

THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Minister's delegate approved this Conservation Advice on 16/12/2016.

Conservation Advice

Paralucia spinifera

purple copper butterfly

Conservation Status

Paralucia spinifera (purple copper butterfly) is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) effective from the 16 July 2000. The species was eligible for listing under the EPBC Act as on 16 July 2000 it was listed as Vulnerable under Schedule 1 of the preceding Act, the *Endangered Species Protection Act 1992* (Cwlth).

This species is also listed as Endangered under the *NSW Threatened Species Conservation Act 1995*.

The main factors that are the cause of the species being eligible for listing in the Vulnerable category are the small area of occupancy, the severely fragmented habitat, decline at some sites, and extreme fluctuation in population.

Description

The purple copper butterfly is a small species with a wingspan of approximately 22 mm (NSW NPWS 2001). The male's wings are shining purple with black margins, with fringes chequered black and white. The female is black or dark brown, with central area suffused with bronze, sometimes with the base of the wings a deep shining purple or blue, and with fringes chequered black and white (NSW NPWS 2001). The lower surface of the wings is patterned with subtle brown, black and grey on both male and female (NSW NPWS 2001). The species' black antennae are dotted with white spots and end with a black tip (Braby 2000).

Eggs are white, 0.8 mm in diameter, generally dome-shaped, and densely and finely pitted (Braby 2000). The larvae have a grey body with brown dorsal and subdorsal lines (NSW NPWS 2001), although final stage larvae can reach 18 mm (Braby 2000). The broadest dorsal lines are separated on each segment by a whitish streak (Braby 2000). The larvae have prominent organs that can be turned inside out and secrete a liquid attractive to the attendant ant (NSW NPWS 2001). Pupae are 12 - 15 mm long, have a brown head and thorax, with lighter brown abdomen.

Distribution

The purple copper butterfly is endemic to New South Wales, where it occurs on the Central Tablelands in an area approximately bounded by Capertee, Black Springs, Hartley and Bathurst (Nally pers. comm., 2016). It occurs in eucalypt woodland, mainly in open clearings (Sands & New 2002). All locations are above 900 m in altitude and are associated with the presence of the larval food plant; *Bursaria spinosa* subsp. *lasiophylla* (blackthorn) and a species of attendant ant; *Anonychomyrma itinerans* (Sands & New 2002). The purple copper butterfly has been recorded from 35 locations, all within the Greater Lithgow, Bathurst Regional and Oberon local government areas (NSW OEH 2016).

Approximately half of the locations occur on freehold land, with the remainder occurring on a range of land tenures including State Forest, Nature Reserve, Travelling Stock Reserve, Commonwealth land, Reserve for Public Recreation, and a range of Crown lands managed by the Councils of Lithgow, Oberon and Bathurst Regional local government areas (NSW NPWS 2001).

Although separate locations have generally been identified by land tenure, there is likely to be some level of genetic flow between small separate occurrences (Nally pers. comm., 2016). Some locations close together, for example those clustered around the township of Lithgow, may be interconnected colonies over longer time frames. Conversely, some locations may be isolated and have no genetic exchange with other colonies (Nally pers. comm. 2016).

Relevant Biology/Ecology

The annual lifecycle of the purple copper butterfly is characterised by butterfly emergence, mating and egg-laying during September-November, larval grazing of the host plant, blackthorn, during October-January, and pupation between December - October. The exact timing varies between years, between sites, and within larger sites according to variations in climate, weather, habitat structure and condition (Mjadwesch & Nally 2008). Eggs are laid singly or in groups of up to four on the larval food plant (Braby 2000). Once hatched, the early stage larvae (approximately 2 mm) feed on the under surface of juvenile blackthorn leaves. There is one generation annually, with eggs taking approximately 15 days to hatch, and larval development taking between 48 - 70 days (Braby 2000).

The purple copper butterfly has an intricate relationship with an attendant ant and a host plant, without which the species will not persist in the wild. The ants patrol the blackthorn in areas of the plant where larvae may be present and inspect eggs and early-stage larva (Mjadwesch & Nally 2008). Once the larva has moulted several times and grown, it develops organs that secrete sugar and protein-rich nectar that are harvested by the ants (Braby 2000, Mjadwesch & Nally 2008). By this time the attendant ants constantly attend the larvae, shepherding them underground into the ant's nest during the day (possibly to protect it from predators), and shepherding them out at night (possibly in sibling groups) to feed on blackthorn leaves (Mjadwesch & Nally 2008, Nally, pers comms., 2016. Mjadwesch and Nally (2008) observed the attendant ants responding to threats, such as human disturbance, by releasing an alarm pheromone, biting, and shepherding the caterpillars into the ant nest.

The host plant, blackthorn, is a widespread understorey plant in heavier soils in many of the forests and woodlands of the central tablelands, but often remains in low density until disturbance such as fire or tree falls reduce overstorey shading, when it vigorously shoots to sometimes form dense thickets (Cayzer et al., 1999). Without new blackthorn growth promoted by post-disturbance conditions, the blackthorn often becomes unsuitable habitat, and the purple copper butterfly can become locally extinct (Nally, pers comm., 2016). Interfire intervals of 4-12 years have been predicted to maintain Themeda woodland with *Bursaria* thickets, open areas, and obligate seeder shrubs in western Sydney, NSW (Watson and Morris, 2006).

After fire events, the purple copper butterfly can boom in numbers, and spread throughout connected habitat, and possibly reoccupy or invade new areas of fresh blackthorn growth (Nally, pers comm., 2016). This species may rely upon having a series of occupied sites within the landscape. These sites can be sources of invasion to new or previously occupied sites after landscape scale or local-scale disturbance events (Nally, pers comm., 2016). This allows genetic exchange and high population numbers necessary to maintain population health (Nally, pers comm., 2016).

Although the butterfly entirely occupied areas totalling several hectares after bushfire surrounding Lithgow, sites range from habitat remnants with clusters of less than ten blackthorn plants, to sites with blackthorn scattered or clumped over several hectares. When present in otherwise comparable habitat, butterfly activity levels appear to be correlated with the amount of fresh young blackthorn leaves available (Nally, pers comm., 2016).

Because of this reliance on the disturbance response of its larval host plant, factors that temporarily disturb the plant may be beneficial to the persistence of a colony of a purple copper butterfly. Habitat may be degraded or lost if the damage occurs at a rate that prevents regrowth and flowering of the blackthorn, or is of sufficient intensity to reduce the resilience or cause the death of blackthorn.

Threats

The purple copper butterfly is at risk from population fragmentation, weeds and inappropriate levels of disturbance.

Table 1 – Threats impacting the purple copper butterfly in approximate order of severity of risk, based on available evidence.

Threat factor	Threat type and status	Evidence base
Invasive species		
Weed invasion	known current	Weeds, particularly blackberry (<i>Rubus fruticosus</i> aggregate) and scotch broom (<i>Cytisus scoparius</i>), occur within or adjacent to habitats, and progressively invade and outcompete the blackthorn habitat (Braby 2000, NSW NPWS 2001).
Habitat destruction and disturbance	suspected potential	Extensive and repeated uprooting of habitat by pigs (<i>Sus scrofa</i>) and goats (<i>Capra hircus</i>) uproot or heavily browse the blackthorn, and allow insufficient time for plants to recover (NSW NPWS 2001, Sands & New 2002).
Fire		
Too infrequent and too small scale fire	suspected potential	Lack of habitat disturbance can allow the blackthorn to become senescent and unsuitable for grazing by larvae, and local extinctions can appear to occur (Nally pers comm., 2016). Lack of simultaneous disturbance over a number of sites prevents population booms, expansion, colonisation, and genetic exchange.
Too frequent or too intense fires	suspected potential	The butterfly larvae feed exclusively on blackthorn. Too frequent or too intense fires inhibit growth or reproduction of blackthorn (NSW OEH 2016). Blackthorn is known to recover after fire (Sands & New 2002), nevertheless timing of fires is critical to avoid damaging the habitat.
Habitat loss and fragmentation		
Roadwork and associated infrastructure	known current	Purple copper butterfly larvae feed exclusively on blackthorn so clearing of this vegetation from known or potential sites is likely to have detrimental impacts on local butterfly persistence. In 2004 a road realignment project near Lidsdale, impacted on one colony, leading to an emergency relocation (Mjadwesch & Nally 2008). Conversely, disturbance by roadside maintenance such as slashing may promote blackthorn regeneration and local persistence.
Agriculture	suspected potential	Hill & Michaelis (1998) identified clearing of habitat for agriculture as a threat. However, Sands & New (2002) stated that in practice few of the known habitats have been destroyed by farming activities. Clearing of saplings and trees that shade and suppress blackthorn, blackthorn disturbance by light grazing, and incomplete woody weed control that retains blackthorn may promote habitat extent and quality (Nally, pers comm., 2016).

Conservation Actions

Conservation and Management priorities

Invasive species

- Ensure weed control is appropriately undertaken at all purple copper butterfly sites (Nally, pers comm., 2016).
- Monitor sites for feral goat and pig activities, and if detected initiate control programs (NSW NPWS 2001).

Fire

- Fires must be managed to ensure that prevailing fire regimes do not disrupt the life cycle of the purple copper butterfly that they support rather than degrade the habitat necessary to the butterfly, that they do not promote invasion of exotic species, that they adequately suppress tree species, and that they do not increase impacts of grazing/predation or impact the attendant ant negatively.
- Trial a regime of burning of sites where blackthorn is senescing through lack of disturbance every six to ten years during late summer and early autumn when the butterflies are pupating underground (Nally, pers comm., 2016).
- In the trial, coordinate the timing of burning so that landscape-level genetic exchange can occur i.e. in 33 percent of the range, burn most sites over a period of three years (Nally, pers comm., 2016).

Habitat loss and fragmentation

- Where developments or activities are planned in potential habitat, ensure thorough surveys are undertaken during the adult flying and juvenile larval seasons in order to implement appropriate protection measures (NSW OEH 2016).
- Assist landholders to manage blackthorn in a way that promotes the conservation of the species, in a way that is cognisant of land management objectives (NSW NPWS 2001).
- Enhance nesting sites for ants near food plants, for example by accumulating suitable logs (Sands & New, 2002).
- Rehabilitate areas adjacent to purple copper butterfly sites by establishing blackthorn, in a manner that maximises habitat links between sites (NSW NPWS 2001).

Stakeholder Engagement

- As purple copper butterfly sites are located on a range of land tenures (freehold, state forest, nature reserve etc), a range of stakeholders must continue to work in partnership to improve the species' management.
- Encourage community awareness of the purple copper butterfly. Erect or improve signage describing the butterfly, its biology and habitat, and threats.
- Ensure appropriate signage is erected at all locations where the butterfly occurs, informing members of the local community of its presence, habitat, threats and conservation.
- Encourage planting of the blackthorn in areas of secure land tenure that are near populations of the butterfly.

- Promote the use of blackthorn as a soil stabiliser, windbreak, and nectar producing plant (Nally, pers comm., 2016).

Survey and Monitoring priorities

- Identify and survey potential habitat for further populations (NSW OEH 2016).
- Continue the monitoring of larval and adult abundance at all current locations and expand to include all appropriate locations.
- Ensure all monitoring methods are systematic and standardised as much as possible for all locations. Ensure that the methods used and the data are collected to best demonstrate trends over time and any decline.
- Undertake survey work in suitable habitat and potential habitat to locate any additional occurrences to more precisely assess population size and distribution.

Information and research priorities

- Improve understanding of the responses of the butterfly, blackthorn and attendant ant species to different fire regimes and identify appropriate fire regimes for conservation of the threatened species.
- Improve understanding about how the growth stage of blackthorn and other habitat qualities influence the colonisation of habitat and persistence of purple copper butterfly populations in the landscape .

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