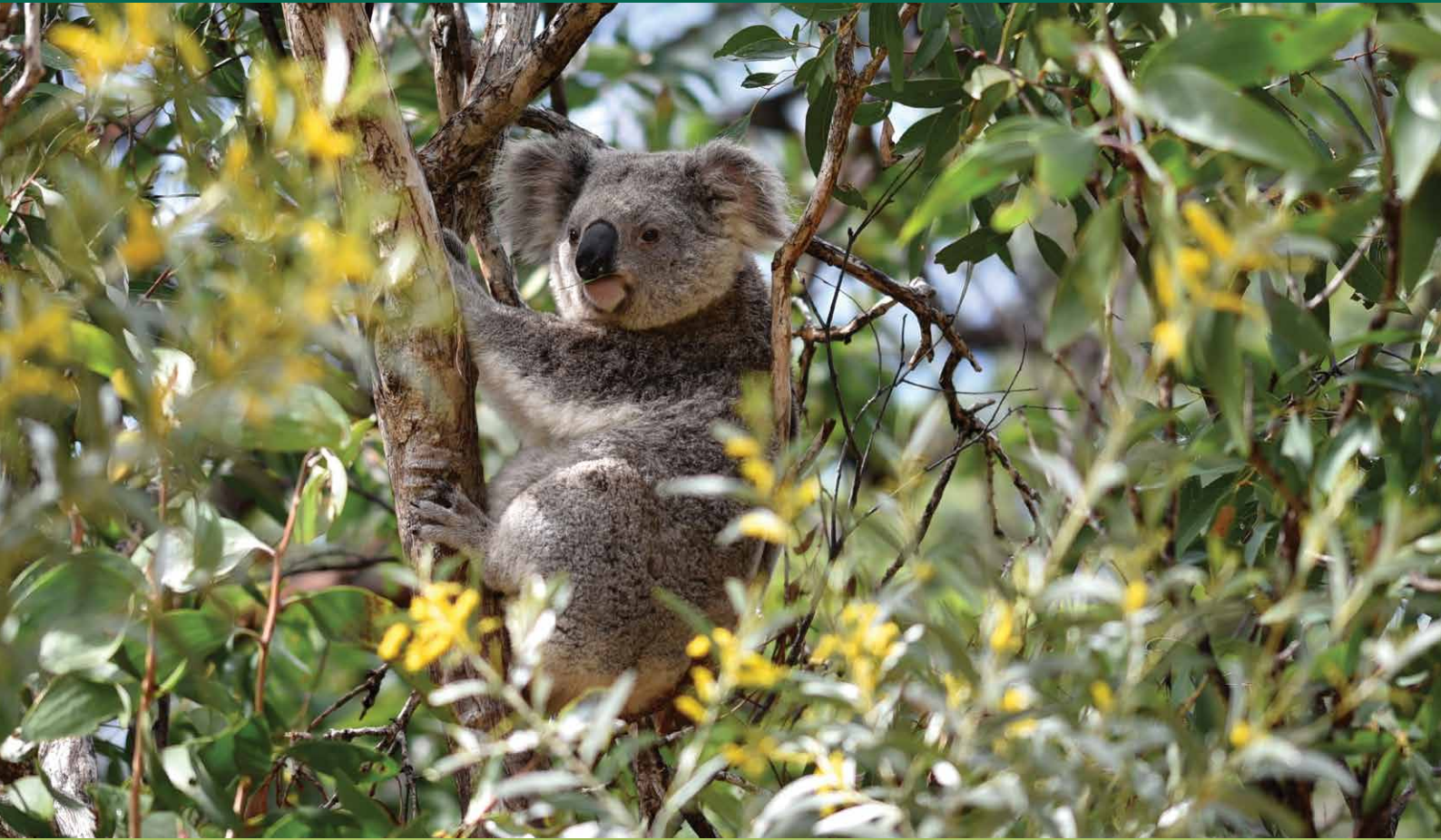




Threatened  
Species  
Recovery  
Hub

National Environmental Science Programme



# Harmonised koala habitat mapping report

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Cover image: Koala. Image: Stefano Borghi, Unsplash

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## Summary

A harmonised map of potential koala habitat was developed for the region encompassing Queensland, New South Wales (NSW) and the Australian Capital Territory (ACT). This map represents the area (ha) and presence of koala habitat in 100ha planning units across this region. The area of habitat is equivalent to the percent coverage of habitat in each planning unit. The map was developed by harmonising existing regional habitat mapping and range-wide and regional species distribution models. Additional models of koala habitat were developed for regions where datasets of koala habitat were not available.

Models that integrate information on bioclimatic variables and koala habitat trees exist for eastern NSW and south-east Queensland (SEQ) and were used without modification. For the rest of Queensland, we generated habitat maps by integrating vegetation mapping and range-wide koala distribution models. In western NSW koala habitat determined from koala distribution models and no information on tree species was included (DES 2020, DPIE 2019).

## Usage

This dataset was developed to inform broad-scale conservation planning associated with the National Koala Recovery plan. The data will be used to inform an updated model of koala distribution and used in spatial query tools that support environmental impact assessments, recovery planning and other spatial analysis in the Commonwealth Department of Agriculture, Water and the Environment (DAWE). The spatial resolution is 100 ha (approximately 1km) and it is not intended for identifying habitat at a fine scale. The dataset has not been ground-truthed. Some areas identified as potential habitat may be too degraded or contain insufficient resources for koalas to occupy. Koalas may be present outside the areas identified as potential habitat. The dataset is available for use under CCBY4.0 licence. Please use the following citation:

Runge CA, Rhodes JR, Cubillos-Lopez DS. 2021. Harmonised koala habitat mapping. Version 1.0. NESP Threatened Species Recovery Hub Project 4.4.12 report. The University of Queensland, Brisbane. <https://doi.org/10.5281/zenodo.4305167>

(a) Likely habitat

(b) Likely and possible habitat

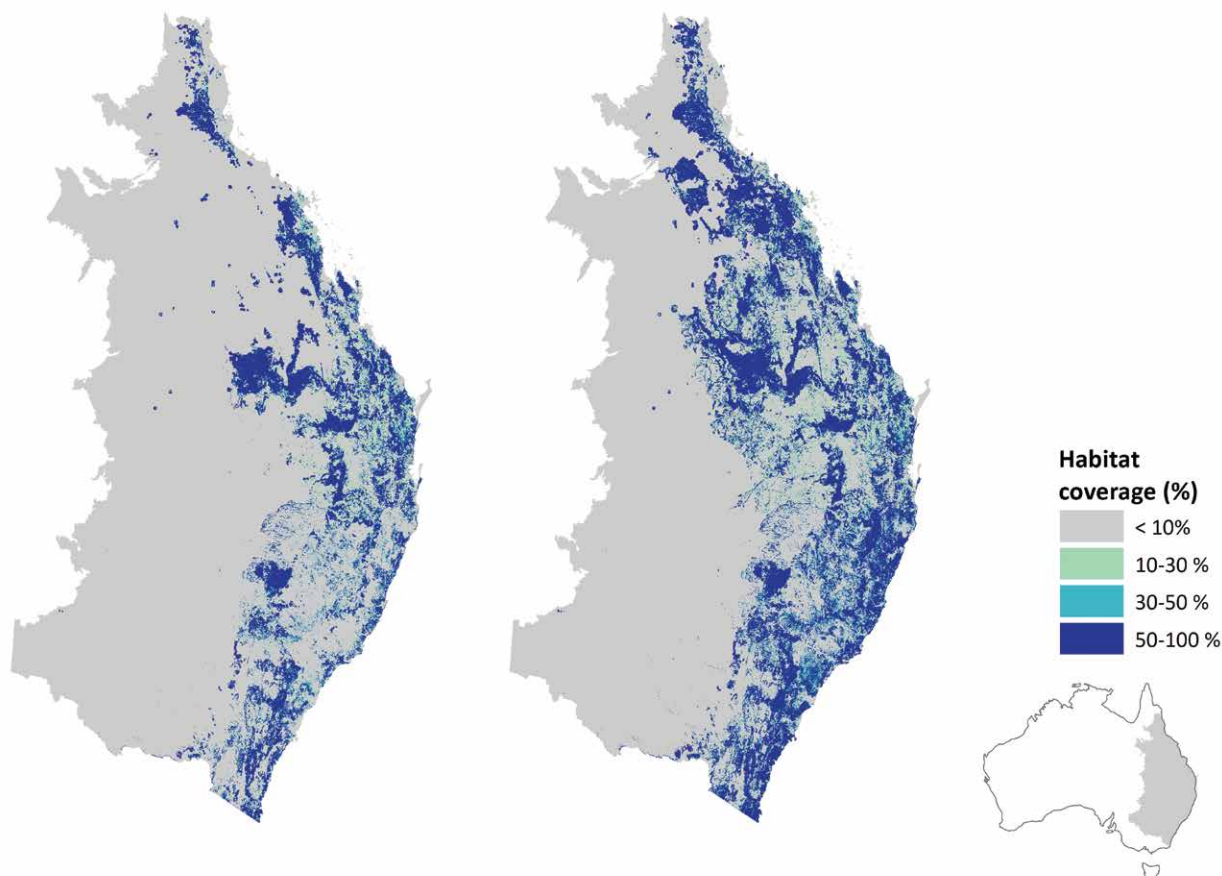


Figure 1. Harmonised map of potential koala habitat (a) coverage of likely habitat and (b) coverage of likely and possible habitat in 100 ha planning units.

## Spatial extent

The dataset maps koala habitat across the range of the listed koala (*EPBC Act 1999*) spanning Queensland, New South Wales and the Australian Capital Territory and excluding Victoria and South Australia. Study region boundaries were drawn by selecting IBRA7 bioregions (DotE 2012) that intersected Commonwealth koala distribution maps (DAWE 2019). Cape York and Gulf bioregions were excluded, and the eastern portions of Mitchell Grass Downs were included as per (Adams-Hosking et al. 2016).

## Methodology

### Methods overview

To develop a dataset suitable for national-scale conservation planning, the study region was projected to GDA94 Australian Albers projection (EPSG:3577) and divided into 100 ha hexagonal planning units (approximately 1km in diameter). The area of habitat and presence of koala habitat in each of these planning units was then estimated from regional datasets as described below. With the exception of western NSW, the area of habitat in each planning unit is equivalent to the percent coverage of habitat in each planning unit, as planning units are 100 ha in area.

Table 1 provides an interpretation of the mapping of habitat area and habitat presence and summary of datasets used in each region.

In planning units spanning border regions, the area of habitat in each planning unit was summed across regions after checking for spatial overlap to avoid double-counting.

Table 1 Summary of habitat mapping within each region

	Interpretation of <i>habitat_ha_total_likely</i> column	Interpretation of <i>habitat_ha_total_possible</i> column	Interpretation of <i>habitat_present_likely</i> column	Interpretation of <i>habitat_present_possible</i> column	Underlying dataset
SEQ	Percentage of planning unit that overlaps core koala habitat area (0-100)	Duplicate of <i>habitat_ha_total_likely</i>	1 = Planning unit overlaps core koala habitat area	Duplicate of <i>habitat_present_likely</i>	Koala Habitat Areas (DES 2020)
Greater Qld	Percentage of planning unit that overlaps regional ecosystem ranked as medium to very high utility for koala, where planning unit predicted to have environmental conditions are highly suitable for koalas. Value= NA where planning unit falls outside koala environmental niche. (0-100)	Percentage of planning unit that overlaps regional ecosystem ranked as medium to very high utility for koala, where planning unit predicted to have environmental conditions that have of medium suitability for koalas. Value= NA where planning unit falls outside koala environmental niche.	1 = planning unit overlaps a regional ecosystem ranked as medium to very high utility for koala, and environmental conditions are predicted to be highly suitable for koalas.	1 = planning unit overlaps a regional ecosystem ranked as medium to very high utility for koala, and environmental conditions are predicted to be of medium suitability for koalas.	Queensland Koala Habitat Mapping (Runge et al. 2021)
Eastern NSW	Percentage of planning unit that overlaps cells ranked as high or very high habitat suitability for koala. 1% = one 10m cell overlapped by planning unit.	Percentage of planning unit that overlaps cells ranked as medium, high or very high habitat suitability for koala. 1% = one 10m cell overlapped by planning unit.	1 = At least 30 % of planning unit ranked as high or very high habitat suitability for koala.	1 = At least 30 % of planning unit ranked as medium to very high habitat suitability for koala.	Regional thresholded Koala Habitat Suitability Models (DPIE 2019)
Western NSW	100 = habitat suitability model predicts conditions within planning unit predicted to fall within koala environmental niche, thresholded at equal sensitivity and specificity. (0, 100)	100 = habitat suitability model predicts conditions within planning unit predicted to fall within koala environmental niche, thresholded at max kappa. (0, 100)	1 = habitat suitability model predicts conditions within planning unit predicted to fall within koala environmental niche, thresholded at equal sensitivity and specificity.	1 = habitat suitability model predicts conditions within planning unit predicted to fall within koala environmental niche, thresholded at max kappa.	Whole-of-range complex Koala Habitat Suitability Model (DPIE 2019)

## Habitat mapping in eastern NSW

The area (ha) of koala habitat in eastern NSW was identified from regional koala habitat suitability models (KHSM, DPIE 2019, 10m resolution) that rank the suitability of the landscape for koala from low to very high. The area of habitat within each planning unit was calculated as the number of cell centroids ranked as high or very high habitat (likely habitat) or medium to very high (possible habitat) suitability for koala. One hectare of habitat is equivalent to one 10m cell overlapped by a given planning unit.

Any planning unit containing >30ha of koala habitat under the two thresholds was assigned as habitat present.

The eastern NSW region includes Koala Management Regions (KMRs) North, Central and South Coast, Northern, Central and Southern Tablelands, and Northwest Slopes. The western region includes KMRs Far West, Riverina, and Darling Riverine Plains.

## Habitat mapping in western NSW

The presence of koala habitat in western NSW was estimated from a koala distribution model developed by the NSW government ('qvn\_sf6\_nrsp\_KHSM/Whole of range complex', DPIE 2019). This model ranks the environmental suitability of each 250m cell for koala. Two thresholds were applied to this dataset. Firstly, a planning unit was assigned as 'likely' koala habitat if the value underlying the centroid of each planning unit was > 0.444 (equal sensitivity and specificity value). Secondly a planning unit was assigned as 'possible' habitat if the value underlying the centroid of each planning unit was > 0.3925 (max kappa value).

Planning units above the threshold value were assigned a nominal habitat area of 100ha, and planning units below this value were assigned non-habitat (0ha).

## Habitat mapping in South-East Queensland

The area (ha) of koala habitat in south-east Queensland (SEQ) was estimated as the percentage of each planning unit intersecting core koala habitat drawn from Koala Habitat Areas (DES 2020). Any planning unit intersecting core koala habitat was assigned as habitat present.

## Habitat mapping in greater Queensland

The area (ha) and presence of koala habitat across greater Queensland was estimated from a dataset developed using a protocol adapted from that used to map habitat in SEQ. Briefly, regional ecosystems (DNRME 2020) were ranked according to their predicted utility to koalas and overlaid with predictions of the environmental suitability of the landscape for koalas (Briscoe et al. 2016; NSW DPIE 2019; Meakin 2020) to generate a predicted ranking of utility of habitat for koalas in each planning unit. Regional ecosystems ranked medium to very-high suitability for koala and falling within planning units ranked as high environmental suitability were assigned as likely habitat. Those falling within planning units ranked as medium environmental suitability were assigned as possible habitat. Full description of the methods can be found in the NESP 4.4.12 report *Mapping habitat for greater Queensland* (Runge et al. 2020). The area (ha) of koala habitat was estimated as the area of each planning unit intersecting habitat ranked 8, 9 or 10 (likely habitat) or between 4 and 10 (possible habitat). Any planning unit containing koala habitat under the two thresholds was assigned as habitat present. Planning units that intersected koala records buffered to 1 km were regarded as having recorded koala observations.

## Data processing

Data processing and analysis was conducted using ArcGIS (ESRI 2020) and R (R Core Team 2020) using packages 'tidyverse' (Wickham et al. 2019), 'raster' (Hijmans 2020), and 'sf' (Pebesma 2018). Code associated with the project can be found at <https://doi.org/10.5281/zenodo.4305356>.

# Harmonised habitat maps, by region

## South-east Queensland

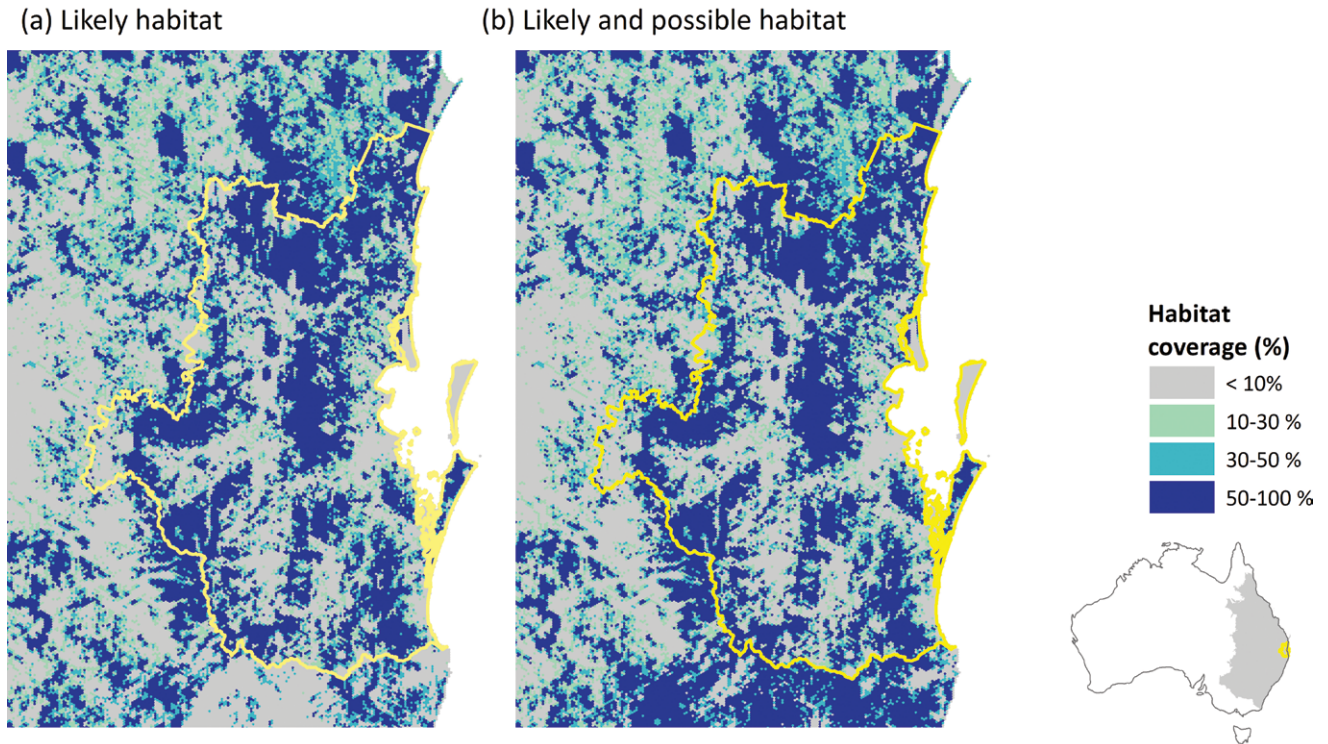


Figure 2. Habitat map for South-east Queensland. a) Percent coverage of likely habitat and b) percent coverage of likely and possible habitat within each planning unit in South-east Queensland.

## Central Queensland

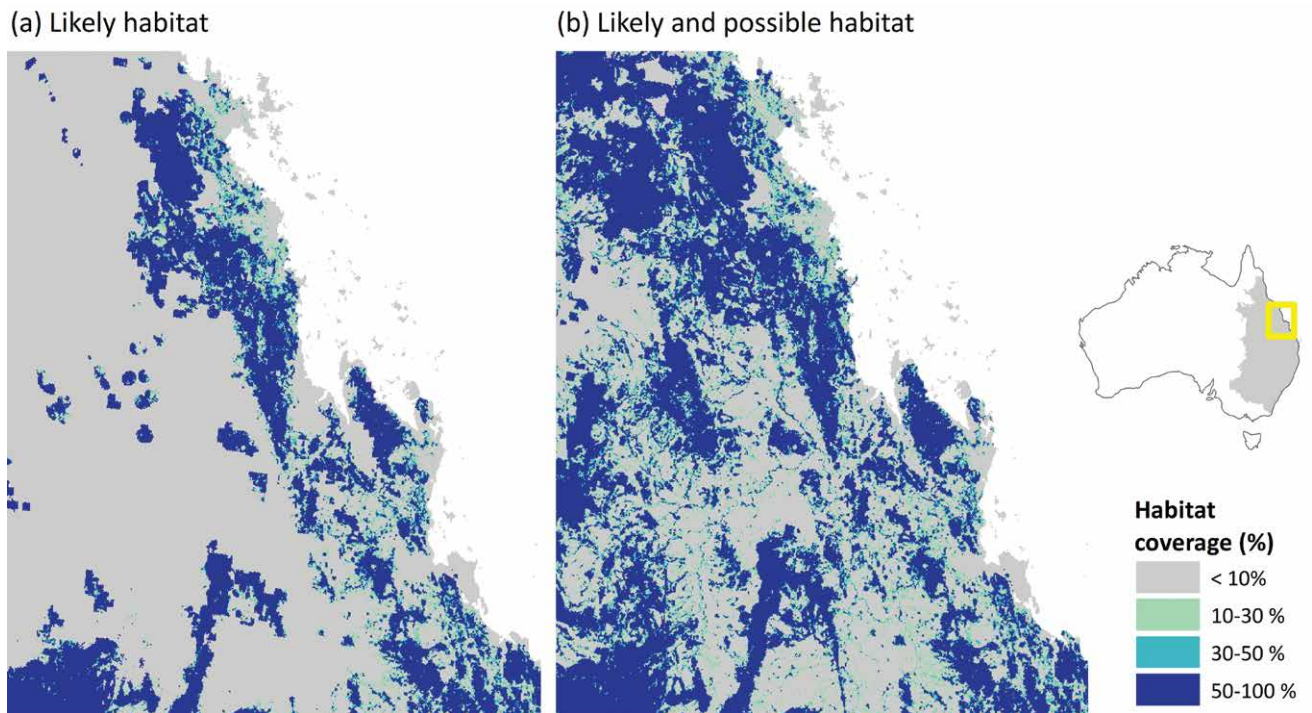


Figure 3. Habitat map for central coastal Queensland. a) Percent coverage of likely habitat and b) percent coverage of likely and possible habitat within each planning unit in central coastal Queensland.

## Eastern and western NSW

(a) Likely habitat

(b) Likely and possible habitat

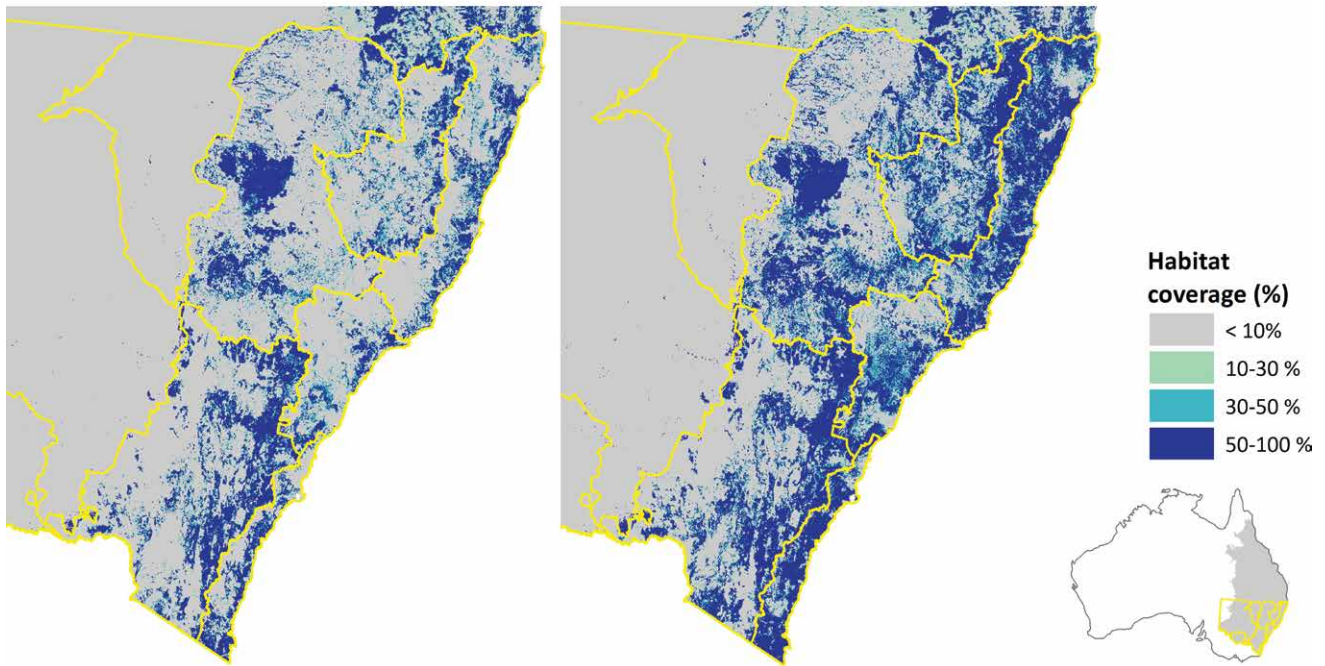


Figure 4. Habitat map for New South Wales. a) Percent coverage of likely habitat and b) percent coverage of likely and possible habitat within each planning unit in NSW.

## Australian Capital Territory

(a) Likely habitat

(b) Likely and possible habitat

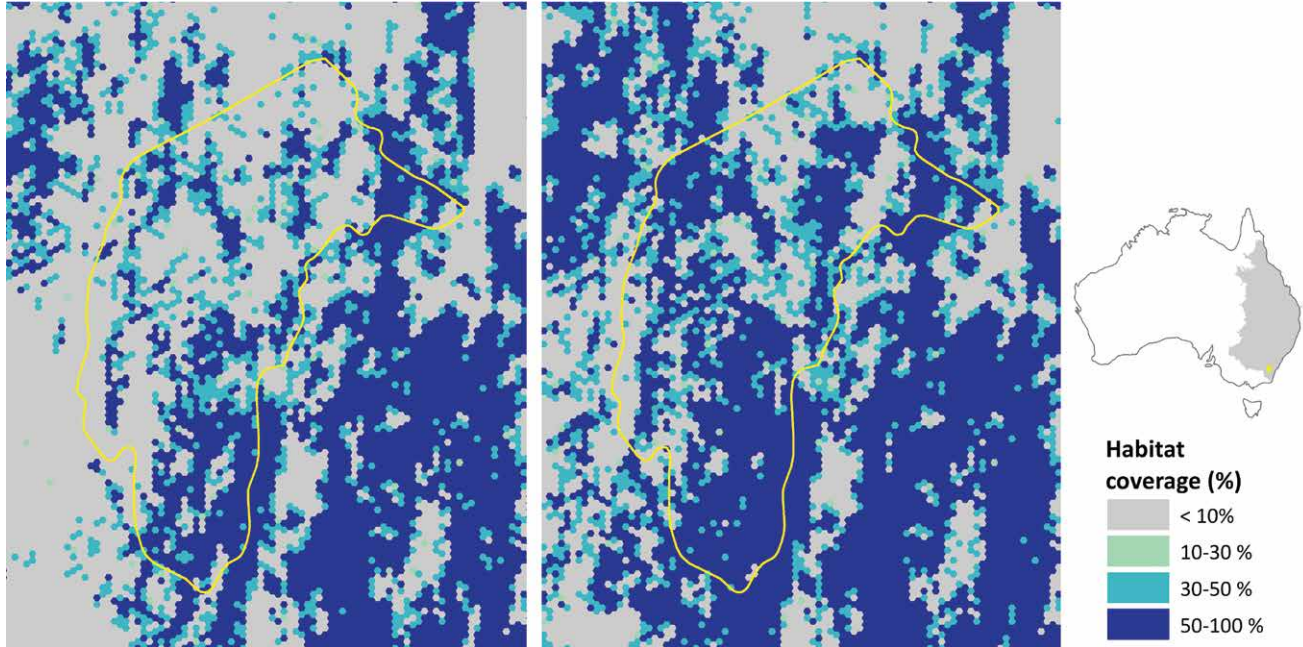


Figure 5. Habitat map for Australian Capital Territory. a) Percent coverage of likely habitat and b) percent coverage of likely and possible habitat within each planning unit in ACT.



## Limitations and suggested improvements

This dataset brings together existing datasets that are based on predictive models. With the exception of South-East Queensland, the dataset has not been ground-truthed nor undergone expert realignment of habitat/non-habitat boundaries to match on-ground conditions. We recommend that this be undertaken before use at a regional scale.

The underlying dataset for ACT is drawn from NSW habitat mapping. This dataset was developed for NSW and filters have not been applied to remove areas that are predicted as habitat but that are in unsuitable land uses. We suggest that before use in the ACT, areas of urbanised and other unsuitable land uses are clipped out of the predicted habitat.

## Datasets

The following datasets can be found at <https://doi.org/10.5281/zenodo.4305167>

Harmonised koala habitat map (GeoPackage, Harmonised\_koala\_habitat\_v1.gpkg)

## Acronyms

DES	Department of Environment and Science (Queensland)
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
DNRME	Department of Natural Resources, Mines and Energy (Queensland)
DotE	Department of the Environment (Commonwealth, former)
DPIE	Department of Planning, Industry and Environment (NSW)

## Acknowledgements

We would like to acknowledge the Traditional Owners of the land on which this research was conducted. We pay our respects to their Ancestors and their descendants, who continue cultural and spiritual connections to Country. We recognise their valuable contributions to Australian and global society.

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*Koala. Image: Cassie Lafferty, Unsplash*

**Further information:**

<http://www.nespthreatenedspecies.edu.au>

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