

## Indicator 1.2a: Forest-dwelling species for which ecological information is available (2024)



This indicator reports the level of information available to manage forest-dwelling species, and tracks changes in this knowledge over time. The amount of habitat, disturbance and life history information available to make management decisions indicates the capacity to assess risk to species and to implement conservation strategies.

### Context and definitions

Knowledge of the species present in a forest, and changes in population size of these species, can provide an indication of the extent and condition of forest habitat, and an indication of ecosystem health.

**Forest-dwelling species:** A species that may use a forest habitat for at least part of its lifecycle. Native forest-dwelling species include only **vertebrates and vascular floras**. Invertebrates and non-vascular floras are not reported because there are a lack of reliable data (many species are yet to be described) and potentially uneven representation across taxonomic groups.

**Native** refers to species with natural distribution (including naturalised) within Australia's National Forest Inventory (NFI) boundaries. Species endemic to Australia's outer islands and territories such as Christmas Island, Lord Howe Island and Norfolk Island are not reported, as these regions are beyond NFI boundaries.

### Key points

- There were 1,788 identified native forest-dwelling vertebrate fauna species and 13,788 identified native forest-dwelling vascular flora species in Australia, as at December 2021.
- Across Australia, reptiles and birds are the dominant groups of vertebrates that inhabit forests.
- Flowering plants are the dominant group of flora in Australia's forests, with the largest families being Fabaceae (including peas and wattles) and Myrtaceae (including eucalypts and melaleucas).

### Native forest-dwelling vertebrate fauna species

There were 1,788 identified native forest-dwelling vertebrate fauna species in Australia (Table 1.2a-1), as at December 2021. The list of Australia's native forest-dwelling vertebrate fauna species is available for download from [forest species and ecological communities data](#).

Queensland has the greatest number of forest-dwelling vertebrate fauna species in each taxonomic group. This reflects the large area and diversity of forest ecosystems in Queensland, including sub-tropical rainforest (see [Table 1.1a.i-2 in Indicator 1.1a.i Forest area by type](#)).

Reptiles (603 species) and birds (520 species) are the groups of vertebrates with the largest proportions of species that inhabit forests. The major forest-dwelling reptile families include:

- Scincidae (skinks, 290 species)
- Elapidae (elapid snakes, 72 species)
- Diplodactylidae (geckos, 47 species)
- Agamidae (iguanian lizards, 44 species).

The major forest-dwelling bird families include:

- Meliphagidae (honeyeaters, 71 species)
- Acanthizidae (Australasian warblers, 37 species)
- Psittacidae (parrots, 36 species).

**Table 1.2a-1: Number of native forest-dwelling vertebrate fauna species, by jurisdiction, 2021**

Taxonomic group	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Australia
Fish	7	71	100	153	45	23	58	78	222
Amphibians	22	83	38	122	23	12	39	57	201
Reptiles	62	217	196	386	174	19	118	225	603
Birds	224	349	285	434	264	139	289	325	520
Mammals	54	110	92	174	79	36	79	106	242
<b>Total</b>	<b>369</b>	<b>830</b>	<b>711</b>	<b>1,269</b>	<b>585</b>	<b>229</b>	<b>583</b>	<b>792</b>	<b>1,788</b>

The species total for Australia is less than the sum of the species totals for the individual jurisdictions as many species occur in more than one jurisdiction.

Source: Atlas of Living Australia, data as at December 2021.

[Click here for a Microsoft Excel workbook of the data for Table 1.2a-1.](#)

Due to methodological changes, the number of forest-dwelling fauna species reported here is lower than that reported in [Australia's State of the Forest Report 2018](#). These changes include a different data source (the [Atlas of Living Australia](#)), reporting at the species level only (and excluding subspecies and other infrataxa), reporting only species with valid (accepted) taxonomic status according to the Australian Faunal Directory, and excluding marine fish and fish reported only from mangroves. The new method for determining forest-dwelling species means that no information can be provided on trends over time. The method used to derive the number of fauna species is explained in the [Supporting information for Indicator 1.2a](#).

## Native forest-dwelling vascular flora species

There were 13,788 identified native forest-dwelling vascular flora species in Australia (Table 1.2a-2), as at December 2021. The list of Australia's native forest-dwelling vascular flora species is available for download from [forest species and ecological communities data](#).

Queensland has the greatest number of forest-dwelling vascular flora species in each taxonomic group. This reflects the large area and diversity of forest ecosystems in Queensland, including sub-tropical rainforest (see [Table 1.1a.i-2 in Indicator 1.1a.i Forest area by type](#)).

Angiosperms (flowering plants, 13,371 species) are the dominant taxonomic group of forest-dwelling flora. The major angiosperm families in Australian forests are:

- Fabaceae (peas and wattles, 1,577 species)
- Myrtaceae (1,438 species, including the eucalypts)
- Orchidaceae (orchids, 996 species)
- Proteaceae (758 species)
- Poaceae (grasses, 678 species).

These are also the largest families of flora Australia-wide, across forest and non-forest ecosystems.

**Table 1.2a-2: Number of native forest-dwelling vascular flora species, by jurisdiction, 2021**

<b>Taxonomic group</b>	<b>ACT</b>	<b>NSW</b>	<b>NT</b>	<b>Qld</b>	<b>SA</b>	<b>Tas.</b>	<b>Vic.</b>	<b>WA</b>	<b>Australia</b>
Lycophytes	2	11	5	25	7	14	13	10	33
Ferns	38	142	73	258	39	68	95	68	294
Gymnosperms	1	31	13	43	4	5	5	18	90
Angiosperms	962	4,892	2,575	6,075	2,141	1,487	2,975	5,439	13,371
<b>Total</b>	<b>1,003</b>	<b>5,076</b>	<b>2,666</b>	<b>6,401</b>	<b>2,191</b>	<b>1,574</b>	<b>3,088</b>	<b>5,535</b>	<b>13,788</b>

The species total for Australia is greater than the sum of the species totals for the individual jurisdictions as many species occur in more than one jurisdiction.

Lycophytes comprise clubmosses and quillworts.

Source: Atlas of Living Australia, data as at December 2021.

[Click here for a Microsoft Excel workbook of the data for Table 1.2a-2.](#)

Due to methodological changes, the number of forest-dwelling flora species reported here is lower than the number reported in [Australia's State of the Forest Report 2018](#). These changes include a different data source (the [Atlas of Living Australia](#)), reporting at the species level only (and excluding subspecies and other infrataxa), and reporting only species with valid (accepted) taxonomic status according to the Australian Plant Census. The new method for species reporting means that no information can be provided on trends over time. The method used to derive the number of flora species is explained in the [Supporting information for Indicator 1.2a](#).

## Supporting information for Indicator 1.2a: Forest-dwelling species for which ecological information is available

### Generating the lists of native forest-dwelling species

The species datasets underpinning Indicator 1.2a are sourced from the species records stored in the [Atlas of Living Australia](#) (ALA). Records in the ALA comprise species observations with an associated location, and are sourced from a range of data custodians, including state and territory museums and herbaria, universities, individuals and community organisations.

The ALA species observation records from January 1970 to December 2021 were intersected with the [Forests of Australia \(2018\)](#) spatial dataset to attribute records as forest or non-forest (the [Forests of Australia \(2023\)](#) spatial dataset was not available at the time of analysis). The [ALA general profile](#) was used to filter records, particularly to exclude those with spatial uncertainty. The filter also excluded records that were incomplete or were based on environmental DNA or fossils. Supplied records were further assessed against the following criteria to determine each species forest-dwelling status.

The updated method which uses ALA as a single data source is likely to reduce error because the ALA data contains validated species occurrence and is less likely to be impacted by differing monitoring methods or monitoring intensities across jurisdictions. The new approach also allows for systematic data analysis and the development of reproducible methods to update this indicator over time. It also enables a national total of species to be calculated.

### Criteria specific to native forest-dwelling fauna species

The ALA dataset contained 5,330 species of chordates. The following criteria were used to determine whether a species is a forest-dwelling vertebrate fauna species:

- i. species is a vertebrate and extant (not extinct)
- ii. scientific name is accepted by the Australian Faunal Directory (AFD) (ABRS, 2023)
- iii. species is native to the National Forest Inventory region (Australia's states and territories and their close offshore islands, but not endemic to external territories such as Norfolk Island, Lord Howe Island, Cocos (Keeling) Islands and Christmas Island)
- iv. species uses forest habitats:
  - species has at least one record within the [Forests of Australia \(2018\)](#) spatial dataset (excluding species separately known not to inhabit or be associated with forest habitats), and
  - the number and proportion of records in forest exceed quantitative thresholds for the relevant taxonomic group (Table 1.2a-3) – a species exceeds quantitative thresholds and therefore is considered forest-dwelling if the number of records in forest (n) and the proportion of records in forest (r) in the ALA dataset pass any of the combinations in Table 1.2a-3 below, or
  - the species does not meet the quantitative thresholds for the relevant taxonomic group (Table 1.2a-3) but is known to inhabit or be associated with forest habitats (listed threatened fauna under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as well as below-threshold species (non-threatened) were individually checked to ensure that naturally rare or cryptic species were retained).

Thresholds were set to optimise the balance between forest species incorrectly excluded (for example, rarely observed or newly discovered species) and non-forest species incorrectly included.

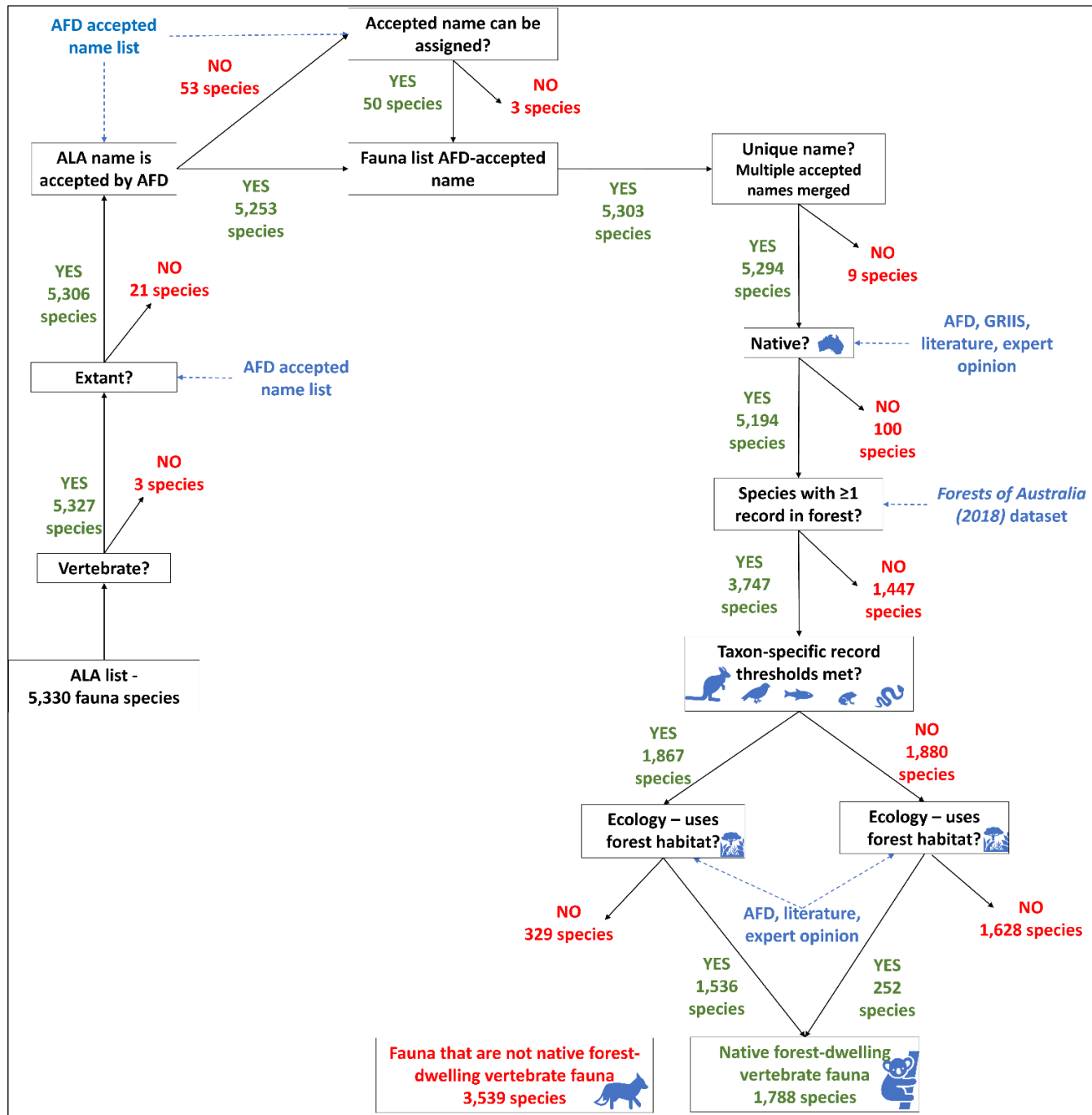
**Table 1.2a-3: Quantitative thresholds for number of records in forest (n) and numbers of records in forest as a proportion of total known records (r) for determination of forest-dwelling fauna species**

Mammals		Birds		Amphibians		Reptiles		Fish (Actinopterygii)		Fish (other)	
n	r	n	r	n	r	n	r	n	r	n	r
5-10	>40%	11-99	>20%	11-99	>15%	11-99	>15%	11-25	>50%	≥11	>50%
11-30	>30%	100-999	>17.5%	100-499	>10%	100-499	>10%	26-49	>25%		
31-99	>20%	≥1000	>15%	500-999	>5%	≥500	>5%	≥50	>10%		
100-999	>10%			≥1000	>3%						
≥1000	>5%										

This process resulted in a final national list of 1,788 native forest-dwelling fauna species. The steps used in the analysis are outlined in Figure 1.2a-1.

The number of forest-dwelling fauna species in each jurisdiction was determined based on the distribution of each species in the Australian Faunal Directory (AFD).

Figure 1.2a-1: Steps used to generate the national list of native forest-dwelling vertebrate fauna



ALA, Atlas of Living Australia; AFD, Australian Faunal Directory; GRIIS, Country Compendium of the Global Register of Introduced and Invasive Species.

### Criteria specific to native forest-dwelling flora species

The ALA dataset contained 27,093 flora taxa. The following criteria were used to determine whether a species is a forest-dwelling vascular flora species:

- i. species is a vascular plant species and extant (not extinct)
- ii. scientific name is accepted by the Australian Plant Census (APC) (CHAH, 2023)
  - records of all subspecies and other infrataxa were merged with records of the corresponding species

- iii. species is native to the National Forest Inventory region (Australia’s states and territories and their close offshore islands, but not endemic to external territories such as Norfolk Island, Lord Howe Island, Cocos (Keeling) Islands and Christmas Island)
- iv. species uses forest habitat:
  - species has at least one record within the [Forests of Australia \(2018\)](#) forest coverage, and
  - the number and proportion of records in forest exceeds quantitative thresholds for the relevant taxonomic group (Table 1.2a-4) – a species exceeds quantitative threshold and therefore is considered forest-dwelling if the number of records in forest (n) and the proportion of records in forest (r) in the ALA dataset pass any of the combinations in Table 1.2a-4 below, or
  - listed threatened flora under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that does not exceed the quantitative thresholds for the relevant taxonomic group (Table 1.2a-4) but is known to inhabit or is associated with forest habitats (listed threatened flora were individually checked to ensure that naturally rare or cryptic species were retained).

Thresholds were set to optimise the balance between forest species incorrectly excluded (for example, rarely observed or newly discovered species) and non-forest species incorrectly included.

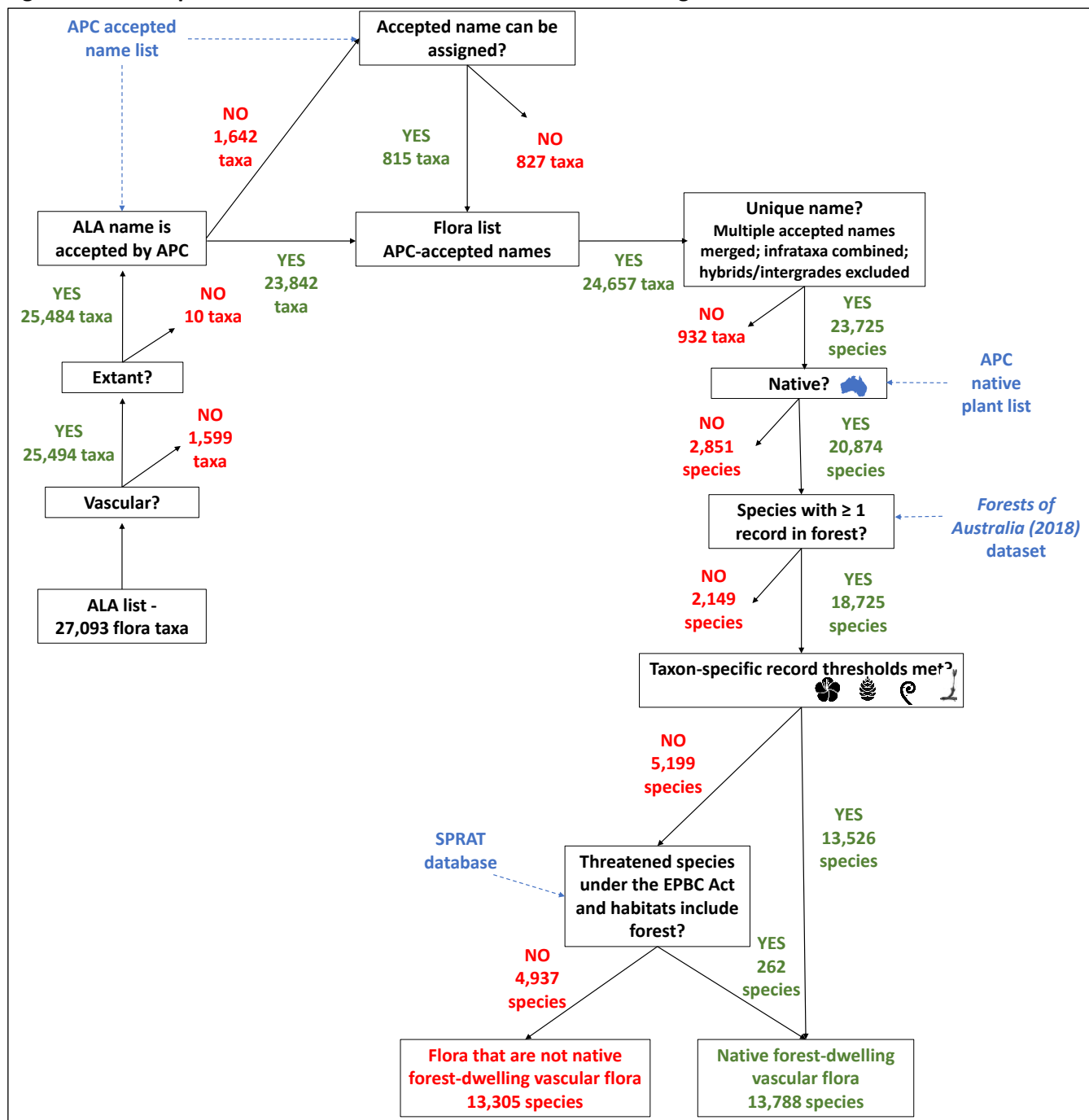
**Table 1.2a-4: Quantitative thresholds for number of records in forest (n) and number of records in forest as a proportion of total known records (r) for determination of forest-dwelling flora species**

Angiosperm		Gymnosperm		Fern		Horsetail		Clubmoss		Quillwort	
n	r	n	r	n	r	n	r	n	r	n	r
11-199	>12.5%	11-499	>5%	11-99	>5%	11-99	>5%	11-99	>5%	11-99	>5%
200-499	>10%	>499	>2.5%	>99	>2.5%	>99	>2.5%	>99	>2.5%	>99	>2.5%
500-999	>7.5%										
>999	>2.5%										

This process resulted in a final list of 13,788 native forest-dwelling vascular flora. The steps used in the analysis are outlined in Figure 1.2a-2.

The number of forest-dwelling flora species in each jurisdiction was based on the distribution of each species in the Australian Plant Census.

Figure 1.2a-2: Steps used to create the national list of forest-dwelling vascular flora



APC, Australian Plant Census; ALA, Atlas of Living Australia; SPRAT, Species Profile and Threats Database; EPBC Act, *Environment Protection and Biodiversity Conservation Act 1999*.

### Previous reporting of native forest-dwelling species

Reporting of native forest-dwelling species in previous *Australia's State of the Forest Reports* were based on a compilation of data provided by states and territories. The new method for species reporting, which uses Atlas of Living Australia as a single data source (see [Generating the lists of forest-dwelling species](#)) means no comparisons can be made with previously reported figures.



## Data sources

[Atlas of Living Australia](#) (ALA) data from 01 January 1970 to 31 December 2021, provided December 2021.

ABARES (2018). *Forests of Australia (2018)*, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra, December. CC BY 4.0 [doi.org/10.25814/5c59170ec780d](https://doi.org/10.25814/5c59170ec780d).

ABRS (Australian Biological Resources Study) (2023). [Australian Faunal Directory](#), Australian Biological Resources Study, Canberra, accessed 15 March 2023.

CHAH (Council of Heads of Australasian Herbaria) (2023). [Australian Plant Census](#), Council of Heads of Australasian Herbaria, Canberra, accessed 11 April 2023.

Randall J, McDonald J, Wong L J, Pagad S (2023). *Global Register of Introduced and Invasive Species - Australia*. Version 1.10. Invasive Species Specialist Group ISSG. Checklist dataset [doi.org/10.15468/3pz20c](https://doi.org/10.15468/3pz20c) accessed via [GBIF.org](https://gbif.org) on 10 February 2023.

## More information

Learn more about [Criterion 1 of Australia's State of the Forest Report](#).

Web [agriculture.gov.au/abares/forestsaustralia/sofr/](https://agriculture.gov.au/abares/forestsaustralia/sofr/)

Download a Microsoft Excel workbook of the data presented in Indicator 1.2a.

Email [Info.ABARES@aff.gov.au](mailto:Info.ABARES@aff.gov.au)

### Acknowledgement of Country

We acknowledge the Traditional Custodians of Australia and their continuing connection to land and sea, waters, environment and community. We pay our respects to the Traditional Custodians of the lands we live and work on, their culture, and their Elders past and present.

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