiatives to the outcomes of this Strategy.

Figure 4: Examples of thoughts offered during community consultation on the Regional Strategy

Vision

A regional strategy designed to guide habitat restoration and koala management actions across the Northern Rivers

Protect

Protect existing habitat and stabilise koala populations

Restore

Restore degraded habitat and reduce threats to koala populations

Create

Create new habitat in strategic locations and engage community in koala conservation

The Regional Strategy will provide a model for protecting and recovering koala populations across the Northern Rivers.

Lindy with Warratah. Photo: FOK.

1.4 Aim and objectives of the Regional Strategy

Aim

To guide a regional approach for coordinating the conservation, recovery, and management efforts to protect and recover koala populations in the Northern Rivers region of NSW over the next 25 years (approximately four koala generations).

The Regional Strategy will seek to increase koala populations and halt any overall decline in the size and distribution of the current regional koala population.

Koalas are mobile in the landscape and it should be acknowledged that considerable fluctuations do occur, especially from drought, and habitat removal. The Regional Strategy will prioritise actions that will contribute to sustaining the population.

A proactive approach to koala population conservation and recovery will be achieved through committed priority actions, monitoring programs, regular performance reviews, and adaptive management.

Local and State Governments and other land management agencies will work together to address threats across all tenures and jurisdictions.

Field day to learn about koala habitat. Photo: Border Ranges Richmond Valley Landcare.

Objectives

The intention of this document is to translate the outcomes of research and the decades of experience of the community, partner organisations, local and state government, practitioners, and volunteers to produce a guiding strategy for koala conservation that applies across the Northern Rivers region. The Regional Strategy aims to:

1. Identify and implement what is required to protect and restore a network of long-term, viable koala habitats across the region.
3. Prioritise conservation actions at a regional scale to address multiple interacting threats.
3. Identify and manage risks to koala populations from habitat loss, roads, dog attack, fire management, disease, and any emerging threats.
4. Provide a network for the pooling of resources to maximise the efficiency of local strategies and programs while collaboratively addressing state and federal priorities.
5. Provide consistency and efficacy of educational material and messaging for engaging with the regional community.
6. Build and maintain ongoing interest, support, and engagement in koala conservation throughout the community.
7. Develop a regional koala population monitoring program.
8. Identify research opportunities and address knowledge gaps arising from local, regional, state, and federal programs.
9. Update and provide a revision of the Regional Strategy through periodic performance reviews based on monitoring outcomes.

1.5 Threats to koalas in the region

The major impacts and threats to koala populations are:

- habitat clearing and fragmentation due to urban development, agriculture, and logging.
- competing interests for land use,
- vehicle strike and domestic dog attack,
- disease especially *chlamydia* and koala retrovirus,
- high-severity fires causing koala mortality and loss of food sources,
- loss of key habitat species due to climate change, high-intensity bushfires, and dieback eg bell miner associated dieback,
- limited habitat regeneration due to the dominance of understory weeds such as lantana or the absence of cool fires to promote eucalypt regeneration resulting in a dominance of rainforest species, and
- potential impact of sea level rise, and other climate effects.

Some examples of wildlife signage
Photo: Brunswick Valley Landcare

1.6 Action prioritisation for the regional strategy

The Regional Strategy builds on a prioritisation framework developed as part of the ARC Linkage Project for protection under conservation agreements and habitat restoration across the region.

The actions, detailed in Part 2 are based on:

- community consultation,
- outcomes of the ARC Linkage Project - Conserving and recovering the koala population on the New South Wales Far North Coast (part 3.3.1),
- a review of local threat management strategies such as Conservation Strategies and CKPoMS (part 3.7)
- effectiveness of combined management actions by Bayesian modelling (part 3.6),
- effectiveness of current projects, and
- the results from monitoring programs (part 3.4.2).

Koala habitat restoration
Photo: Brunswick Valley Landcare

Management actions vary geographically within the region and will vary between stakeholder groups, hence the critical importance of ongoing collaboration.

The mapping layers provide guidance on linkages and connections across the region on public and private land. As much of the koala habitat in the region is under private ownership, there is potentially high area gains through restoration and creation of habitat on private land, where there is community interest. The community acceptance mapping layer was developed to highlight these areas across the region. Management actions are strengthend by local approaches with community knowledge.

The results of expert elicitation processes analysed by Bayesian network probability models of Camus et al. (2022) identified that while individual management actions are crucial for koala recovery, the most effective solution was likely to be achieved through combined management actions with a focus on local landscape types - coastal, riverine and hinterland; it was not necessary to carry out all management actions to achieve an increase in the koala populations, and that the balance of the management options varied across the three landscapes.

A range of activities within each of the action themes has been implemented previously and are ongoing by multiple organisations and individuals. These actions are not new but organising and prioritising across the whole region is a new approach.

1.7 Management themes – Protect, Restore and Create

The main management actions for habitat are focused under the themes of

Protect, Restore and Create

Table 1: The role of Protect – Restore - Create within the Regional Strategy

PROTECT	RESTORE	CREATE
Protect existing habitat Prevent habitat clearing, climate effects, pest species, inappropriate laws Advocating against and providing effective alternatives for over development, legislation and habitat clearing that impact on koalas Monitor koala populations	Restore through regeneration and revegetation Restore koala populations Monitor habitat restoration and effectiveness for increases in koala populations	Create linkages and habitat connections Educate and communicate to the broader community Build and create knowledge sharing Create healthy connections between populations Monitor habitat creation and effectiveness for increases in koala populations

1.8 Strategic map – spatial prioritisation

The Regional Strategy strategic mapping prioritises areas for koala Protection, Restoration and Creation (Part 2 Action 1) using ecological information and existing mapping. This mapping is a tool for practitioners to prioritise actions in implementation of the strategy.

The strategic mapping categorises habitat at a regional scale and will require on the ground validation before any works commence.

The strategic mapping includes all tenure types in the six LGAs of the Northern Rivers region – Tweed, Byron, Ballina, Lismore, Kyogle and Richmond Valley.

It should be noted that the strategic mapping layers are not a regulatory instrument and do not categorise land for regulatory purposes.

The Strategic mapping layers are made up of four categories:

PROTECT	Existing koala habitat with highest value to regional koala populations.
RESTORE (Priority)	Existing koala habitat that should be prioritised for restoration.
RESTORE	Existing koala habitat that is suitable for restoration.
CREATE	Priority areas for koala habitat creation.

An example of the strategic mapping output with the 4 categories can be seen below (Figure 5).

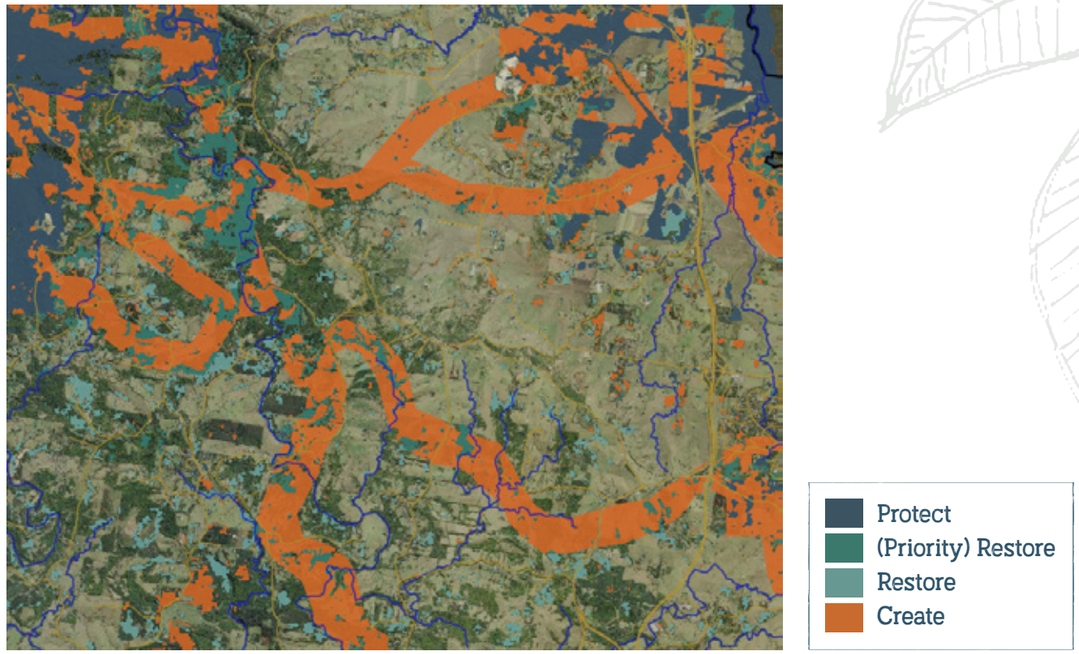


Figure 5: An example of the strategic mapping categories

The interactive Northern Rivers Koala Habitat Strategic mapping is available online — click here

The strategic mapping has identified the following areas:

	Total Area (Ha)						
	Northern Rivers	Ballina	Byron	Kyogle	Lismore	Richmond Valley	Tweed
PROTECT	**163,198**	5,009	9,163	56,512	13,738	49,735	29,042
RESTORE (Priority)	**80,675**	1,095	4,277	14,066	4,934	49,850	6,452
RESTORE	**60,462**	1,939	1,701	32,122	4,661	9,112	10,928
CREATE	**58,108**	4,483	6,669	7,945	20,338	10,866	7,808
	362,442	**12,526**	**21,811**	**110,645**	**43,670**	**119,563**	**54,228**

The strategic mapping output has been generated by running a Geographical Information System (GIS) model that analyses a number of spatial layers (see Figure 7, page 28). See part 3.6 for details on the criteria for the strategic mapping and the datasets used.

Figure 6: Datasets and knowledge used to map koala habitat as Protect, Restore or Create.

Koala and joey. Photo: Border Ranges Richmond Valley Landcare.

Part 2 – Actions under the Regional Strategy

Action 1: Habitat protection, restoration, and creation

- **Protect –** highly suitable koala habitat remains secure and in good condition in the landscape
- **Restore –** maintain and improve the ecological integrity of koala habitat
- **Create –** management for functional connectivity for koala populations through revegetation across the landscape

Action 2: Koala communications and community liaison

Action 3: Disease and injury – reduce, educate, and raise community awareness

Action 4: Pest and domestic animal control

Action 5: Protecting koalas from climate change

Action 6: Understanding koala populations– population trends, health status, demographics

Action 7: Partnership and strategic coordination for regional actions

Action 8: Regional Strategy review

Action 1: Habitat protection, restoration, and creation

Habitat removal and fragmentation through clearing is the primary threat to koalas and their habitat in the Northern Rivers region. Protection and enhancement of habitat through restoration and creation is the foundation of Action 1 in the Regional Strategy.

Best practice techniques for restoration and creation show the optimal habitat areas for koalas will include areas where the preferred food trees occur in association with a diverse range of other potential food and shelter trees (McAlpine et al. 2023).

Restoration programs should include preferred koala food trees (McAlpine et al. 2023), plus a diversity of local species in the structure of the pre-existing vegetation community or reference site.

Not all areas are suitable or appropriate to be restored to koala habitat.

Protection

The first principle in restoration is to protect existing habitat, even if it is individual isolated mature koala feed or shelter trees.

By retaining habitat in good condition habitat including koala food trees, and protecting it from clearing, allows koalas to feed, rest and reproduce in safety. These areas then become the cores from which recovery can expand.

These areas also act as refugia in times of climate stress.

Protection has different meanings depending on the land tenure. On protected public reserves (National Parks and Nature Reserves) koala habitat is protected from clearing but still subject to effects of climate such as landslips, or drought and subsequent wildfire. On Indigenous land (Indigenous Protected Areas and shared management reserves) habitat is protected. On other public land (council, crown and state forest) some clearing of koala habitat can occur for development or forestry agreements. On private land planning rules are limited in protecting koala habitat so clearing does occur except in privately protected areas such as private land conservation agreements.

The strategic mapping includes areas with:

PROTECT

- High koala habitat suitability rating with existing native vegetation present.
- Persistent koala populations.
- Bushfire refugia.
- Drought and heatwave refugia.

The primary organisations tasked with “protect” actions are the Biodiversity Conservation Trust, FOK, Landcare, Councils, NPWS, the Northern Rivers Koala Network (NRKN) and state government agencies.

The protection of koala habitat from being subject to Private Native Forestry Agreements is a key focus. Actions include advocating for changes in legislation to prevent the clearing of mapped threatened species habitat.

Just south of Woodburn, Minyumai IPA covers 2,100 hectares of paperbark groves and scribbly gum, swamp mahogany and bloodwood forests. It forms a crucial corridor between Tabbimobile Swamp Nature Reserve and Bundjalung National Park. A Firestick project enabled Minyumai rangers to be trained in and carry out traditional land management techniques to look after country. Burns have been undertaken regularly for 10 years and they are seeing an increase in fauna species recorded through regular monitoring. The rangers have also hosted educational days to share knowledge.

Koala habitat restoration. Photo: Tweed Shire Council.

What is the difference between restoration and creation?

Restoration, mainly weed control, is carried out in areas with existing native vegetation. The actions of controlling invasive environmental weeds allows the existing native species to flourish, natural forest structure to return and for native seed regeneration to occur.

Creation (also referred to as tree planting, revegetation, fabrication) is carried out in areas of very little existing native vegetation, or where regeneration of native seeds is low in diversity or not the desired species.

The aim of restoration and creation is a mosaic of tree species and vegetation community types in the landscape, which includes koala habitat. Koala habitat includes preferred koala food trees in varying proportions, depending on the landscape position. Restoring and creating koala habitat should be guided by nearby reference communities and be site specific to allow for individual site conditions eg wallaby browsing, frost, and water availability.

Caitlin Weatherstone, Koala Project Officer Byron Shire Council with koala habitat trees

Restoration

All restoration of koala habitats are to follow best practice methods for the North Coast Koala Management Area -

NSW Environment and Heritage | Koala habitat restoration guidelines.
click here

Restoration in the strategic mapping is split into two categories – restore priority and restore. Funding and resources should be guided towards the priority areas first with the restore areas to follow. The priority areas have high community acceptance and are adjacent to persistent koala populations.

The strategic mapping includes a layer indicating landholder willingness for habitat restoration. This is indicative only, using local knowledge.

Society for Ecological Restoration Australasia | National standards for the practice of ecological restoration in Australia. click here

The strategic mapping indicates areas that should be the focus of restoration efforts under these two categories with the following criteria:

Restore (Priority)	• High community acceptance. • Bushfire affected areas with high koala habitat suitability. • Adjacent to persistent populations. • Existing native vegetation within an identified linkage. • Flood affected areas.
Restore	• Medium koala habitat suitability rating with existing native vegetation present. • Bushfire affected areas with medium koala habitat suitability.

Creation

All creation of new habitat should follow best practice methods and a multi species approach.

Australian Government DCCEEW | Revegetating koala habitat
click here

Koala habitat should include primary koala food trees appropriate to the site. Koalas rely on a select few species of eucalypt trees, which are their primary food trees, in a particular region. The species they prefer varies throughout their range and on the climatic and abiotic conditions at a site. Other species of eucalypts and non-eucalypts are browsed opportunistically and used for shade and shelter.

The preferred koala food trees for the Northern Rivers have been identified by the work of McAlpine et al. (2023). The selection of tree species for a site is particularly important if nutrient availability is a consideration (McAlpine et al. 2023). Success in creating suitable habitat links to creating a vegetation community following nearby koala habitat reference sites as a guide and incorporating all the features of the habitat; the food and shelter trees and ground layers.

Habitat buffers (areas around protected areas of preferred koala habitat) provide for the likely extension of koala activity. Habitat buffers that extend over mainly cleared land containing only scattered food trees can help to facilitate koala activity within preferred koala habitat areas and safe koala movement between adjoining habitats. Such areas should be considered a priority for habitat restoration projects where feasible.

The strategic mapping indicates areas that should be the focus of habitat creation efforts by applying these criteria:

Create	• Medium to high koala habitat suitability rating with no existing native vegetation present. • Cleared land within persistent population grid. • Linkages between key population areas which have a low urbanisation value.

Koala Connections

Tweed Byron Koala Connections was a five-year federal government-funded project (Biodiversity Fund) completed in 2016. It created 55 ha of new koala habitat by planting 73,000 trees and improved a further 150 ha of habitat across the Tweed and Byron shires.

Full case study
click here

Action 2: Koala communications and community liaison

The koala is an internationally recognised Australian Icon and getting the message out about what people can do to help our local koala population is vital. Clarity and cohesion are needed in messaging about what members of the community can do to help koalas. The wider community of landholders, volunteers and even peri-urban residents have a vital role to play. There are lots of communication materials currently in circulation. The intention is to not duplicate effort, and to combine resources for regional consistency while recognising differing engagement levels between different LGAs.

The Northern Rivers Koala Network (NRKN) continues to promote awareness and encourage discussion by bringing issues to the public's attention through the media and providing information and advice.

Jo Green with Joanne the koala Credit Byron Shire Council

'Boodahbee – Festival of the Koala' in Kyogle occurs annually in September.
Through a series of events the festival explores and celebrates koala conservation efforts occurring across the Kyogle LGA.
Boodahbee is the Gulli-bul word for koala and is a culturally significant animal for this bio-region.

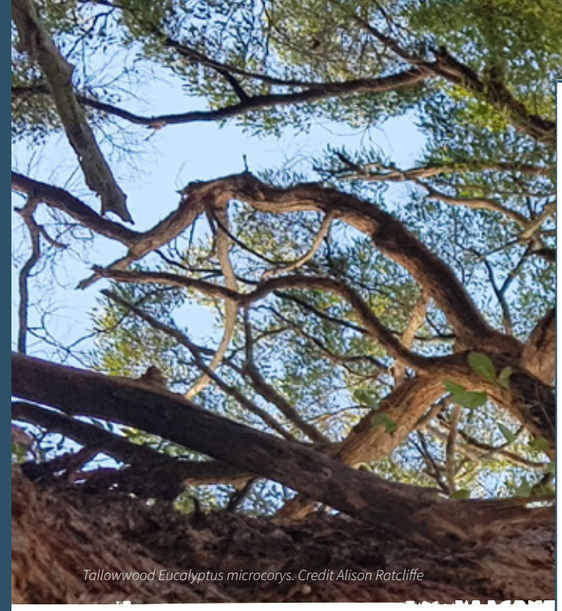
Action 3: Disease and injury

Disease accounts overwhelmingly for the largest proportion of koalas brought into care at the FOK hospital. Vehicle strike follows (see part 3.3.3.3).

Priority actions for the Regional Strategy are to support FOK to continue their work as outlined in their strategic plan.

FOK strategic plan click here

Tweed Shire Council installed new road signage designed to change driver behavior on one of the Tweed's worst koala mortality black spots on a connecting road at Cabarita. The variable message signs can be changed to different messages. This is teamed with pavement treatments.
They also worked with 3 local schools and the kids came up with their own ways to communicate the message to their parents and families.



Tallowwood Eucalyptus microcorys. Credit Alison Ratcliffe

Reporting sightings

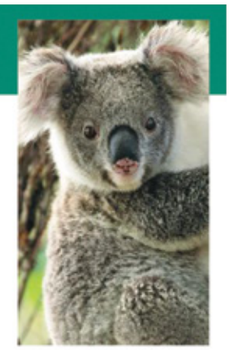
A priority for the Regional Strategy will be to increase appropriate reporting of koala sightings. This is not only beneficial for sick koalas but also for land managers to understand the locations, density and movement of koalas. There are multiple databases to report sightings including FOK's 'Report a Sighting' (located on their website) and the 'I Spy Koala' App in addition to local organisation websites.

There is sometimes confusion within the community of what is the best place to report koala sightings. The main message is to just report it. If all sightings are loaded up to BioNet and Australian Living Atlas (ALA) on a regular basis, then all relevant organisations can access this data.

Knowing when to call the 24hr Friends of the Koala Rescue Hotline for a sick or injured koala is critical.

Friends of the Koala Rescue Hotline
02 6622 1233
available 24 hours

KOALA WATCH



Healthy Koala
- Thick, grey coat, with white chest and rump
- Bright, alert, clear eyes
- Rounded, full belly
- Moves and climbs well
- Responds when startled

Distressed, Sick or Injured Koalas

Check the Eyes
- Red or swollen
- Pus or crust

Check the Rump
- Stained (yellow to black)
- Wet

Check the Body
- Wasted appearance
- Shoulder blades or spine visible through fur
- Brown, dry, matted or brittle fur
- Evidence of wounds
- Lumps and lesions

Check for Other Signs
- Low in tree or sitting on ground
- Flies buzzing around
- If you can get close enough to touch a koala there is something wrong with it

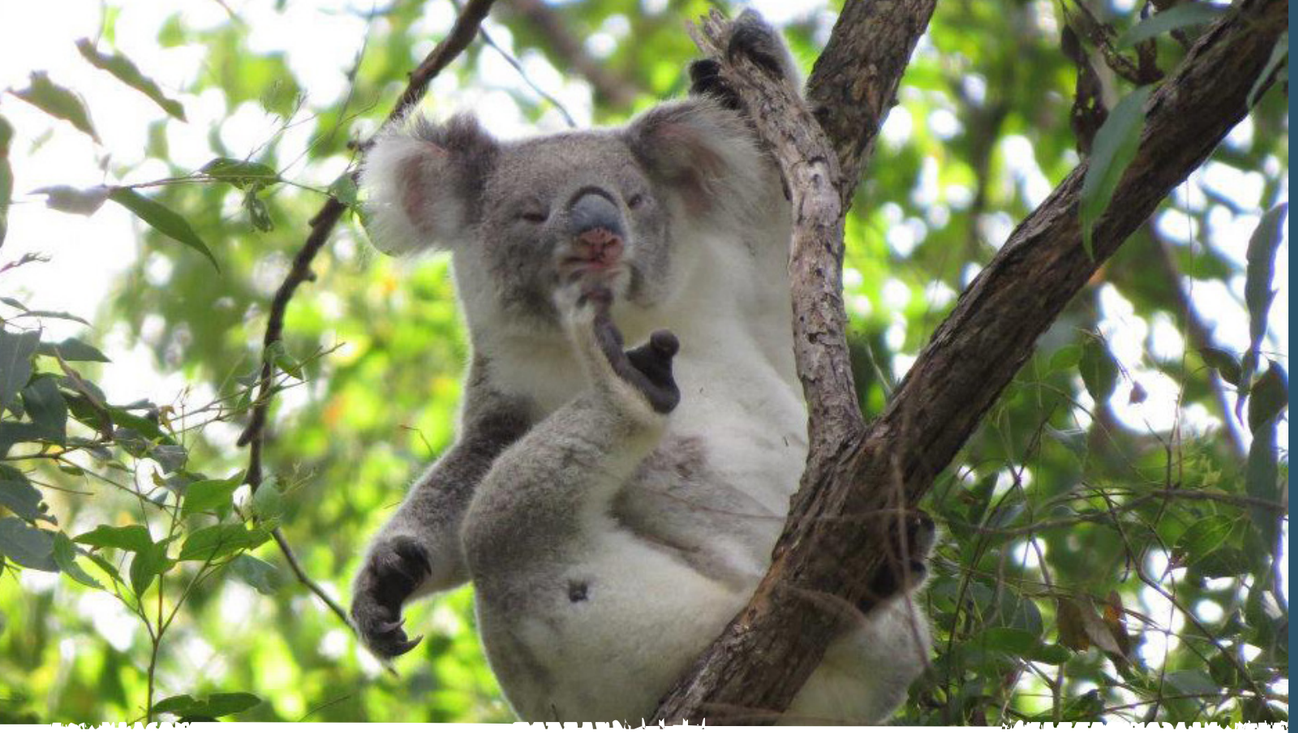
Joeys
- Smaller than a rockmelon should never be without its mother nearby

NSW GOVERNMENT NSW Environmental TRUST
This Project has been assisted by the New South Wales Government through its Environmental Trust

FOK Koala Watch

A FOK initiative, Koala Watch is a community-led koala recovery project in the Northern Rivers. The project concentrates on helping community members and landholders understand when koalas are in need of care and helps educate people on habitat restoration, fire, storms and climate change considerations for koalas.

Koala watch case study click here



A pale koala. Photo Friends of the Koala

Action 4: Pest and domestic animal control

Dog attacks account for the third largest proportion of injured koalas as reported to FOK. The impact of dog attack on koala populations increases with increased urbanisation and fragmentation of habitat. There is limited research that indicates that wild dogs may be responsible for some of the reported dog attacks (Part 3.3.3.4). Some LGAs have suburbs adjacent to koala habitat that are completely pet-free or wildlife protection areas, but compliance is an issue. The NSW Government has guidelines on protecting wildlife from domestic dogs .

A Guide to Community Engagement. click here

Actions to achieve animal control are largely based on education and on ground awareness. Within many of the local government areas, programs are already in place for raising community awareness. These are reported to NRKN at their meetings for potential wider application.

Bow Wow! Leash me now! Byron Shire Council's Leash-Up project ran from June 2020 – June 2021. It was funded by a $84,890 grant under the NSW Koala Strategy's 'Conservation through Community Action' pillar.
The project researched attitudes and social norms of the target dog-owner community, and developed and pre-tested a communications strategy incorporating social behaviour change theory.
A media campaign ran for 8 weeks with a TV campaign using 'If koalas could talk' video, and Facebook posts using 'if dogs could talk' alongside other more traditional media including signage.

Action 5: Protecting koalas from climate extremes

Koalas need safe areas to shelter when climate extremes occur e.g. wild fire, drought, heatwaves, flood and intense rainfall. Climate refugia are mapped and available in the online mapping.

Actions to protect koalas from climate extremes focus on understanding and mitigating the impacts. There is much research underway so this action will need frequent reviews to include up to date information.

Climate Ready Koala Food Trees

There is some research into the need for climate ready koala food trees (KFTs). DPE used climate projections and temperature range changes for key KFTs in the region and found that under all future projections for the Richmond catchment, some naturally occurring Tallowwoods *Eucalyptus microcorys* in the region will be impacted by climate change.

Broadhurst, Hughes, Hancock and Harris (2019) provides step by step instructions on where to find and how to use climate projections and how to consider suitability of species and provenances for revegetation projects.

Climate Ready revegetation. A Guide for natural resource management click here

Considering koalas in planned burns - Guidelines to reduce the impact of planned burns on koala populations click here

Richmond Climate-ready Revegetation Project is assisting 10 landholders from across the Richmond catchment with species selection and seed sourcing for koala habitat revegetation projects. The aim is to support climate change resilience and adaptation to the changing NSW environment. Five species of koala food tree were selected and seeds from 4 different provenances were collected, grown, planted, and then monitored to see which species and provenance were most successful.

Koala Fire Management

An important priority for the region is to understand and manage fire in koala habitat.

It is critical to understand the management of fire in koala habitats, both to protect habitat from high-severity wildfires and also to ensure open forest habitat persists. There are currently challenges associated with implementing fire management for nearly all land managers. Ideally, fire management will be through Aboriginal-led initiatives, however when cultural burning is not an option ecological burns may be possible. The Northern Rivers Fire and Biodiversity Consortium (NRFABCON) was established in 2011 to promote a coordinated, landscape-level approach to fire management for biodiversity.

Fire in Open Forest Case Study click here

Some areas have detailed Koala Fire Management guidelines, for example the Tweed Coast Koala Fire Management Plan (Baker, 2016) and Ballina Shire Council have just completed a Koala Fire Management Plan (Baker, 2022).

Climate Refugia

Climate refugia are areas that remain relatively buffered from climate change over time and enable the persistence of koalas. An action to identify, map (or if mapped update the mapping) and protect refugia sites for koalas is essential.

There is still a lot to learn about koalas and improving our knowledge is key to informing effective conservation actions in our changing climate.

Action 6: Understanding koala populations

Contemporary, on-ground knowledge about the size, location and distribution of koala populations is required to direct regional and local conservation action. Detecting changes in these parameters (e.g., changes in population size and distribution within whole landscapes, patches, or sites) over time can inform on ongoing and emerging threats, detect recovery or ongoing decline, and ideally indicate the success or otherwise of conservation actions.

The koala's low reproductive rate and strong social structure mean that changes and trends in koala populations are slow to develop and detect and require robust and long-term monitoring strategies.

The NSW Department of Planning and Environment's NSW Koala Monitoring Framework aims to provide a structure for long-term monitoring across NSW at the state, regional and local scale, across the matters of population dynamics, koala habitat, genetic diversity, disease, reproduction, and threats. At the time of writing, the NSW Government has commenced state-wide baseline monitoring.

The NSW DPE NSW Koala Monitoring Framework click here

Alongside the preparation of this Strategy, a set of 383 sites across the region was assessed for koala activity during 2022 (Biolink Ecological Consultants, 2023). Sites were arranged on a 5x5 km grid across all tenures and sampled using the Spot Assessment Technique of Phillips and Callaghan (2011).

The 2022 survey aimed to:

- determine koala occupancy and activity levels across the region, and to
- compare these results to previous studies.

This work provides the first region-wide activity assessment in the Northern Rivers, and a significant contribution to knowledge across much of the region, which has had limited systematic survey work to date. 325 of these sites were assessed for the first time, and 25 of the sites established during the 2018 surveys were revisited. 33 sites from individual Councils' CKPOM monitoring programs were included in the analyses (Biolink Ecological Consultants, 2023).

Development of a robust regional monitoring program should be built on results of this work and utilise the now established network of field sites across the region. These results may also direct or prioritise more detailed local investigations where necessary for local planning.

An ongoing regional monitoring program will:

- include sufficient replication/power to detect trends (increase or decrease) over time across the region,
- obtain information on occupancy and distribution from areas where current knowledge is limited,
- include monitoring in created and restored habitat,
- effectively utilise the network of established sites on privately-owned land and maintain relationships with landholders,
- promote and effectively use community reporting of koala sightings,
- inform and be informed by the state-wide monitoring framework and programs,
- ideally be undertaken intra-generationally (3-yearly) to detect changes early and enable responses,
- consider targeting selected areas with finer-scale sampling in order to gain better understanding of population locations and boundaries across the landscape,
- consider incorporating additional survey methods to answer specific questions or efficiently obtain presence/absence data.

BURABI Matters Case study

Burabi Matters – working together has made a difference for koalas on Ngunya Jargoon Indigenous Protected Area

click here

Koala sleeping. Photo: Kathryn Kermode

Action 7: Partnership and strategic coordination

Northern Rivers Koala Network (NRKN) currently offers an opportunity for koala conservation stakeholders in the region to come together regularly to communicate their existing projects to share and collaborate on ideas and learn from each other. FOK is the main driver behind NRKN.

Specific partnerships and strategic coordination is the role of the Regional Koala Officer.

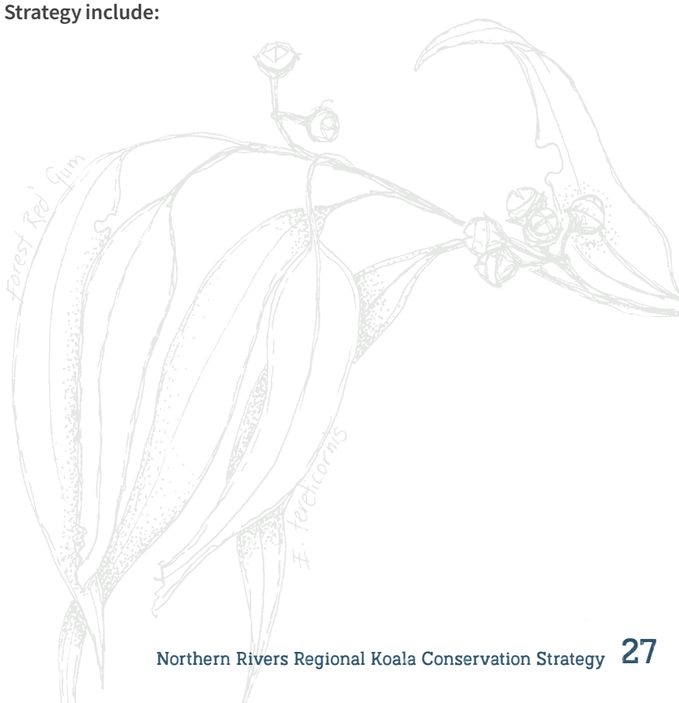
Action 8: Regional Strategy review

The Regional Strategy identifies high-level aspirational goals supported by realistic and measurable targets. Achievable monitoring timeframes and frequencies will be incorporated to maximise the likelihood of identifying and tracking trends at every stage.

Annual reporting against the action table by all members of the Regional Partnership will allow collating of collective progress. The strategic mapping will be updated annually to include new data layers. The Regional Strategy will be updated after 7 years.

Key components for monitoring the results of the Regional Strategy include:

- Habitat gain and loss.
- Monitor a subset of restoration sites for occupancy.
- Extent of habitat restoration.
- Extent of habitat revegetation.
- Changes in habitat connectivity.
- Koala population distribution and abundance.
- Analysis of FOK admission data to indicate changes in koala population health.
- Impacts of climate change.
- Number of mitigated road blackspots
- Report on regional communication actions.



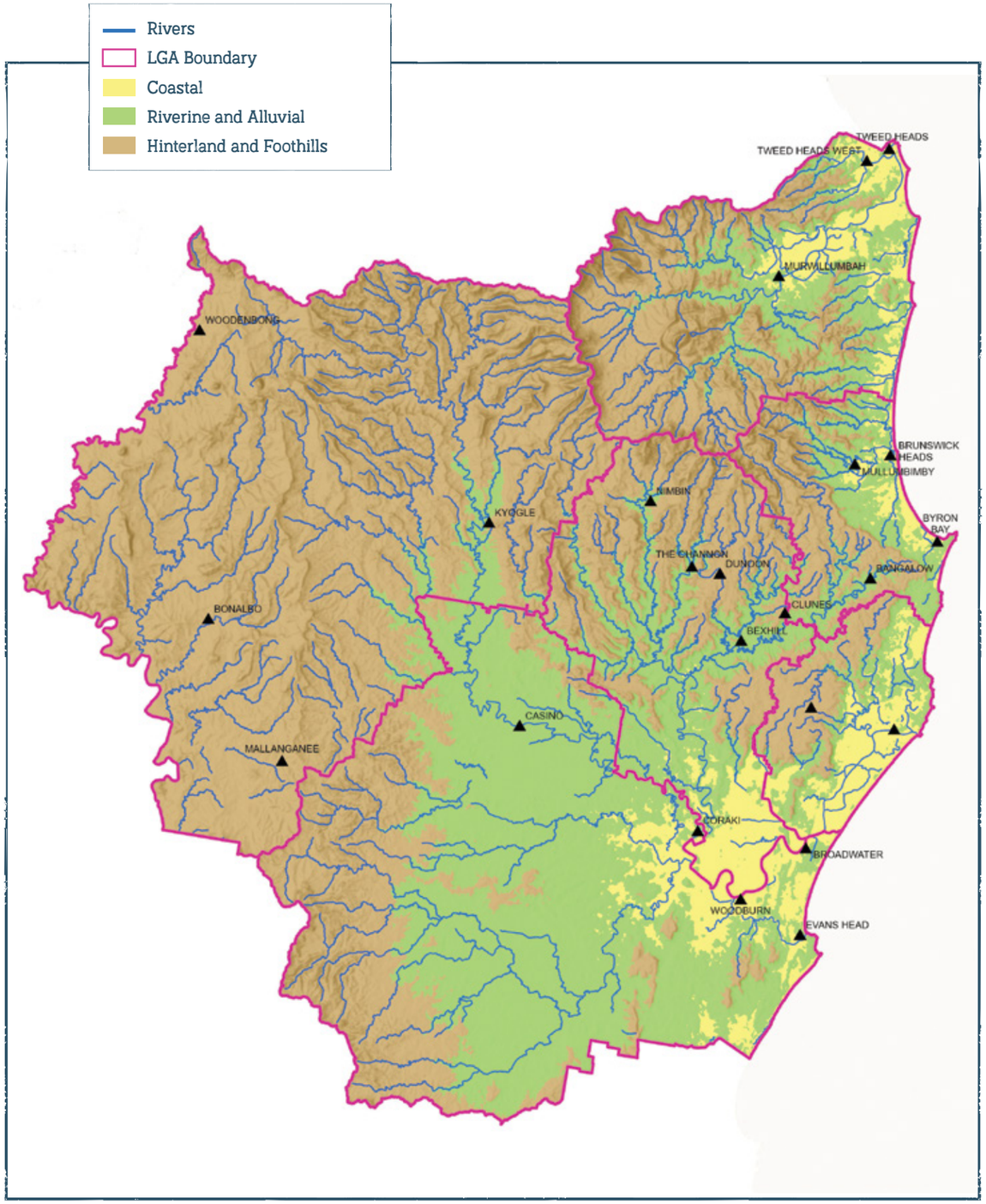


Figure 7: Regional landscapes - Coastal, Riverine, and Hinterland.

For maximisation of management efforts, actions for the recovery of koala populations are prioritised under three regional landscapes (Coastal, Riverine, and Hinterland). Figure 7 shows the landscapes across the Northern Rivers region and the actions are detailed in the Action Table.

Part 2 – The Regional Strategy

	Management Objectives and Priority Actions	Measure		Timing *	Priority management area	Lead agency & partners	Strategy Objectives
	Habitat protection - conserve and maintain the ecological integrity of koala habitat						
1.1	Investigate regional opportunities for private land conservation and facilitate agreements in these areas.	area of habitat protected		medium term	prioritise area mapped PROTECT	all stakeholders	1, 2
1.2	Encourage and support protection of existing habitat through workshops, field days, and communications.	number of workshops, field days, and communications related to habitat protection		medium term	all	all stakeholders	1, 5, 6
1.3	Collaborate with NPWS and other state agencies to protect koala habitat through regional management actions and recommending land for purchases.	area of habitat protected		medium term	all	all stakeholders	1, 2
1.4	Provide resources to assist the community and partners to communicate with local decision makers about koala habitat.	number of resources developed		short term	all	FOK, NGOs	4, 5, 6
1.5	Identify and protect koala habitat on private land e.g. using appropriate planning mechanisms.	area of habitat protected		short term	coastal & hinterland	councils	1, 2
1.6	Promote and advocate for laws that prevent the clearing of koala habitat, including the exclusion of koala habitat from private native forestry operations.	number of submissions/actions recommending laws that protect all koala habitat from being cleared		ongoing	all	all stakeholders	1, 2, 6
	Habitat restoration – provide functional connectivity for koala populations						
1.7	Restore koala habitat.	area of habitat restored		short term	prioritise area mapped RESTORE	all stakeholders	1, 2
1.8	Hold knowledge-building habitat restoration workshops or field days with the community.	number of workshops and attendees		medium term	all	all stakeholders	5, 6

Protect

Restore

* **short** = joey to maturity ~1 year / **medium** = koala gen 5 - 8 years / **long** = ~> 3 koala generations > 8 years

Create

	Management Objectives and Priority Actions	Measure		Timing *	Priority management area	Lead agency & partners	Strategy Objectives
	Habitat creation - management for revegetation across the landscape						
1.9	Implement habitat revegetation projects to create linkages between areas of established koala habitat using best practice guidelines.	area of habitat revegetated		long term	prioritise areas mapped CREATE	all stakeholders	1, 2
1.10	Record results of habitat creation projects to the ALA Habitat Restoration Hub.	data on ALA Habitat Restoration Hub is accurate within 3 months from project completion		short term, medium term	all	all stakeholders	1, 9
1.11	Hold workshops or events to encourage landholders to create koala habitat in appropriate locations.	number of events and number of attendees		short term	coastal & hinterland	all stakeholders	1, 5, 6
1.12	Support the creation of koala habitat in emerging markets (carbon farming, biodiversity farming) using best practice methods.	area of koala habitat planted or restored for carbon and/or biodiversity markets		long term	hinterland	all stakeholders	1, 2
	Koala communications and community education						
2.1	Continue regional partnerships through the Northern Rivers Koala Network (NRKN) meetings and collaboration.	regular meetings held and well attended		long term	all	all stakeholders	4, 6
2.2	Develop and implement regional koala communication projects for major themes.	number and type of communications developed		medium term	all	FOK, all stakeholders	5, 6
2.3	Investigate the effectiveness of different communication methods.	community/target audience feed-back, monitor social media/web analytics		medium term	all	FOK, all stakeholders	5, 6
2.4	Build and maintain ongoing interest, support, and engagement in koala conservation throughout the community.	number of people engaged in koala conservation by participation in projects, membership of conservation groups, events, and media engagement		medium term	all	FOK	6
2.5	Build and maintain ongoing interest and engagement in koala conservation through delivery of schools-based workshops and programs.	number of school visits/ workshops/events		medium term	all	FOK, all stakeholders	6
2.6	Encourage community involvement through citizen science projects.	number of new Citizen Science projects and number of participants		medium term	all	FOK, all stakeholders	6, 8
2.7	Build skills of community members to frequently and effectively report koala sightings.	number of sightings recorded		short term	all	FOK, all stakeholders	3, 6

* **short** = joey to maturity ~1 year / **medium** = koala gen 5 - 8 years / **long** = ~> 3 koala generations > 8 years

	Management Objectives and Priority Actions	Measure		Timing *	Priority management area	Lead agency & partners	Strategy Objectives
	Disease and injury – reduce impact, increase community awareness						
3.1	Hold koala health workshops with a focus on increasing reporting of diseased and injured animals.	number of koala health workshops		short term	all	FOK, Bangalow Koalas	3, 6
3.2	Seek and secure funding to maintain wildlife hospital, training, and financial support for vets.	FOK hospital is sufficiently funded and staffed		short term	all	FOK, all stakeholders	2, 3
3.3	Publicise the important work of FOK.	number of media releases		medium term	all	FOK	5, 6
3.4	Support and participate in research into koala health through funding.	number of research projects in the region		short term	all	FOK, all stakeholders	8
3.5	Support ongoing vaccination programs.	number of koalas vaccinated in the region each year		long term	all	FOK, all stakeholders	3
3.6	Identify vehicle strike hotspots and install best practice road-strike mitigation measures.	number of koala vehicle strike mitigation actions implemented		short term	all	councils, Transport for NSW	3
3.7	Maintain koala vehicle strike mitigation measures on all roads.	proportion of mitigation measures in functional condition		medium term	coastal & hinterland	councils, Transport for NSW	3
	Pest and domestic animal control						
4.2	Public education campaign for domestic dog management and support for increased compliance.	fines issued, before and after records of compliance		short term	coastal	councils, DPE	3, 5
4.2	Encourage councils to develop planning controls that reduce the risk of dog attack for developments adjacent to koala habitat.	number of dog impact mitigation measures in place in developed areas		long term	all	councils	3
4.3	Identify areas with high levels of conflict with wild dogs/dingos and work with partners and current research to develop responses.	number of areas identified		short term	hinterland & coastal	councils, LLS	2, 8

* **short** = joey to maturity ~1 year / **medium** = koala gen 5 - 8 years / **long** = ~> 3 koala generations > 8 years

Protect

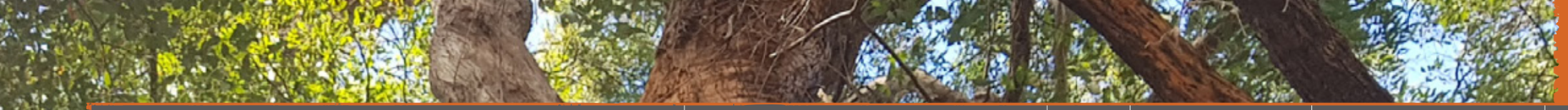
Create

	Management Objectives and Priority Actions	Measure		Timing *	Priority management area	Lead agency & partners	Strategy Objectives
	Climate change impacts						
5.1	Promote understanding of burning regimes and koalas, with the view to identification of regional actions to reduce fire severity and canopy loss.	number of research projects number of community engagements		long term	hinterland & coastal	councils, other stakeholders	6
5.2	Engage with RFS to share occupied koala habitat and fire refugia mapping and coordinate local fire responses.	number of RFS engagements		medium term	all	councils, FOK	1, 3, 4, 5
5.3	Protect koala drought refuge habitat.	area of drought refuge habitat protected		long term	hinterland & coastal	all stakeholders	1, 2, 3
5.4	Develop communications around actions to take during extreme weather events.	number of communications		short term	all	FOK, councils	5
	Monitoring						
6.1	Develop and implement regional koala monitoring program.	regional monitoring undertaken regularly, and results documented		medium term	all	Regional partnership, DPE	7, 9
6.2	Identify and secure funding for ongoing regional koala monitoring.	funding identified and secured		medium term, ongoing	all	councils	7
6.3	Undertake monitoring in restoration sites.	restoration monitoring recorded in Habitat Restoration Hub		medium term	all	all stakeholders	7
6.4	Develop a platform for data and information collection and sharing.	shared space accessible and used by relevant stakeholders		medium term	all	all stakeholders	4, 5, 6

* **short** = joey to maturity ~1 year / **medium** = koala gen 5 - 8 years / **long** = ~> 3 koala generations > 8 years

Protect

Create



	Management Objectives and Priority Actions	Measure		Timing *	Priority management area	Lead agency & partners	Strategy Objectives
	Partnerships and strategic coordination for regional actions						
7.1	Continue Northern Rivers Regional Koala Network NRKN and Regional Koala Officer role to ensure strategic collaboration in koala conservation across the region.	shared activities and outcomes		short term, ongoing	all	DPE, FOK, all stakeholders	6
7.2	Advocate for update and finalisation of koala legislation including the Koala Habitat Protection SEPP.	number of submissions/actions		medium term	all	all stakeholders	6
7.3	Collaborate to build partnerships with Indigenous people and groups and co-design initiatives and practical strategies that respect cultural values and traditions.	number of initiatives		short term	all	all stakeholders	6
7.4	Support training programs for indigenous people, landowners, and the community in koala education and cultural burning for koala habitat e.g. support indigenous youth programs.	number of people trained		long term	all	DPE, all stakeholders	5, 6
7.5	Identify opportunities for collaborative applied research projects to help guide koala population recovery.	number of research projects		long term	all	all stakeholders	8
7.6	Hold events to improve practitioners' skills and knowledge of current and emerging research.	number of workshops, events and conferences held		ongoing	all	all stakeholders	5, 6, 7, 8
	Review of the Strategy						
8.1	Record details of all habitat restoration projects on ALA Habitat Restoration Hub.	area of restoration recorded on ALA Habitat Restoration Hub		medium term	all	all stakeholders	7, 9
8.2	Revise mapping with new information including knowledge about koala habitat use under changing climate variables.	mapping updated annually		short term	all	Regional Partnership	9
8.3	Revise the Strategy.	stakeholder actions reported annually, strategy review after 7 years		medium term	all	Regional Partnership	9

Create

* **short** = joey to maturity ~1 year / **medium** = koala gen 5 - 8 years / **long** = ~> 3 koala generations > 8 years

Part 3 – Foundations of the Strategy

The Regional Strategy is informed by a significant amount of information and collaboration. This part outlines some of the legislation, research, and community work that has been used as the foundation for the Regional Strategy.

It also synthesises data and findings from existing regional research and monitoring programs and summarises the extent and type of actions being done by key stakeholders in the region.

3.1 The role of Friends of the Koala (FOK) Inc.

Formed in 1986, FOK had a key role in the development of the Regional Strategy and will have an ongoing role in the implementation of the strategy.

FOK is dedicated to rescuing, rehabilitating, and releasing koalas, protecting and restoring koala habitat, research, engaging and educating the community, and advocating on behalf of koalas at the local, state, and national levels. The organisation operates a 24/7 rescue hotline, the only Koala Hospital in the region, a community education centre, seven koala food tree plantations, a community native plant nursery and bushfire recovery nursery, and a state-of-the-art research & diagnostics laboratory, which is set to open soon. Each year FOK rescues and treats approximately 350 sick, injured, and orphaned koalas - more than any other wildlife hospital in New South Wales. Over 200 trained hotline, rescue, koala care, nursery, leaf harvest, plantation maintenance, site maintenance, admin and management committee volunteers, and nine staff members, work together to protect koalas in the Northern Rivers. The organisation is supported by over 500 members and a wide range of partners.

FOK also works with local government to develop and implement Comprehensive Koala Plans of Management and provides advice to landowners on improving koala habitat.

"FOK is the voice for all koalas' survival throughout the Northern Rivers of New South Wales (NSW). We continue to be a forthright advocate, a committed community educator and an eager partner in koala-related research. The group also facilitates long-standing friendships amongst its members, providing many with a sense of family, belonging, and purpose. The social aspect of FOK's function is often overlooked but it's important to the success of the organisation's mission and to community cohesion."

Lorraine Vass AM, FOK Patron and past president 2002-2017

FOK Case Study

click here

Advocacy

The role of advocacy by FOK is well recognised in the region. The members and volunteers of Friends of the Koala Inc. have been the frontline of the battle to save the species from extinction in the Northern Rivers for over 35 years.

FOK has been the voice for koalas, raising awareness and educating local community members, landholders, policy makers, visitors and the next generation regarding all aspects of koala and habitat conservation, protection and restoration, health and vaccination.

Political will, strong policy, robust legislation and regulatory compliance in all three levels of government are essential to koala conservation.

3.2 Legislation behind the Regional Strategy

The Regional Strategy works in with NSW and Commonwealth Government legislation and programs including the NSW 2022 Koala Strategy and associated funding programs.

In addition, the recommendations from the NSW Bushfire Inquiry and the lessons from the 2019-2020 bushfires, the 2022 intense rainfall and flooding have been incorporated to build an integrated Regional Strategy.

The National Recovery Plan for the koala identifies the following as crucial for koala population recovery

- avoid clearing of habitat used by koalas for feeding and resting,
- prevent the reduction of connectivity between patches of habitat used by koalas for feeding, resting, commuting, and dispersing (either by clearing of vegetation or by the erection of barriers to passage),
- prevent clearing of habitat used by koalas during extreme events (heat waves, drought/fire refuge),
- avoid activities that will expose koalas to additional threats (e.g. dogs, cars) in places where koalas must use the ground to move between trees.

The table, Effects of legislation and policy on koalas and their habitat, provides more detail on the protective framework presently in place.

Legislation Table click here

Koala Action Day, Lismore.

3.3 Koala research – the science behind the Regional Strategy

Lacey. Photo: Tweed Shire Council

Koala research continues to broaden our knowledge on every aspect of the species and its habitat.

The NSW Koala Strategy and the NSW Koala Research Plan set statewide research priorities across habitat, climate, disease, genetics and other aspects. Some key outputs at the state level have been the statewide spatial data on habitat suitability and koala likelihood, available from the Koala Habitat Information Base.

the Koala Habitat Information Base click here

and

the NSW Koala Research Plan. click here

At a regional level, the Australian Research Council (ARC) Linkage project, 'Conserving and recovering the koala populations on the NSW Far North Coast' (known as the ARC Linkage project) was innovative for many reasons but especially the following:

1. It looked at koala conservation from an ecological AND a social perspective. Both were map-based thereby providing the essential spatial component to this regional strategy.
2. It was a collaboration between scientists from Southern Cross University, University of QLD, University of Sydney AND importantly practitioners, land managers and FOK as a care group.
3. The research was regional (across 4 LGAs) and formed a foundation for this Regional Strategy.

FOK's communications group meetings and the ARC Linkage project built on an important relationship that had developed through years of preparing and then implementing the region's four Comprehensive Koala Plans of Management: a group of Council officers and FOK volunteers working TOGETHER. There has always been incredibly good will in the room and a desire to see real on ground action.

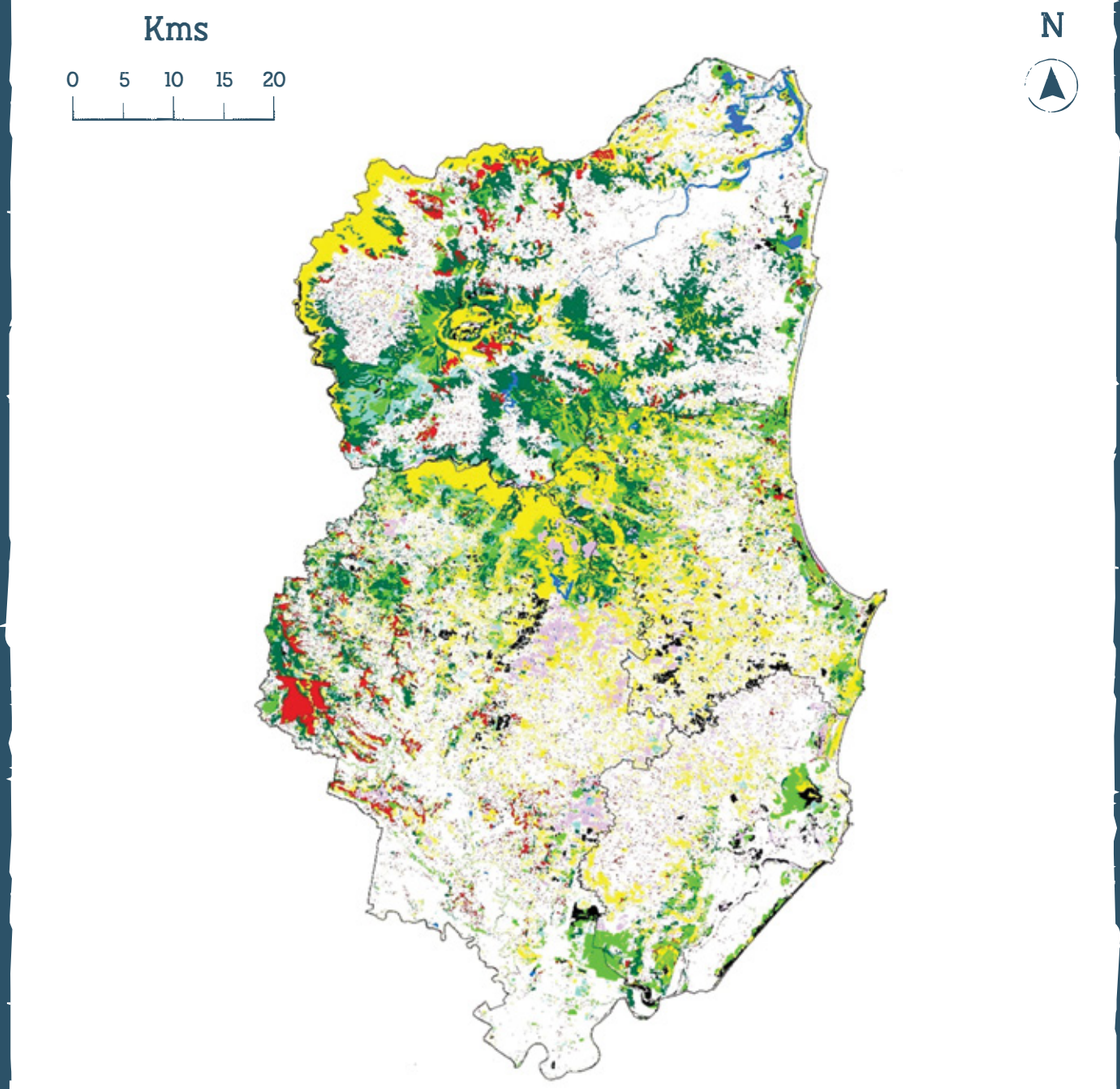
The Regional Strategy will provide a model for conserving and recovering koala populations across the Northern Rivers, and for mitigating major (catastrophic) declines due to extreme events, such as droughts, bushfires, and the effects of climate change.

3.3.1 Koala habitat research

3.3.1.1 ARC Linkage Project

A key output from the ARC Linkage project was a consolidated vegetation map identifying koala habitat categories for 4 of the LGAs in the region, based on the likely proportion of preferred koala food trees within each vegetation community (Figure 8). This provides a basis on which to focus efforts in the conservation and restoration of key areas. These data were a component of the mapping for the Regional Strategy. The seven peer-reviewed published papers arising from the ARC Linkage project are cited throughout the Regional Strategy and are included in the references.

Decision criteria applied for habitat categorisations are outlined in Table 2.



Koala habitat categories

- Highly Suitable (HS) Koala Habitat = Preferred Koala Food Trees (PKFTs) dominant or co-dominant
- Suitable (S) Koala Habitat = PKFTs common to occasional associate
- Ancillary (AN) Koala Habitat = PKFTs present but uncommon
- Marginal (M) Koala Habitat = PKFTs absent, but other eucalypt species present
- Other (O) = Forest or woodland communities lacking eucalypts
- Not koala habitat (NKH) = Non-forest and woodland communities
- Unknown (U) = Non-typed vegetation community
- WATER
- CLEARED

Figure 8: Koala habitat quality rankings map for 4 local government areas of the strategy region.

Table 2: Of particular importance for prioritising areas for habitat protection and species selection for habitat restoration, the ARC Linkage Projects Application 'Conserving and recovering the koala populations on the New South Wales Far North Coast' study identified three ranked-groupings of eucalypt and non-eucalypt species. PKFT - Primary Koala Food Trees.

Assigned Koala habitat category	Decision criteria
Primary Koala Habitat (P)	PKFTs dominant
Secondary A Koala Habitat (2A)	PKFTs co-dominant
Secondary B Koala Habitat (2B)	PKFTs occasional to common associate
Secondary C Koala Habitat (2C)	PKFTs present but uncommon
Marginal Koala Habitat (M)	PKFTs absent, but other eucalypt species present
Other (O)	Forest or woodland communities that lack eucalypts
Not Koala Habitat (NKH)	Non forest or woodland communities
Unknown (U)	Non-typed vegetation communities

Analysis of the field survey results showed that the top eucalypt preference group has the greatest influence on where koalas occur (Table 3). Also, where these most preferred eucalypt species occur on sites it was confirmed that a diversity of other tree species was also used by koalas. Of particular importance for prioritising areas for habitat protection and species selection for habitat restoration, the study identified three ranked groupings of eucalypt and non-eucalypt species (McAlpine et al., 2023). *Eucalyptus propinqua* was confirmed as a preferred species and ranked highest (52%) for use in the study, followed by *Eucalyptus robusta*, and *Eucalyptus tereticornis*. The well-known food tree, *Eucalyptus microcorys* was also confirmed as a preferred koala species and was the most frequently encountered species in the survey, representing 39% of the trees used by koalas. This study also confirmed that other species of eucalypts and other co-existing species in the vegetation community are also important components of koala habitat. The finding adds weight to the importance of restoring a vegetation community following nearby reference sites as a guide and using a mosaic of koala-preferred food tree species and other species recognised for their value as shelter.

Table 3: The rank grouping for eucalypts (and non-eucalypts) based on statistical comparisons of proportional use by koala.

Eucalyptus	Non-Eucalypts
Subset 1	
Grey Gums *Eucalyptus propinqua/biturbinata* Swamp Mahogany *Eucalyptus robusta* Forest Red Gum *Eucalyptus tereticornis* Tallowwood *Eucalyptus microcorys* Flooded Gum *Eucalyptus grandis*	Broad-leaved Paperbark *Melaleuca quinquenervia* Swamp Box *Lophostemon suaveolens*
Subset 2	
Sydney Blue Gum *Eucalyptus saligna* Blackbutt *Eucalyptus pilularis* Thick-leaved Mahogany *Eucalyptus carnea* Red Mahogany *Eucalyptus resinifera* White Gum *Eucalyptus dunnii*	Forest Oak *Allocasuarina torulosa* Camphor Laurel *Cinnamomum camphora* Wattles Acacia (pooled species) Broad-leaved Apple *Angophora subvelutina* Brush Box *Lophostemon confertus*
Subset 3	
Grey Ironbark *Eucalyptus siderophloia,* White Mahogany *Eucalyptus acmenoides*	Turpentine *Syncarpia glomulifera* Pink Bloodwood *Corymbia intermedia*

Koala populations utilise a mosaic of landscape-types across the region.

Since the completion of this work, further koala habitat category mapping has been carried out using vegetation mapping covering the region. Biolink Ecological Consultants (2023) incorporated additional vegetation mapping products and examined the effect of applying differing habitat category decision criteria. There is broad agreement between different methods when categorising preferred koala habitat broadly, which lends strength to using a regional approach for identifying priority habitat.

Multiple koala habitat layers and approaches to their identification now exist at multiple scales. All mapping should be used with care and using on-ground and local information at the appropriate scale to inform actions.

These findings from the ARC Linkage projects application highlight the importance of restoring as near as possible the full suite of species composition and the structure of the vegetation community for koala habitat and not just to focus on the planting of a few preferred koala food tree species. McAlpine et al. (2023)

"These results will inform a regional approach to strategic planning for Koala habitat protection and restoration."

3.3.1.2 Research on the role of fire and koala habitat.

Over the decades of koala research, there have been a few studies on the role of fire on koalas and their habitat (Lunney et al., 2007; Matthews et al., 2007; Matthew et al., 2016, Phillips et al., 2021).

After the 2019-20 Black Summer fires, the Threatened Species Recovery Hub (Dickman et al. 2020) produced

After the Catastrophe:
A Blueprint for a Conservation Response to a Large-scale Ecological Disaster
click here

This document has guided much of the research undertaken following these catastrophic fires. Of relevance to the Regional Strategy, are Negret et al., 2021 'Better managing fires and their impacts for koala conservation', Beale et al., 2022 'Effects of fire on koalas and their habitat', and Law et al., 2022 'Fire severity and its local extent are key to assessing impacts of Australia mega-fires on koala density'.

A recent study (Gardiner et al., in press) undertaken in Ngunya Jargoon Indigenous Protected Area to determine koala and population health 2 years after the fires, and habitat response to fire intensity. The results of koala surveys overlaid post-fire koala records with Fire Extent and Severity Mapping (FESM) illustrated the way in which fire intensity can affect post-fire habitat use by koalas and how fire management can play a role in maintaining koala habitat in the landscape.

High severity fire can temporarily or permanently destroy koala habitat (Matthes, pers. obs.). Koalas can die directly through burns and smoke inhalation, or indirectly through starvation from temporary loss of food, dehydration, disorientation, or joey being separated from their mother. Radiant heat can be lethal to koala internal organs (pers comm Ros Irwin LCC, KIG). Koalas can also be injured from falls or jumping from burning trees. Koalas that manage to escape a fire are likely to return to their original home range once trees start to regenerate.

Manual (e.g. raking) or mechanical (e.g. slashing) methods can be used in some situations to reduce fuel loads and/or maintain asset protection and firebreak zones.

Cool fire (called good fire) plays an important role in maintaining koala habitat through low intensity ecological burns, cultural burns, and appropriate planning before and during a fire event. The long-term exclusion of fire, particularly in high rainfall regions, can result in a dense mid-storey that impacts eucalypt health and forest structure. Open forests are needed to enable easy movement and migration of koalas and allows regeneration of koala food trees.

Carefully applied planned burns at an appropriate frequency and temperature, including cultural burns informed by Indigenous traditional ecological knowledge relating to koala habitat, can help reduce high-intensity wildfire hazard, maintain open forest or woodland conditions, and reduce fire hazard to adjacent areas.

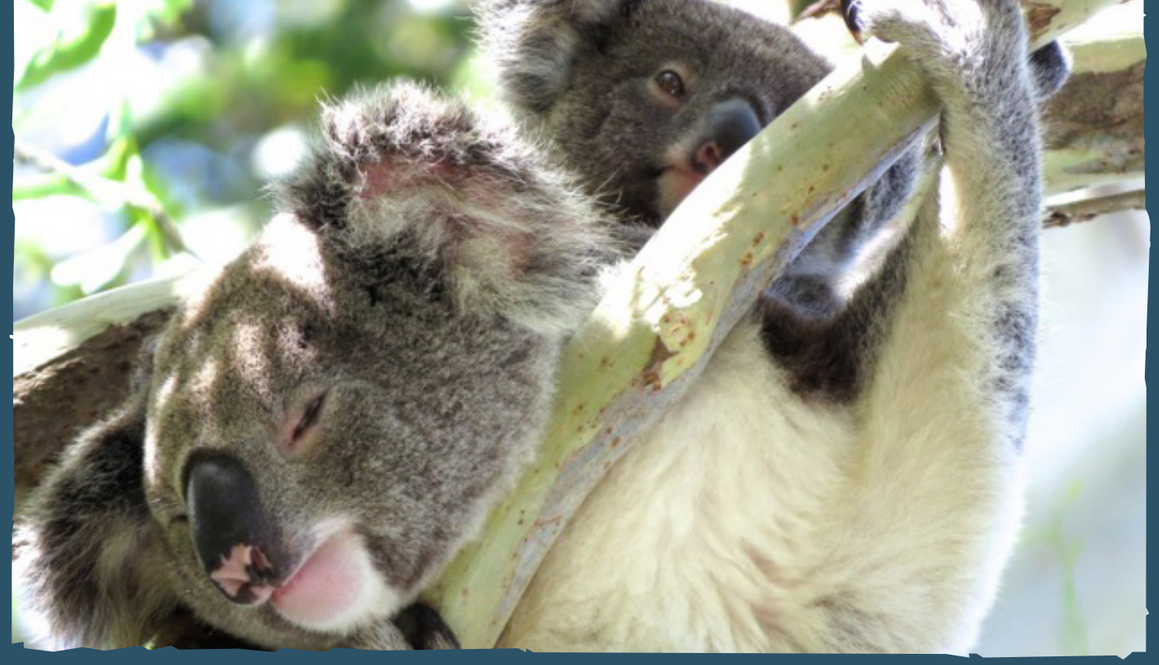


Photo FOK

3.3.1.3 Previous koala habitat restoration

Atlas of Living Australia: Habitat Restoration Hub

For many years habitat restoration practitioners and program managers, field ecologists and researchers have recognised the need to establish a central repository for documenting the extensive restoration work that has been and continues to be conducted in NSW. Starting in late 2020, a small group of highly experienced people worked with the CSIRO Atlas of Living Australia to create a free, online, open access, enduring archive of restoration sites.

The project has received strong interest and support. Development work and early data entry were funded by the NSW Koala Strategy, an Australian Bushfire Recovery Grant and an American National Science Foundation Grant.

Information describing the locations and physical characteristics of habitat restoration work sites and the work conducted at the sites are entered using a standard form. As of October 2022, 36 organisations had become members of the archive and details of over 1200 work sites had been entered, primarily in NE NSW. More are being entered every week.

Information can be shared among members to assist with regional coordination and can be used to create maps and summary tables for reporting, communication and promotions.

A large amount of the koala projects undertaken in the Northern Rivers has been entered enabling the contents to contribute to strategic conservation planning.

It is an aim of the Regional Strategy to include all koala habitat restoration projects, past, current and future on the hub.

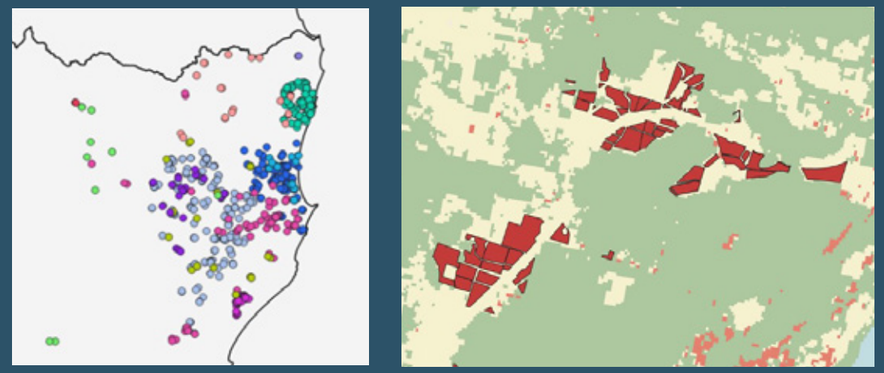


Figure 9: Sites entered by individual restoration groups and Transport for NSW Pacific Highway offset plantings for koalas

3.3.2 Koala population monitoring research

Population monitoring aims to pick up the long-term changes in koala numbers, population trends and spatial distribution over time.

The NSW Koala Monitoring Framework outlines current methods for local, regional and state-wide monitoring.

Regional population monitoring

The first regional assessment was completed in 2018 through an ARC Linkage collaboration between the University of Queensland, four far north Councils (Ballina, Byron, Lismore and Tweed), Friends of the Koala, the university of Sydney and Southern Cross University, as part of the Conserving and recovering the koala populations on the New South Wales Far North Coast project.

Spot Assessment technique (SAT) surveys were done at 302 field sites, following the techniques of Phillips and Callaghan (2011). This resulted in more than 9,000 trees surveyed for evidence of koala use, and biophysical site features recorded for each site (McAlpine et al. 2023).

Outputs of the 2018 and 2022 (see below) surveys included regional-scale information on koala distribution and activity levels, habitat use and tree species preferences. A particular focus was on the interaction between the distribution of preferred food tree species and the amount of habitat in the landscape.

The second regional survey was undertaken in 2021-2022 and was expanded to cover the entire region (including Kyogle and Richmond Valley), an area of over one million hectares, that is highly diverse in terms of topography, vegetation and current and historical land uses.

Spot Assessment Technique (SAT) was again used at 350 sites distributed evenly at 5 km intervals across the study area including all land tenures. A subset of sites from the 2018 surveys were re-sampled (n=25) during this survey and results of recent Council surveys were used (n = 33) where possible.

The 2021-22 survey confirmed the widespread persistence of koalas and highlighted the particular importance of the Richmond River floodplain as supporting a significant population and a substantial proportion of the highest quality koala habitat in the region.

Koala occupancy across the region was estimated at between 30% and 37%, with low residential occupancy at between 16% and 24%. The higher estimates are obtained when analysing only those sites which contained Preferred Koala Food Trees (PKFTs).

Koala occupancy is highly variable across the study area, with resident koalas occurring in 48.65% of all occupied sites but ranging from 0% in Byron Shire to > 60% of occupied sites in Lismore.

No significant difference in koala occupancy and activity levels was found for the 25 sites which were surveyed in both 2018 and in the 2021-22 survey. Site-based changes were observed at 16 sites, and were attributed to metapopulation dynamics.

Transport for NSW monitoring

In 2016 the Roads and Maritime Service (now Transport for NSW) was granted approval for the Woolgoolga to Ballina upgrade of the Pacific Highway. The highway passed through several koala populations in Ballina and Richmond Valley Local Government Areas. One of the approval conditions required Transport NSW to undertake a long-term biennial monitoring program for these koala populations. Approximately 100 transects are searched for koalas and results measured against the baseline of the Population Viability Analysis. Scats are collected for analysis. The fifth year of monitoring has been completed in 2022.

Detailed results can be found in the Koala Monitoring Program Annual Report. Year four population surveys were completed during spring 2020 and autumn 2021. Fewer koalas were recorded in year 4 than year 3 in both focal areas. Bayesian estimation analyses of survey data suggest there is increasing evidence of a negative population trend at Broadwater and a stable population at Bagotville, even though the latter did have lower empirical counts and densities compared to Year 3. More years of population data are required to reduce the level of uncertainty and improve the level of confidence in determining population trends (Transport NSW, 2021).

Survey Techniques

Other survey techniques are being trialled in the regional area by members of the Northern Regional Koala Network (NRKN). These techniques include a visual search survey such as spotlighting, line transects, detection dogs and sound meters.

The choice of survey techniques depends upon the research question and data requirements.

The following provides a brief overview of techniques from McAlpine et al., (2023).

The SAT survey techniques contrast with visual search for koalas, but unlike SAT, visual methods rely upon a koala's presence at the time of the survey. Detection dogs can be used for koala presence, or recent koala pellets. The advantage of the systematic SAT surveys are the collection of detailed tree species and habitat data at each site for later analyses. Another advantage of systematic SAT surveys is that they record evidence of koala use of sites over a period of time, rather than relying upon koala presence at the specific time of survey.

Acoustic surveys are useful for detection of koalas but cannot identify specific tree use. Radio-tracking is useful to identify the sequence of trees used by koalas during the survey time, 24-hour, and annual cycles. Radio tracking can allow for comparison of tree use by males and females and distances moved between trees, but is limited by extensive resource requirements and the area it can cover compared to visual techniques.

Citizen science and community observation records, especially recording of sightings is extremely useful to help establish and monitor koala occupancy and distribution. Sightings data are limited to areas close to human settlements and the ability of the recorder. All efforts to encourage robust data collected by citizen science is encouraged under the Regional Strategy.

Koala injection. Photo FOK

Magnus in hospital. Photo FOK

3.3.3 Threat reduction research and management

All of the following threats in this section can seriously affect koala populations. Actions under the strategy address these threats.

3.3.3.1 Koala health - disease and injury research and findings

IFAW vets assessing a sick koala. Photo FOK

Across the Far North Coast region, the rehabilitation of injured, sick, and orphaned koalas is carried out by Friends of the Koala (FOK) Inc under a biodiversity conservation license in accordance with the provisions of Part 2 of the NSW Biodiversity Conservation Act 2016. Other wildlife care organisations (WIRES Northern Rivers, Northern Rivers Wildlife Carers, Byron Bay Wildlife Hospital, Tweed Valley Wildlife Carers) work in partnership with FOK and direct enquiries re sick/injured koalas to FOK.

Chlamydia is a serious issue for koalas, leading to blindness, infections, and infertility. This disease weakens koalas and can make them more susceptible to dog attacks and other threats. A *Chlamydia* vaccine for koalas could increase the species' resistance to the potentially fatal disease. Two vaccines developed independently by the University of Sunshine Coast and Queensland University of Technology are currently undergoing trials in koalas in NSW and Queensland. Trials are showing positive results for protection against *Chlamydia* however most are still in the early phases and trials are ongoing. Friends of the Koala and the University of the Sunshine Coast have a project that is trialing the vaccine in the Northern Rivers.

The NSW Government has supported vaccine trials through grants established as part of the NSW Koala Research Plan, an action under the NSW Koala Strategy. Recent advances in vaccine research were presented at the 2023 Koala Research Symposium.

The University of Sydney Koala Health Hub is striving to bring together researchers and koala managers from across the country, so that research can better inform management, and so managers can better direct research, to find the answers they need to protect the koala from disease.

3.3.3.2 Koalas and climate change

The International Union for Conservation of Nature (IUCN) has identified the koala as one of a handful of species highly vulnerable to climate change and koalas are recorded in the IUCN Red List of Threatened Species (IUCN, 2009).
One of the most important elements in understanding the future impacts on koalas due to climate change is the changing distribution of their preferred food trees (Adams-Hosking et al., 2012).

The National Recovery Plan identifies the risks to koalas due to a 'shrinking climate envelope' and the wide scale effects of climate change. National recovery plan climate change (Section 19).

The increasing level of atmospheric CO_2 is changing the nutritional value of plants (Adams-Hosking et al., 2012). As Carbon Dioxide (CO_2) increases, the production of protein within the foliage has been shown to reduce with a corresponding rise in levels of tannins, resulting in increases in malnutrition within folivores such as koalas (Lunney et al., 2012). This is exacerbated during drought conditions when reduced water availability may limit moisture and quality of leaves in food trees. Low moisture content and higher toxin levels in the foliage of food trees such as the Tallowwood *Eucalyptus microcorys* during droughts can result in the koalas changing their preference for eating these leaves (Adams-Hosking et al., 2012). The effects of CO_2-driven concentrations of nitrogen and toxic secondary metabolites are still under study but critically important to koala conservation (Hovenden & Williams, 2010). This is crucial to koalas as eucalypts are their only food source and tree preference is often observed by wildlife carers. The added challenge of finding enough suitable food means increased time spent moving across the landscape, leading to higher levels of vehicle strike and interactions with dogs (IUCN, 2009, Adams-Hosking et al., 2011).

Places for climate refugia, e.g., habitat on riparian zones, become increasingly vital under climate change scenarios. Contractions in koala populations due to drier and warmer conditions are occurring across the eastern areas of NSW and south-east Queensland. This effect on populations is possibly added to by the additional threats that arise from increased human populations with their associated dogs and cars (Adams-Hosking et al., 2011, Adams-Hosking et al., 2012).

Additional stresses under a changing climate arise in the face of increasing impacts from extreme weather events. These may come in the form of ever more devastating flooding, intense heatwaves, catastrophic fire, storms, and insect defoliation. Many of which have been experienced in record breaking scale in recent years on the east coast of Australia. The CSIRO State of the Climate report (2020) documents a rise in average temperatures in Australia by 1.44 ± 0.24°C since national records began in 1910, with increases in the number of fire days and heatwaves. As droughts become more frequent, so too do more intense rainfall events (CSIRO, 2020).

The north coast of NSW is predicted to see a decrease in rainfall in winter and early spring, and increased rainfall in autumn and late spring (Adapt NSW, 2021). The average maximum temperatures are projected to rise by a further 0.4 - 1.0°C in coming years and 1.5 - 2.4°C later in the 21st Century, with severe fire weather days increasing in spring and summer (Adapt NSW, 2021).

Within the region, key source populations of koalas are vital for recovery following adverse events, such as droughts and bushfires. Given climate extremes and variables under current scenarios, there is increasing importance for each of the local Councils as well as all community organisations, to share expertise and resources and to work in partnership towards assisting the existing koala populations to survive and become climate resilient.

3.3.3.3 Koalas and vehicle strike

Some roads are a barrier to koala movements across the landscape (NSW, 2006) and vehicle strike is a known threat to koala populations (OEH, 2017 & 2018, DEEC, 2008). Vehicle strike accounted for 7% of FOK hospital admissions in 2021-2022.

Death and injury of koalas on roads is highly seasonal with the peak activity being closely associated with the breeding season from mid-July through to January/February. Records of road kills usually peak through the early part of the breeding season starting as early as August and taper off in mid to late summer. Road kills outside this period are less common (Lassau et al., 2010). Recent studies have confirmed the extent of koala roadkill and the challenges in mitigating the impact (Lunney et al., 2022).

Koala road sign. Photo: Byron Shire Council.

Generally, the records of koala care groups show that speeds greater than 60 km/hour are considered incompatible with drivers being able to safely see a koala crossing the road and take evasive action (J. Turbill, DECC, pers. comm.). Trials of koala zone speed limits require that drivers lower driving speeds between the months of August and December and between 7 pm and 5 am, when koalas are most likely to be moving on the ground. This has met with limited success in terms of reducing car speed (de Villiers, 1999). Koala speed zones may have potential benefits in urban areas in NSW, but cooperation and support from local governments and the NSW Police Force is required for this to be successful.

The NSW Government has produced a series of fact sheets to help local governments to prevent koala vehicle strike.

Fact sheet 1: Wildlife vehicle strike and contributing factors — click here

Fact sheet 2: How to keep koalas of the road — click here

Fact sheet 3: How to change driver behavior — click here

Fact sheet 4: How to record koala vehicle strike and monitor mitigation efforts — click here

Councils will be the lead agency for these actions working with appropriate agencies to identify feasible mitigation actions. Actions available to councils include installation of crossing structures (e.g. culverts), fencing, dynamic signs, pavement treatments, slow points/roundabouts, driver alert systems, roadside management/slashing, media campaigns, community art projects, and community action.

3.3.3.4 Pest and domestic animal control

Dogs attacks contribute to about 5% of admissions to the FOK hospital. Actions to achieve domestic animal control, mainly dogs, are largely based on education, on ground awareness and best practice / current science.

The psychology of behavior change is being increasingly used by councils to deliver programs to their communities on the benefits of responsible dog ownership.

Research in peri-urban areas of south-east Queensland (Gentle M et al., 2019) show that wild dog predation is a significant cause of koala mortality and the researchers suggested strategies to reduce predation on koalas should focus on reducing the impact of free-ranging wild dog populations. This may not be the case in the Northern Rivers but given the proximity of south-east Queensland and the growing peri-urban areas in our region. Recent genetic testing suggests that the vast majority of animals considered to be wild dogs are actually dingoes (Cairns et al., 2022). In terms of their genetic composition, only 1% of 5000 wild canids tested were, in fact, feral dogs, with 33.7% pure dingoes, 30.4 % probable dingoes, and 34.7% canids having a higher 50-60% dingo ancestry. There is also research to suggest that culling dingoes can affect their pack social structures destabilising populations (Wallach et al., 2009). Baiting and trapping of dingoes can even affect native grasslands leading to an over-abundance of weedy shrubs (Gordon et al., 2016). This topic warrants further research.

3.4 Community research – the role of education and social willingness

3.4.1 Social willingness

Social willingness to engage in conservation actions is a key contributor to project success.

> "..... social acceptability exerted a strong influence on spatial conservation priorities suggesting it plays a key role in prioritising conservation opportunities."

An internet-based mapping survey was conducted across four north coast LGAs during December 2017 and March 2018 (Brown et al., 2019 a,b).

The aim of this project was to use mapping completed online by the public to collect spatial data of where koalas are seen within the region. This was then compared to an expert-derived koala likelihood map to improve the accuracy. When economic, sociological and social criteria were added, the social acceptability criterion exerted the greatest influence on spatial conservation priorities (Brown et al., 2019 a,b)

This work is now being extended to better understand landholder willingness to participate in private land conservation on their properties and what this means for private land conservation investment priorities and engagement strategies.

Combining this spatial information with ecological information and economic feasibility (such as property values and data from voluntary conservation agreements), can help us to better identify areas for conservation.

The most successful strategies for identifying viable opportunities for protecting koalas and their habitat identified by Brown et al., (2019) lay where socially acceptable, economically viable and ecologically significant elements overlapped (Figure 10).

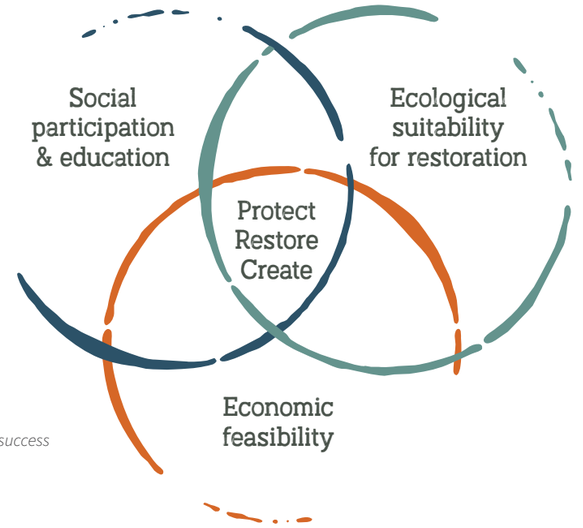


Figure 10: The sweet spot to achieve success

3.4.2 Education and training

What will be the major factors to encourage community to safeguarde koalas?

It has been shown (Fielding et al., 2022) that people in the Northern Rivers with a stronger environmental identity and more knowledge about koalas were also more likely to advocate government for koala protection.

The study identified the role of conservation agencies such as the Biodiversity Conservation Trust (BCT) in addressing the economic and ecological elements in property selection for habitat restoration programs.

The study by Fielding et al. (2022) fleshed out the social acceptance element finding that a greater willingness to protect koalas was highly correlated with knowledge of koalas. Education about threats, ways to assist in koala survival and positive role models are all equally important.

The results of this research are the concepts that underpin successful community groups and their outcomes. People are more likely to act in a positive environmental manner when their social group is supportive of pro-environmental action (Fielding and Hornsey, 2016). Social identity or being part of a positive environmental organisation (e.g. Friends of Koala Inc, Landcare, Recovering Ballina Koalas, Team Koala and Bangalow Koalas) provides both positive environmental and social outcomes. Crucial to future outcomes for koala groups are connections to younger people especially indigenous youth (Schlagloth et al., 2018). Young people in general are supportive of good environmental outcomes and this offers great opportunity for koala habitat restoration (Fielding and Hornsey, 2016, Hansen and Sandberg, 2020).

> The level of environmental awareness is the main indicator for engagement in koala conservation initiatives in the Northern Rivers
>
> (Fielding et al., 2022)

Planting for the next generation.
Photo Border Ranges Richmond Valley Landcare.

Education through on-ground learning such as practical workshops and participation in community tree plantings has been shown to have tangible outcomes for restoration of habitat (Hansen and Sandberg, 2020). It is commonly recognised that new landowners buying property in the Northern Rivers are looking for the values associated with living in a natural landscape.

The role of on-ground assistance through FOK, regional groups, NGOs, Landcare, and Council extension services will be crucial for large scale restoration of degraded koala habitat. Information sharing through workshops and newsletters has also been found to be beneficial.

Unified clear messages are essential and a regional approach to communications has great merit.

3.5 Why we need combined management actions

It is through the adoption of multiple management actions that regional koala populations can be preserved and assisted in recovery, building resilience in a changing climate.

The study by Camus et al. (2022), based on observations by regional experts in koala ecology, found the populations in the hinterland regions were most likely to respond positively (though marginally) to the implementation of any single management action compared to coastal and riverine landscapes. Single actions were not effective except in the riverine landscape where it was thought that disease and injury management alone could prevent population decline. When multi action scenarios were implemented, the riverine landscape showed the highest recovery.

The unambiguous findings of McAlpine et al. (2023) that "…large specimens of the preferred eucalypt and other species are an even more critical resource for koalas, so we should maximise their protection and plan for the long-term restoration of mature forests containing these species" provides the incentivisation for combining habitat protection, restoration and creation, with vehicle, disease and dog control management strategies (Camus et al., 2019). The results of the expert elicitation process analysed by Bayesian network probability models of Camus et al., (2022) identified that if most management actions tested were carried out then there was a high probability that koala populations would increase in abundance in all landscapes - coastal, hinterland and riverine in the region.

Although habitat protection and/or habitat restoration alone were not predicted to be sufficient to reverse the decline of koala populations in any landscape, any reduction in habitat area will result in changes in the potential stability, viability, and maximum size of the koala population. Habitat protection is assumed to also reduce the likelihood of disease prevalence.

For riverine and coastal areas, the management of disease, injury and vehicle hotspot strikes provide the most effective slowing of population decline. When these actions are combined with one or more other actions, such as habitat protection and/or restoration, the populations are predicted to begin recovering across all zones. It is important to note that this research was conducted prior to the extensive loss of habitat due to the fires of 2019 and the floods of 2022. A more recent study by Goldingay et al. (2022) found that proximity of rainforest areas positively influenced koala populations across drought years, potentially due to thermal buffering and higher retention of moisture in the soil.

> …..Camus et al., 2022 identified that if most management actions tested were carried out then there was a high probability that koala populations would increase in abundance in all landscapes, coastal, hinterland and riverine in the Northern Rivers region.

3.6 Strategic mapping criteria

The following existing data sets and local knowledge have been used to prioritise areas under the three categories of

Protect – Restore – Create.

For more details on the strategic mapping methodology and details of data sets.

click here

PROTECT	• High koala habitat suitability rating with existing native vegetation present. • Persistent populations. • Bushfire refugia. • Drought and heatwave refugia.
RESTORE (Priority)	• High community acceptance. • Bushfire affected areas with High Koala Habitat Suitability. • Adjacent to persistent populations. • Existing native vegetation within an identified linkage. • Flood affected areas.
RESTORE	• Medium koala habitat suitability rating with existing native vegetation present. • Bushfire affected areas with medium koala habitat suitability.
CREATE	• Medium to high koala habitat suitability rating with no existing native vegetation present. • Cleared land within persistent population grid. • Linkages between key population areas which have a low urbanisation value.

Koala Habitat Suitability

NSW Koala Habitat Information Base (2019) - state-wide spatial data on koala habitat, likelihood, koala preferred food trees and koala sightings for NSW. This model is being updated, and the updates will be used when they become available.

Koala Habitat Suitability Model (KHSM) – the probability of finding koala habitat at any location. The model predicts the likelihood of finding habitat that is ecologically similar to where koalas have been observed over the past 40 years.

Persistent populations

BioNet and ALA sightings data were used to create a 1 km grid of persistent populations. This was defined as at least 3 generations of koalas (DPE pers. comm).

Refugia

Refugia can be considered as habitat that provides spatial and/or temporal protection from one or more threats (Youngentob et al., 2021).

Several projects are currently underway to elicit key factors determining koala persistence during drought and heatwave, including projects by NSW Department of Environment (DPE) and projects at Australian National University.

The DPE 2022 Koala habitat restoration guidelines emphasises the need and potential for fire and/or drought refugia for koalas in the coming decades (DPE, 2022). Runge et al. (2021) discuss the key elements of adaption as:

- Bushfire refugia - Short or long-term refugia from bushfire.
- Climate refugia - Short or long-term refugia from drought and heatwaves.

Bushfire Refugia:

Bushfire refugia are places that have a low burn frequency based on historical fire history mapping or NDVI/water availability (Runge et al., 2021).

This criterion was mapped as large remnants that have not been burnt in recorded history.

Climate Refugia:

Climate refugia - The availability of surface water may be an important ancillary habitat element of refugia in these areas (Youngentob et al., 2021). DPIE (2020) suggest patches of vegetation contiguous with perennial streams provide some protection during times of drought and heat stress.

This criterion was mapped as existing vegetation adjacent to perennial water and in close proximity to a large

Eco-cultural burn. Photo Andy Baker.

Together. Photo: Border Ranges Richmond Valley Landcare.

Community Acceptance

These areas have been identified through several methods:

- Advice from on the ground networks (Council Project Officers and Landcare Coordinators).
- Social data of community acceptance of koalas from the study by (Brown et al. 2019); Tweed, Ballina, Byron and Lismore LGAs.
- Existing data such as Conservation Agreements, ALA Hub data etc.

Bushfire Affected Areas

Mapped Wildfires in the previous 10 years were used to map bushfire affected areas.

Flood Affected Areas

These data have been requested from DPE but have not yet been made available.

Linkages

North-east NSW Fauna Corridor mapping was used as the base for identifying linkages between koala populations. Lismore City Council Habitats and Corridors mapping was also incorporated.

It will be important to incorporate other wildlife corridor mapping as it becomes available.

3.7 Management actions and plans in the region

Figure 11: The Northern Rivers region with local government area boundaries and areasthat have Comprehensive Koala Plans of Management (Source NPWS and LGA's).

It has been a goal of some local governments (Tweed, Byron, Ballina and Lismore) to produce part of LGA Comprehensive Koala Plans of Management (CKPoM) that collectively address koala conservation planning for sections of the study region. CKPoMS are formally approved under NSW planning legislation and managed within the shire council. These plans were developed in accordance with the previous SEPP 44 but have been adopted by NSW government under the 2021 SEPP. Some of these plans may be updated when the new guidelines are finalised.

Tweed and Byron Councils also have dedicated Koala Project or Conservation Officers. These officers are the point of contact for landowners wishing to be involved in koala projects on their land or on other sites. Subject to resources, regional partners can apply for funding from various government sources for dedicated koala restoration projects which may involve planting, education, and maintenance of koala habitat. Partnerships between councils to apply for funding and administer large grants has helped the smaller councils to achieve significant habitat restoration.

The long-term value of a CKPoM has been considered for Coffs Harbour (Lunney et al. 2019) providing a means of predicting the value of this current Regional Strategy.

Comprehensive Koala Plans of Management (CKPoM)

Tweed click here

Ballina click here

Byron click here

Lismore click here

3.7.2 Local Government Conservation Zones

The types of zones that Council can use are set by the NSW Government. In 2012, a new set of rules was developed for how Councils should apply environmental zoning in northern NSW. This included ecological criteria that land must meet before it can be zoned for environmental purposes, and a range of other recommendations for Councils on how to apply zones to protect natural areas while also supporting rural activities. The NSW Government also recently changed the name of environmental zones to 'Conservation zones'.

Conservation zones, or C zones, are used to define areas of land where protection of environmental significance is the main consideration. C Zones are an important part of Local Environment Plans (LEPs) and are standard in most local government areas that have bushland or other natural areas that need to be carefully managed. There are 4 C zones available for use:

- **C1 – National Parks and Nature Reserves**
- **C2 – Environmental Conservation**
- **C3 – Environmental Management**
- **C4 – Environmental Living**

Each council in the Northern Rivers is at a different stage with regard to implementing C zones.

3.7.3 Local Government koala studies

In addition to CKPoMs some LGAs have undertaken habitat and population studies. For example:

- Tweed Coast Koala Habitat Study 2011
- Tweed Coast Koala Study 2015
- Tweed Coast Koala Study 2018
- Byron Coast Koala Habitat Study 2012
- Ballina LGA Koala Habitat & Population Assessment 2013
- Lismore LGA Aspects of the Ecology, Distribution and Abundance of koalas 2011
- Lismore LGA (part) Koala Habitat & Population Assessment 2017
- Lismore CKPoM Koala Monitoring Field Survey Report 2020
- Richmond Valley LGA Koala Habitat & Population Assessment 2015

Koala and joey in the road. Photo: M Bingham, BSC.

3.7.4 National Parks and Wildlife Service

NSW National Parks and Wildlife Service (NPWS) is the first national parks agency in Australia to commit to a zero extinctions target. The National Parks and Wildlife Act 1974 was amended to allow the Minister for Energy and Environment to declare an area to be an Asset of Intergenerational Significance (AIS). An AIS can be any area of exceptional value – natural or cultural – that warrants special protection, including dedicated management. Practically, it means that the NSW National Parks and Wildlife Service will have increased ability to prioritise management at these sites and identify emerging threats early so interventions can take place rapidly. Assets of Intergenerational Significance will play a critical role in meeting our zero extinctions target. There are more than 200 sites declared, protecting over 90 declared threatened species including the iconic koala. AIS in the Northern Rivers can be viewed via the

Assets of Intergeneration Significance Interactive Map click here

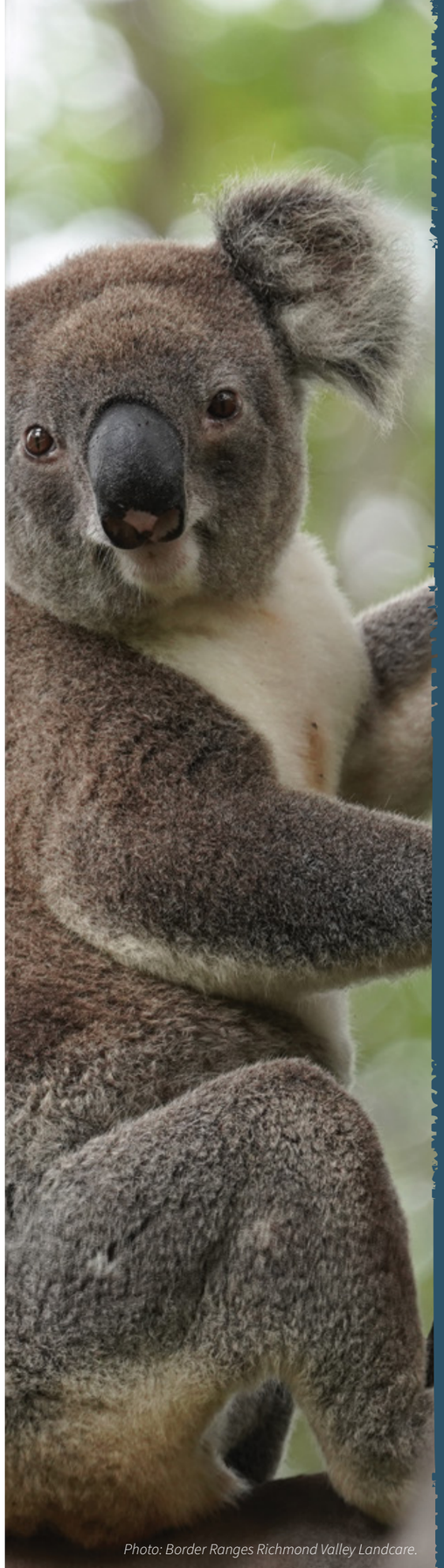


Photo: Border Ranges Richmond Valley Landcare.

3.7.5 Private Land Conservation

Private landholders hold the key to re-building connectivity for koalas across the landscape and therefore helping to maintain and increase declining koala populations.

Private land conservation occurs where a private landholder manages some or all of their land for biodiversity, nature or wildlife conservation purposes.

There is active involvement in private land conservation programs in the region. This includes non-binding programs such as Land for Wildlife, together with perpetual voluntary conservation agreements. The level of interest in voluntary conservation agreements is currently higher than can be addressed by the Biodiversity Conservation Trust. Actions and projects to address this limitation can greatly assist to protect koala habitat.

The International Union for the Conservation of Nature (IUCN) defines a protected area as 'a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.'

3.7.5.1 Biodiversity Conservation Trust

The Biodiversity Conservation Trust (BCT) partners with private landholders to conserve biodiversity. In NSW, choosing to participate in private land conservation is voluntary. However, if a landholder and the BCT enter an in-perpetuity agreement, that agreement takes the form of a permanent legal covenant on the title of the land that binds the NSW Government and the successors in title (except in exceptional circumstances allowed in the Act). It has three major programs offering different levels of private land conservation.

- Wildlife refuge agreements
- Conservation agreements
- Biodiversity stewardship agreements

A biodiversity stewardship agreement or a permanent conservation agreement under the Act meet the IUCN definition of a private protected area and becomes part of the National Reserve System.

For more info on Private Land Conservation click here

3.7.5.2 Land for Wildlife

Land for Wildlife (LfW) encourages and assists landholders to include nature conservation along with other land management objectives. The program is free for landholders to join and is not legally binding. It is a great stepping stone for landholders into further conservation actions and links to other landholders and organisations doing similar conservation work.

Koala habitat. Photo Andy Baker

3.7.6 NSW Koala Strategy

The NSW Government's updated Koala Strategy is providing financial support for Councils, FOK, and other organisations on a range of koala conservation projects across the Northern Rivers.

Tweed Shire Council monitoring of the Sleepy Hollow land bridge on the Pacific Highway undertaken in 2014 recorded koala use, including a mother with back young. Photo Brendan Taylor

3.7.7 Indigenous Protected Areas

There are two Indigenous Protected Areas (IPAs) in the region and both have cultural burning projects.

- Ngunya jargoon
- Minyumai

3.7.8 Transport for NSW

With the upgrade of the Pacific Highway between Woolgoolga and Ballina Transport for NSW were required to implement mitigation measures (grids, fencing and underpasses) compensatory planting and carry out annual monitoring (Transport for NSW, 2021).

Box culvert under Pacific Hwy at Broadwater with escape pole for koala and post and rail furniture for arboreals to move through the underpass. Photo Brendan Taylor

Table 4: Understanding various current management actions and plans within the region and their roles in protection, restoration and creation and threat mitigation.

Local Government Area	Protect	Restore	Create
Tweed Shire	**Tweed Coast Comprehensive Koala Plan of Management** protects Koala habitat in the coastal zone east of the M1 motorway. As part of Council funded **CKPoM** program – • Koala zones - black spot road treatments. • Domestic dog education programs **High Biodiversity Values** mapping of Core Koala Habitat means clearing requires entry into the NSW Biodiversity Offsets scheme. **Tweed Coast Habitat Studies** in coastal zone 2011, 2015, 2018 and 2022 enable koala activity monitoring. Council run the **Land for Wildlife** program.	As part of Council funded **CKPoM** program – • Koala project officer guiding restoration works on private land. • Koala habitat restoration throughout bushland reserves on the Tweed Coast • Koala habitat restoration areas published as an online map. **NPWS & TSC** funded **bush regeneration** works in Cudgen & Cudgera Creek Nature Reserve. **Fire and Koalas** working with NSW Rural Fire Service, NPWS, the Northern Rivers Fire and Biodiversity Consortium and FOK to implement burn plans in Council bushland reserves. **Private Land Restoration**	**Council Environmental Grants** provide funding to create new habitat connections on private land. A Koala project officer is employed to guide these works. Koala habitat creation areas outlined in an online map. **Tweed Coast Comprehensive Koala Plan of Management** - more than 60,000 trees planted on public and private land sites **Koala Connections** project 2012 - 2016 planted 73000 trees over 120 sites across Tweed and Byron Local government areas **Saving our Koalas** donations to plant trees on private property. **Tweed Landcare Inc** run many funded projects and provide small grants for tree planting. As of March 2023 **Bangalow Koalas** has planted over 250 000 trees across the 6 LGAs.
Byron Shire	**Byron Coast Comprehensive Koala Plan of Management** protects koala habitat in the coastal zone east of the M1 Motorway. As part of Council funded **CKPoM** program – • Koala black spot road treatments. • Award-winning pilot Leash-up program, engaging dog owners, including signage and regional TV advertising. **High Environmental Values** mapping of Core Koala Habitat means clearing requires entry into the NSW Biodiversity Offsets scheme. **Habitat Studies** in coastal zone 2012, 2016, 2021 enable population monitoring. CZones have been applied under Local Environmental Plan.	As part of Council funded **CKPoM** program – • Koala project officer guiding restoration works on private land. • Council restorations team working to restore and maintain koala habitat at Council Sewerage Treatment Facilities and Resource Recovery Centre. **Private landholders** • Farm extension program supporting rural land custodians with regenerative agriculture and biodiversity conservation. • Database of private landholders interested in on-ground habitat restoration. • Map of Byron Shire restoration sites. **Fire** • Developing map of sclerophyll forest sites requiring reintroduction of fire. • Working with BVL and ZEB on Good Fire project to encourage eco-cultural burning in priority areas. Wildlife corridor mapping identifying key landscape-scale connections for threatened fauna including koalas.	• A Koala Project Officer is employed to guide grant-funded habitat connections on private land. • Area planted through Byron Shire habitat restoration projects : Byron Habitat Corridors: 10 ha koala habitat planted/restored between 2016 and 2019; Koala Food for the Future and NE Hinterland Project: over 12 Ha koala habitat planting/restoration between 2018 and 2021; 2022 Koala habitat restoration project : aiming to achieve additional 6ha koala habitat planting/restoration by end 2022. As of March 2023 **Bangalow Koalas** has planted over 250 000 trees across the 6 LGAs. **Brunswick Valley Landcare** run many funded projects and landholder engagement. Currently have an Environmental Trust project focusing on koala habitat along Tallowood Ridge. Run the Land for Wildlife program with some financial support from council.

Local Government Area	Protect	Restore	Create
Lismore City	Comprehensive Koala Plan of Management for south-east Lismore protects habitat in the south-east portion of LGA. High Biodiversity Values mapping of Core Koala Habitat means clearing requires entry into the NSW Biodiversity Offsets scheme.	Council-funded restoration works through Rural Landholder Initiative. Road strike projects	Council-funded revegetation works through Rural Landholder Initiative **Friends of the Koala** hospital based here. Friends of the Koala nursery based here. Friends of the Koala run many funded projects including Environmental Trust projects and other DPE funded projects As of March 2023 **Bangalow Koalas** has planted over 250 000 trees across the 6 LGAs. **Richmond Landcare** run many funded projets and landholder engagement. Run the Land for Wildlife program. Rural Landowner Iniative (RLI) Community Plantings Citizen science
Ballina Shire	Ballina Shire Koala Management Strategy seeks to protect habitat in Cumbulum and East Ballina areas. High Biodiversity Values mapping of Core Koala Habitat means clearing requires entry into the NSW Biodiversity Offsets scheme.	Conservation Volunteers Australia restoration programs.	Council projects As of March 2023 **Bangalow Koalas** has planted over 250 000 trees across the 6 LGAs. **Richmond Landcare** run many funded projets and landholder engagement. Run the Land for Wildlife program. Conservation Volunteers Australia revegetation. Community workshops and Field days IFAW programs Citizen science Recovering Ballina Koalas

Local Government Area	Protect	Restore	Create
Kyogle Council	Council resolved to investigate options to protect koala habitat and support koala populations, consistent with the objectives of the Kyogle community Strategic Plan 2022-2032 and Kyogle Council Local Strategic Planning Statement 2020.	Border Ranges Richmond Valley Landcare Network BRRVLN: 154 ha koala habitat restored over 36 properties. Mackellar Range Landcare 2021-23: 9.4 ha of koala habitat restored over 6 properties. 'Boodahbee – Festival of the Koala' occurs annually throughout September. Series of events celebrates koala conservation efforts across the LGA. WWF Australia partnered with Climate Friendly in a new environmental plantings initiative to support landholders to establish koala-friendly carbon farming projects.	BRRVLN: 8245 koala food trees planted over 39 properties. NSW Koala Strategy enabled restoration in occupied koala habitat, planting koala food trees and workshops wot build community knowledge. Saving our Species and the Forestry Cooperation provided additional support to plant a further 7000 trees in corridor plantings. As of March 2023 Bangalow Koalas has planted over 250 000 trees across the 6 LGAs.
Richmond Valley	A Koala Habitat & Population assessment was undertaken in 2014 by Biolink. In this study an analysis of historical records indicated long-term stability in the geographic extent of koala populations across the Richmond Valley LGA but there was a recent drop in the occupied habitat within this extent (Biolink 2014). The recently completed Northern Rivers Koala Activity Assessment identified Richmond Valley Council area as having the largest amount, proportionally, of koala habitat in the region. Based on sightings records alone, it was considered that the central part of the LGA was devoid of koalas (Biolink 2014), though areas of significant koala activity near Casino controvert this notion and illustrate the widespread presence of resident koala populations across all but the southern part of the LGA.	Koala habitat projects in the Richmond Valley LGA have been funded under a mix of riparian and bushfire recovery funding streams. Border Ranges Richmond Valley Landcare Network (BRRVLN) completed restoration across 152 ha over 21 properties. Rappville Landcare 2023 currently underway Restoration across 14 ha – 4 properties.	Rous County Council – currently undertaking a project along the Richmond River in Coraki in partnership with Richmond Valley Council, Bogal Land Council, DPI Fisheries, OzFish, Friends of the Koala, North Coast Local Land Services.

3.8 Organisations in the region involved in habitat restoration and rehabilitation

Each Local Government area hosts projects funded through internal and external government funding. Non-government organisations (NGOs) receive funding from both federal and state government and non-government grant sources. Examples of grants include Landcare Australia, WIRES and NRMA. Other funding comes from philanthropists and donations. Contractors with specialist skills are employed to implement these projects.

Table 5: Government agencies involved in koala habitat restoration

Group	Area covered	Project Focus
Ballina Shire Council	Ballina LGA	Habitat restoration, extenstion, community awareness
Byron Shire Council	Byron LGA	Habitat restoration, extenstion, community awareness
Kyogle Shire Council	Kyogle LGA	Habitat restoration, extenstion, community awareness
Lismore City Council	Lismore LGA	Habitat restoration, extenstion, community awareness
Richmond Valley Council	Richmond Valley LGA	Habitat restoration, extenstion, community awareness
Tweed Shire Council	Tweed LGA	Habitat restoration, extenstion, community awareness
Rous County Council	Ballina, Byron, Lismore & Richmond Valley LGAs	Weed biosecurity (& habitat restoration), flood mitigation, water supply
Local Land Services	Region	Habitat restoration, extension, Pest animal control
National Parks & Wildlife Service	Region	Habitat restoration, support for wildlife care groups
DPE Koala Strategy	Region	Support habitat restoration, research, monitoring
Biodiversity Conservation Trust	Region	Administer Private Land Conservation agreements on private land; support for habitat restoration works part of both funded and unfunded agreements.

Table 6: NGOs and other regional organisation involved in habitat restoration and rehabilitation.

Group	Area covered	Project Focus	Major funding source	Partners
Friends of the Koala Inc. FOK	Region	Habitat restoration, native plant nursery, rescue, koala hospital, rehabilitation, research, koala database, advocacy, community engagement and education.	Donations, Grants	All council, government, universities, NFPs, community and volunteers
Bangalow Koalas	Region	Tree planting, community engagement and education	Donations, Grants	Bangalow Koalas
Saving our Koalas	Tweed Shire	Habitat restoration Bilambil Tweed Heads KMA	Grants	IFAW, TSC, DPE
Team Koala Tweed	Tweed Shire	Community awareness, habitat restoration, advocacy	Donations, Grants	Tweed Shire Council, landowners, other groups
Friends of Cudgen Nature Reserve Inc. FCNR	Tweed Shire	Koala advocacy, Habitat restoration	Grants	TSC, BRS, NPWS
Recovering Ballina Koalas (non incorporated)	Ballina	Habitat restoration	Grants	Community, landholders
ENVITE	Region	Community awareness, Report sightings, Habitat restoration	Grants	All councils, all groups, BCT
Landcare (4 networks cover region) • Tweed Landcare • Brunswick Valley Landcare • Richmond Landcare • Border Ranges Richmond Valley Landcare	Region	Habitat restoration	Grants, Private Donations	Councils, landowners, other groups
Conservation Volunteers Australia	Region & National	Habitat restoration	Grants, Private Donations	Councils, landowners, other groups
World Wildlife Fund WWF Australia	Region & National	Planting Corridors, wildlife hospital, Koala advocacy	Donations	Local koala groups
International Fund for Animal Welfare	Region and National	Research, Monitoring, Advocacy, Supporting habitat restoration	Donations	Local koala groups
Nature Conservation Council	Region	Advocacy	Donations	Local koala groups
Northern Rivers Fire and Biodiversity Consortium NRFABCON	Region	Habitat Restoration using fire	Grants	Councils and other Government Agencies

Case Studies

- Bangalow Koalas — click here
- Burabi Matters — click here
- Fire in Broken Head Open Forest — click here
- Friends of the Koala — click here
- Gondwana Koala Connections — click here
- Koala Watch — click here

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My Notes

Northern Rivers

Regional Koala Conservation Strategy
Protect – Restore – Create