

Science for Saving Species

Research findings factsheet

Project 2.1



National Environmental Science Programme

Butterflies on the brink: identifying the Australian butterflies most at risk of extinction

In brief

Invertebrates are declining globally in both diversity and abundance, with potentially serious consequences for ecosystem functioning. Many Australian butterflies are imperilled or declining but few are listed for protection by legislation. We identified the 26 Australian butterflies at most immediate risk of extinction within a 20-year time frame. We found that one butterfly is facing a greater than 90% chance of extinction in the next 20 years (and may already be extinct), and four species have a moderate to

high (greater than 30%) chance of extinction. We also identified key threatening processes affecting these species (chiefly inappropriate fire regimes, habitat loss and fragmentation, invasive species and climate change), and the research and management actions needed to save them. Mapping of the 26 butterflies' distributions revealed that most are now found only in a single state or territory and many occupy narrow ranges. Increased resourcing and management intervention is required to avert future extinctions.

Background

Terrestrial invertebrates and their habitats are increasingly threatened by human disturbances, particularly habitat loss and fragmentation, invasive species, inappropriate fire regimes and climate change.

Continuing declines and extinctions in native terrestrial invertebrate communities are likely to negatively affect ecosystem functioning. This is because invertebrates play a central role in many ecological processes, including pollination, herbivory, the consumption of dead plant and animal matter, and nutrient cycling, as well as providing a good source of food for other animals.

There is urgent need to explore the causes of these declines, and the implications for ecosystems and ecosystem services. We must also put appropriate management actions in place to halt and reverse declines in the species at greatest risk of extinction.

Invertebrate conservation and management has many challenges. Invertebrates are generally poorly known and under-studied, and much of their vast biodiversity remains undescribed. Resources are also limited, both in terms of scientific expertise and funds, making it difficult to assess and hence address their conservation needs.



Bulloak jewel (Hypochrysops piceatus).
Image: Michael Braby





LEFT: Larva of the Australian fritillary (*Argynnis hyperbius inconstans*); its host plant is the native violet (*Viola betonicifolia*). Image: Garry Sankowsky

Background (continued)

Although there have been some recent advancements in conservation assessments for butterflies in Australia, these have typically not translated into additions to statutory lists. Just 10 butterfly species are listed for protection under the Australian Government's EBPC Act.

The Australian Government has committed to averting extinctions, and this first requires identification of the species at most immediate risk. We worked with experts to identify highly imperilled Australian butterfly species and subspecies that are threatened with extinction in the near future.

The experts included NESP Threatened Species Recovery Hub researchers; amateur entomologists (who carry much of the natural history knowledge of butterflies in Australia); and butterfly biologists from academic institutions, state or federal government agencies and environmental NGOs. They included representatives from every Australian state or territory.

Research aims

We aimed to:

1. identify the Australian butterflies at most immediate risk of extinction in the next 20 years;
2. estimate their probability of extinction (in the wild) by 2040;
3. map their distribution to identify regions for priority research and management; and
4. identify their key threats, to inform key research and management objectives for averting future butterfly extinctions.



The Australian fritillary (*Argynnis hyperbius inconstans*) on native violet. Image: Garry Sankowski

What we did

The project consisted primarily of desktop research and structured interviews with experts.

Identifying at risk species –

We produced a preliminary list of Australian butterflies at high risk of extinction based on all available published and unpublished information; this included information provided by butterfly experts, including at a workshop in 2019. From this we finalised a list of 26 species most likely to be lost to extinction within 20 years. See Table 1.

Extinction probabilities –

We used structured expert elicitation to obtain estimates of extinction probability in the next 20 years. Our approach involved giving participants relevant information on ecology, threats and trends, then asking them to estimate probability of extinction over the 20-year time frame of interest. Assessments assumed current management would continue, with no new actions implemented.

Distributions – We mapped the distribution of the most imperilled butterflies using distribution data compiled from *The Complete Field Guide to Butterflies of Australia*. See Figure 1.

Threats and management –

We identified key threats to each species from the published literature, conservation listing advices, the Action Plan for Australian Butterflies, and from unpublished information from and observations by species experts. We classified the threats using the IUCN Threats Classification Scheme. We used this information to determine the number and proportion of species affected by the various threat types.

We identified relevant research and management actions for reducing risks of extinction using published and unpublished sources. We categorised these actions using the IUCN Research Needed and Conservation Actions Classification Schemes.

Rank	Scientific name	Common names	EX	Lower 95% CI	Upper 95% CI	Conservation status in State/Territory of occurrence	EPBC Status
1	<i>Argynnis hyperbius inconstans</i>	Australian fritillary, laced fritillary	0.94	0.89	0.97	QLD (EN),NSW (-)	CR
2	<i>Jalmenus eubulus</i>	Pale imperial hairstreak	0.42	0.28	0.58	QLD (VU), NSW (CR)	-
3	<i>Hypochrysops piceatus</i>	Bulloak jewel	0.37	0.24	0.53	QLD (EN)	-
4	<i>Oreisplanus munionga larana</i>	Marrawah skipper, alpine sedge-skipper	0.33	0.2	0.49	TAS (EN)	VU
5	<i>Jalmenus aridus</i>	Inland hairstreak	0.3	0.15	0.5	WA (P1)	-
6	<i>Ogyris sp. aff. aenone</i>	Sapphire azure (southern population)	0.28	0.16	0.44	QLD (-)	-
7	<i>Ogyris subterrestris subterrestris</i>	Arid bronze azure	0.28	0.16	0.44	VIC (Thr), SA (-)	-
8	<i>Croitana arenaria arenaria</i>	Inland grass-skipper	0.22	0.12	0.36	NT (-)	-
9	<i>Heteronympha banksii nevina</i>	Banks' brown	0.19	0.1	0.32	VIC (-)	-
10	<i>Heteronympha cordace wilsoni</i>	Bright-eyed brown	0.18	0.1	0.3	VIC (Thr), SA (-)	-
11	<i>Ogyris subterrestris petrina</i>	Arid bronze azure	0.15	0.08	0.26	WA (CR)	CR
12	<i>Candalides noelkeri</i>	Golden-rayed blue	0.13	0.07	0.23	VIC (Thr)	-
13	<i>Antipodia chaostola leucophaea</i>	Tas. chaostola skipper, heath sand-skipper	0.11	0.06	0.19	TAS (EN)	EN
14	<i>Acrodipsas illidgei</i>	Mangrove ant-blue, Illidge's ant blue	0.1	0.05	0.17	QLD (VU), NSW (-)	-
15	<i>Oreixenica ptunarra</i>	Ptunarra xenica, ptunarra brown	0.09	0.05	0.17	TAS (VU)	EN
16	<i>Ogyris otales sublustris</i>	Western dark azure	0.09	0.05	0.17	WA (-)	-
17	<i>Ogyris iphis doddi</i>	Dodd's azure, orange-tipped azure	0.07	0.03	0.14	NT (EN)	-
18	<i>Hesperilla flavescens flavescens</i>	Yellow sedge-skipper	0.07	0.03	0.14	VIC (Thr)	-
19	<i>Exometoeca nycteris</i>	Western flat	0.07	0.03	0.14	WA (-)	-
20	<i>Oreixenica latialis theddora</i>	Small alpine xenica	0.06	0.03	0.12	VIC (Thr)	-
21	<i>Ogyris halmaturia</i>	Eastern bronze azure	0.06	0.03	0.11	VIC (Thr), SA (-)	-
22	<i>Ogyris otales otales</i>	Small bronze azure	0.06	0.03	0.11	NSW (-), VIC (-), SA (-)	-
23	<i>Ocybadistes knightorum</i>	Black grass-dart	0.05	0.03	0.1	NSW (EN)	-
24	<i>Telicota eurychlora</i>	Southern sedge-darter	0.03	0.01	0.05	QLD (-), NSW (-), VIC (Thr)	-
25	<i>Paralucia spinifera</i>	Purple copper, Bathurst copper	0.03	0.01	0.05	NSW (EN)	VU
26	<i>Hypochrysops apollo apollo</i>	Apollo jewel	0.02	0.01	0.04	QLD (VU)	-

Table 1. The scientific and common names, likelihoods of extinction based on structured expert elicitation with lower/upper 95% confidence intervals, and listed conservation status in state/territory of occurrence and under EPBC Act for the 26 most imperilled Australian butterflies. (- denotes Not Listed).

Key findings

Of the 26 butterflies included in our assessment, only six were listed as threatened under Australian federal legislation (the *EPBC Act*) as of February 2020, with a further two nominated. A larger number (20) were recognised as threatened under the relevant legislation for one or more of the states or territories in which they are known to occur.

The Australian fritillary (*Argynnis hyperbius inconstans*) is at extremely high risk of extinction within the next 20 years (likelihood >90%). It may already be extinct,

with no confirmed specimen records since 2001. Another four butterflies had a moderate to high probability of extinction (30–50%).

We estimated that five butterflies could be lost to extinction by 2040 unless management improves, and there was a high level of agreement about this among experts.

All 26 species of Australian butterfly are found nowhere else but Australia, and 18 are found only in a single state or territory. The remaining eight are known historically from two or three neighbouring states or territories,

but some are believed to be locally extinct. For example, the small bronze azure (*Ogyris otales otales*) is most likely locally extinct in New South Wales and possibly Victoria, with surviving populations confirmed only in South Australia, while the eastern bronze azure (*Ogyris halmaturia*) is almost certainly locally extinct from its formerly wide range in western Victoria, and now persists precariously at only two or three locations in South Australia.

Threats

We found that the most prevalent threats to the imperilled butterflies



The 26 Australian butterflies at greatest risk of extinction

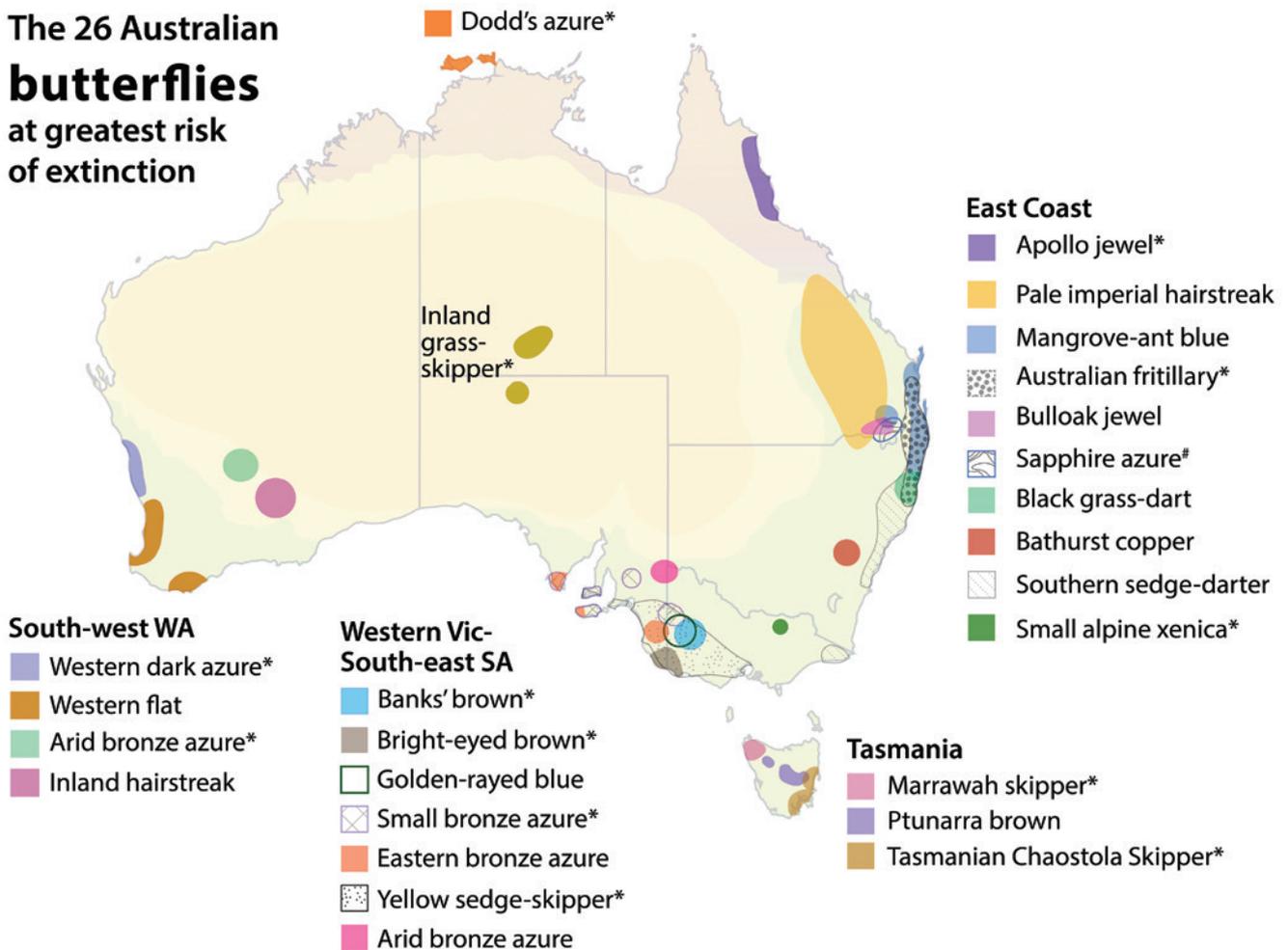


Figure 1. The Australian butterfly species and sub-species at greatest risk of extinction. * indicates a sub-species # indicates a population. Image: Threatened Species Recovery Hub

Key findings (continued)

were natural system modifications, such as changes to fire regimes, or dams and water management impacts on the vegetative habitat of the species (a threat to 21 of the butterflies).

Other important threats included agriculture, notably the clearing and fragmenting of habitat associated with non-timber crops and domestic livestock (affecting 17 butterflies), and invasive species, particularly introduced grasses, European rabbits and introduced invertebrates (affecting 14 butterflies).

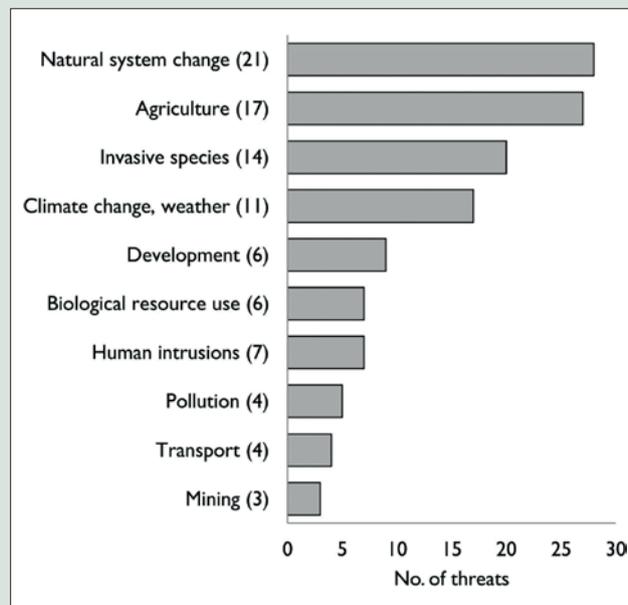


Figure 2. The number of imperilled Australian butterflies affected by different types of threats, categorised using the IUCN Threats Classification scheme. The total number of species affected by each broad threat category is provided in parentheses. Note that "Natural system change" includes fire and fire suppression, and weather refers to extreme weather events.



Key findings (continued)

Climate change is likely to affect almost half of the butterflies we considered (11), with increases in temperature, longer and more frequent droughts and sea level rise potentially catastrophic future threats. See Figure 2.

Need for further surveys and research

All 26 butterflies are likely to benefit from further surveys, which could more precisely estimate geographic distribution, population size and density.

Likewise, all 26 butterflies would benefit from further research to assess the impacts of threatening processes, especially the role of fire.

The ecological requirements of 10 butterflies, such as habitat and seral stage critical to their survival and interactions with ants, require further investigation.

The taxonomy of six of the butterflies requires clarification.



*Black grass-dart (Ocybadistes knightorum).
Image: Mick Andren*

Management actions

The experts estimated an average probability of extinction of 18% for the 26 butterflies over the next 20 years. This suggests that without adequate new management actions the total number of future extinctions may be significant.

We found that the most important management actions to reduce the risk of extinction were:

1. education and awareness (site visits, signage, discussions with private landholders and land managers);
2. land/water management (appropriate fire management, invasive species control); and
3. land/water protection (identifying and protecting sites of high conservation value).

Implications and recommendations

These findings will be of greatest practical value to decision-makers and funding bodies such as state and Commonwealth government agencies, conservation land managers, and researchers looking to prioritise and apply research and management actions for threatened butterflies.

Identifying the species at greatest risk of extinction can help forewarn governments, conservation managers and the community about which species are most threatened, so that emergency care and recovery actions may

be implemented to prevent their extinctions before it is too late.

While no extinctions of Australian butterflies have been recorded officially, the pace of modern insect extinctions is suspected to have surpassed that of vertebrates.

However, confirming this is hampered by the lack of historical data on trends in population size and geographical range size. Nevertheless, in areas of the world where it has been possible to assess how populations of butterflies are faring, the majority have declined, including not only specialist species

with narrow ecological requirements, such as dependence on a single host plant, but also generalist species that were once very common. This suggests that earlier undetected extinctions are likely, and that future extinctions are inevitable without rapid and targeted intervention.

Our assessments of extinction probability preceded the 2019–20 wildfires, which are likely to have severely worsened the conservation outlook for many of the species considered in our study, and also for many others that were not included, but now may warrant inclusion.

Implications and recommendations (continued)

Given that we predict that up to five Australian butterflies may become extinct in the next two decades without substantial improvements to current management regimes, we recommend urgently implementing the following research and management actions:

1. Formal listing of highly threatened but currently unlisted species as threatened under national and state/territory legislation, with recovery plans/Conservation Advices developed and recovery teams established.
2. Ensure that adequate policies are in place to protect habitat critical to the survival of the species at greatest risk. This is the most important action for butterfly conservation in Australia.
3. Updating the 2002 *Action Plan for Australian Butterflies* to assess the current conservation status of all butterfly species of conservation concern (not just the most imperilled). This will assist in enabling the coordination of recovery efforts for nationally threatened butterflies.
4. Ensuring that state/territory governments provide more leadership in the conservation management of imperilled butterflies that are restricted in range to their jurisdictions.
5. Promoting the amateur study, collection and sharing of information about butterflies, and ensuring that it is not impeded by conservation policy. Butterfly collecting by non-professional lepidopterists has contributed significantly to the knowledge of the taxonomy, distribution, biology and conservation of butterflies in Australia, and will remain a vital future source of information relevant to butterfly conservation and management. Prohibiting the collection of listed butterfly species is likely to have adverse effects on butterfly conservation. For exceptionally rare species, put in place measures to ensure maximum responsibility for their conservation. The code of conduct in the *Action Plan for Australian Butterflies* is still relevant today and should be applied widely across Australia.

Only urgent action, enhanced policy and planning, increased community awareness and a better resourced conservation response will prevent future extinctions in Australian butterflies.

Cited material

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RIGHT: Bathurst Copper
(*Paralucia spinifera*).
Image: Tessa Barratt

