Australian Entomological Society

AES Conservation Committee
Species Nomination Form

Taxonomy

Scientific name: *Acrodipsas illidgei* Waterhouse & Lyell, 1914 (Lepidoptera: Lycaenidae)

Common name: Mangrove Ant-blue; Illidge's Ant-blue

Acrodipsas illidgei was originally described by Waterhouse and Lyell (1914) as a subspecies of *Pseudodipsas myrmecophila* Waterhouse & Lyell, 1914, but was later separated as a distinct species by Kerr *et al.* (1968). Sands (1979) subsequently erected the genus *Acrodipsas* for several species formerly classified within *Pseudodipsas*, including *A. illidgei*. *Acrodipsas illidgei* is most closely related to *A. arcana* (Miller & E.D. Edwards, 1978) and it has been hypothesized that the two species may be allopatric populations of a single polymorphic species due to minimal genetic differentiation (Eastwood and Hughes 2003). However, the male genitalia and wing pattern elements of *A. illidgei* differ from those of *A. arcana* (Miller and Edwards 1978; Sands 1979).

Description

Acrodipsas illidgei is a small lycaenid butterfly with an average wingspan of 22 mm for the male and 24 mm for the female (Braby 2000). The female has broad areas of iridescent blue on the upperside of the wings, whereas the male is dark brown above. In both sexes, the underside pattern of the wings is pale brown with broad dark brown markings.

Similar species: *Acrodipsas illidgei* is distinguished from other species in the genus by the dark brown bands beneath the wings (Miller and Edwards 1978; Sands 1979). The rounded termen of the forewing of males and the shade of blue and absence of a postmedian band on the hindwing above of females assists with identification. *Acrodipsas illidgei* is similar to *A. myrmecophila*, but is larger and darker, with more prominent underside markings (Braby 2000, 2016).

Distribution

IBRA region: SEQ (South Eastern Queensland).

Distribution: *Acrodipsas illidgei* has a very limited and patchy distributed in SE Qld and NE NSW, from Mary River Heads, QLD to Brunswick Heads, NSW (Beale 1998; Braby 2000). Historically, it is known to occur in four coastal regions, plus an outlying record on the Great Escarpment:

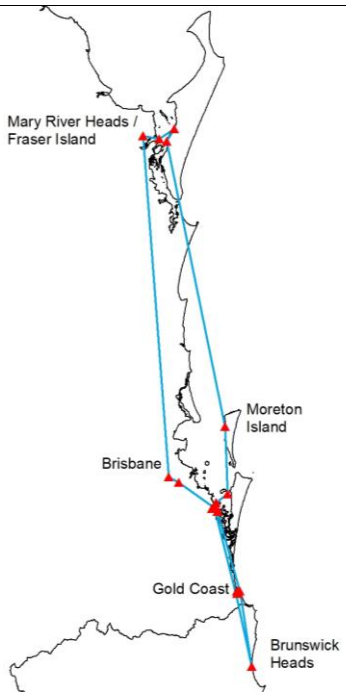
(1) Mary River Heads / Fraser Island. It is known from five sites in this region, including Mary River Heads (Manskie and Manskie 1989), Beaver Rock and Maaroon (Beale and Zalucki 1995), and Fraser Island at the mouth of Wanggoolbva Creek and Dundonga Creek, Great Sandy National Park (observations by Hobson in 1996, in the *Atlas of Living Australia*).

(2) Moreton Bay. There is a gap of about 200 km in range from the northern limit of distribution at Mary River Heads to the nearest known occurrence in Moreton Bay, at Hays Inlet where it was first collected by De Baar (1976); however, the species has not been recently collected in that location (Beale and Zalucki 1995; Sands and New 2002). Other known localities in Moreton Bay include Redland Bay (Hagan 1980), Point Halloran (Beale and Zalucki 1995), Coomera Island (Breitfuss and Dale 2004), Boondall Wetlands (Sands and New 2002) and at least two other unnamed islands (Sands and New 2002). At Goat Island, the species is not known to have been collected since 1904 (Beale and Zalucki 1995; Sands and New 2002, D.P.A. Sands unpublished data). There is an old record (1924) from Moreton Island at Camp Cowan (from Franzen in the *Atlas of Living Australia*); however, the occurrence of *A. illidgei* on Moreton Island has not been verified by a photograph or specimen.

(3) Gold Coast. Specimens were obtained at the well-known collection site at Burleigh Heads in the 1980s and have not been sampled since, although there is still suitable habitat in the area. *Acrodipsas illidgei* was also collected at Southport in 1941 and Tallebudgera in 1980, but the species has subsequently not been recorded at these sites despite targeted searches suggesting populations are no longer extant (Beale and Zalucki 1995).

(4) Brunswick Heads, NSW. A single male was collected in 1983 by C.G. Miller in what is now Marshall's Creek Nature Reserve. Suitable habitat still occurs at this site, and at several other locations in the Brunswick Heads estuary.

(5) Toowoomba. Lane (1991) collected a single freshly emerged female on a hilltop at Toowoomba in 1987. This specimen may have been resident, but it could also have been a vagrant from coastal areas (Beale and Zalucki 1995). No other collectors in the Toowoomba area or any other non-coastal area have reported *A. illidgei* and there is no other example of the species being observed on hilltops. Thus, for the present we treat this location record as an outlier.



Spatial distribution of *A. illidgei*. The records (red) are compiled from the *Atlas of Living Australia*, NSW *BioNet* and an estimate of the Toowoomba location. The blue line shows the minimum convex polygon.

Land tenure: A number of conservation reserves in Moreton Bay are likely to protect *A. illidgei* and its habitat, including South Moreton Bay Islands National Park, Point Halloran Conservation Area and Boondall Wetlands Reserve.

Biology

Eggs are laid on the trunk and branches of trees colonised by the host ant (Samson 1987). However, even in an area generally known to support *A. illidgei*, eggs cannot be found on most trees containing the ants (Samson 1989). Eggs are laid in small groups on specific trees, which were found by Samson (1999) to contain a median of five eggs and a maximum of 25. Eggs hatch in about one week (Samson 1989).

In captivity (and probably in natural conditions), first instar larvae are carried by the ants into the ant colony, where the butterfly larvae feed on the ant larvae (Samson 1987). Larvae are closely attended by the ants, which feed on exudate from the larvae (Samson 1989). Observed trophallactic behaviour (Sampson 1989; Beale and Zalucki 1995) implies that regurgitation may supplement the butterfly larva's diet (Beale and Zalucki 1995). Larvae moult to the second instar 3–5 days after hatching (Samson 1989). Large larvae have been found in June, suggesting the onset of pupation with the onset of warmer weather in August–September (Samson 1999).

The larvae pupate in the ant nest and the pupal stage lasts about 40 days (Smales and Ledward 1942). On emergence, the adult butterfly quickly exits the ant nest before succumbing to attacks from the ants. Fluffy scales on newly emerged adults may hinder ant attacks (Samson 1987). Freshly emerged females are autogenous, and their inflated

abdomens contain a large number of fully developed eggs (Sands 1979; Samson 1999).

Adults have been collected from late August to April (Dunn and Dunn 1991), with the majority in September and December–February, suggesting at least two generations annually (Samson 1999). They seldom fly and are very inconspicuous when settled with wings closed (Braby 2000). Males settle at the tops of mangroves, but unlike all other species of *Acropdipsas*, adult males of *A. illidgei* are not known to frequent hilltops (Sands 1979).

Ecology

Larvae and pupae of *A. illidgei* were initially found in nests of a widespread and abundant ant, *Crematogaster* sp. (*laeviceps* group), in hollow branches of mangroves at Burleigh Heads, QLD (Smales and Ledward 1942). Smales and Ledward (1942) surmised that the butterfly larvae fed on the ant larvae, a hypothesis later confirmed by Samson (1987) and the late M. De Baar (unpublished) that butterfly larvae are indeed predatory on ant larvae (myrmecophagy). The ants nest in dead branches, under bark or hollows in old growth trees. The insect borers of mangroves that form these hollows are fundamental to the ecology of the ant and butterfly (Beale and Zalucki 1995).

There is a strong tendency for *A. illidgei* to occupy specific mangrove trees with ant colonies over time, supporting the hypothesis that the odour of an ant colony could play a significant role in female oviposition (Beale 1998). Larvae are restricted to one ant colony and will be attacked by ants from another colony (Beale and Zalucki 1995). These factors may partly explain the low abundance of *A. illidgei* (Beale 1998).

Critical habitat

The critical habitat of *Acrodipsas illidgei* is mangrove dominated by Grey Mangrove *Avicennia marina* or Red Mangrove *Rhizophora stylosa* (Braby 2000, 2016; Valentine and Johnson 2012). Adjacent woodland on the landward edge of mangrove is also used for breeding: Smales and Ledward (1942) collected larvae and pupae beneath bark of a bloodwood (*Corymbia* sp.), and Beale and Zalucki (1995) reported breeding from hollows in mature Swamp Oak *Casuarina glauca*. An adult female has also been collected on an ironbark ridge top at 460 m just below the main escarpment at Toowoomba (Lane 1991), but the extent to which it uses this habitat is not clear. The primary habitat is old-growth mangrove trees where the host ant *Crematogaster* sp. (*laeviceps* group) nests in hollow twigs and branches. However, the butterfly is highly localised. Even in areas where *Acrodipsas illidgei* is generally known to occur, and in apparently suitable old-growth mangrove containing the host ant, only a fraction (c. 2%) of potential breeding sites are occupied (Beale and Zalucki 1995, Beale 1998). Beale (1998) did not find any larvae in trees other than *Avicennia marina* (14 non-mangrove species sampled 37 times).

Key threatening processes

Evidence of decline: At Bulimba and Enoggera in Brisbane, where *A. illidgei* was collected in 1908 and 1909, respectively, it is likely that suitable habitat no longer exists and the species has been extirpated (Dunn *et al*. 1994; Beale and Zalucki 1995). Similarly, the

species may no longer occur on the Gold Coast (Beale and Zalucki 1995).

Past threats: *(a) Coastal development: habitat clearing and secondary impacts*. Coastal development has long been identified as a threat to *A. illidgei* (Hill and Michaelis 1988; Samson 1993; Dunn *et al*. 1994; Sands and New 2002). The coastal, estuarine environment between Mary River Heads and Brunswick Heads is one of the most developed areas in Australia, encompassing Brisbane, Gold Coast, Sunshine Coast and Tweed Coast. Mangroves were cleared for development in QLD and NSW in the early and middle twentieth century before the rates of clearing were slowed by legislative protection. There have also been declines in mangroves adjacent to development due to secondary impacts such as direct human disturbance, alterations in water flow, rapid sedimentation rates and pollution. *(b) Insecticides*. Hill and Michaelis (1988), Samson (1993), Dunn *et al.* (1994) and Sands and New (2002) all identified the spraying of insecticides for mosquito control as a threat to *A. illidgei*. Spraying of broad-spectrum insecticides to control mosquitoes was common in mangroves near urban areas in both QLD and NSW prior to the 1990s (DDT was banned in Australia in 1987). Broad-spectrum insecticides continued to be used into the 2000s (Sands and New 2002). The ongoing impact that this practice has had on the insect ecology in mangroves is not known.

Current threats: *(a) Coastal development: clearing and secondary impacts*. Clearing of mangroves is still occurring in QLD and NSW, both legally (e.g. the Pacific Highway development in NSW) and illegally (e.g. Russell Island in Moreton Bay). Small-scale illegal clearing is occurring, often for waterfront views or access to waterways. Secondary impacts, including direct human disturbance, alterations in water flow, rapid sedimentation rates and pollution are continuing although preventative controls are in place in many areas. The old-growth non-mangrove habitat used by *A. illidgei* that occurs adjacent to mangroves is under great threat from development where it occurs outside conservation reserves in the region. Since this habitat occurs above the mangrove zone, occupying a higher and drier niche, in many places it has already been removed. Secondary impacts from development are often evident in this habitat. *(b) Mangrove dieback*. Mangrove dieback, which has been a serious problem in parts of northern Australia, has also been recognised as a potential problem in the southern QLD and northern NSW region (see Mangrove dieback (Department of Environment and Science)). Mangrove dieback is likely to have multiple causes, including: (i) climate / weather, such as prolonged flooding (e.g. 1974 Brisbane River flood), drought and hail (Moreton Bay); (ii) fungal disease (Brisbane 2006), including *Phytopthera cinnamomi* (Gladstone in the 1970s); (iii) excessive nutrients (Brisbane River); (iv) pollution, such as oil blocking lenticels, herbicides; (v) sea-level rise; and (vi) erosion from landward sources or boating.

Potential future threats: *(a) Climate change: sea-level rise*. Across the known range of *A. illidgei*, sea level is predicted to rise by between 0.38 m and 0.66 m by 2100 (Church *et al*. 2016). This rise could be catastrophic for old-growth mangroves, with even the lower height prediction likely to lead to widespread loss of the old trees. Where old-growth mangroves do survive, the host ant colonies may not. The *Crematogaster* sp. (*laeviceps* group) ants forage on the mudflats and any diminution of the exposure time at low tide will have consequences for colony size and survival. Ants occupying mangroves are recognised as playing a key functional role in the ecosystem; in addition to their foraging activities, they improve the performance of mangrove trees by protecting them from insect herbivores (Cannicci *et al.* 2008). Although significant attention has been paid in general to the protection of mangroves for the maintenance of fish nurseries, less attention has been given to the specific

conservation value of old-growth mangroves and the key roles played by their diverse and abundant insect fauna. *(b) Mangrove dieback*. The potential causes of mangrove dieback remain and future outbreaks of dieback are likely. *(c) Coastal development: clearing and secondary impacts*. Coastal development is projected to increase indefinitely in the region. This includes the development pressure for waterfront properties and the need for more infrastructure. If not managed very carefully, greater population size will result in increasing the direct and indirect impacts on the habitat of *A. illidgei*.

Community engagement and conservation management

Community engagement: *Acrodipsas illidgei* has had a long history of conservation concern. Hagan (1980) assessed *A. illidgei* as a 'rare' species; De Baar and Hockey (1987) assessed *A. illidgei* as one of Australia's 'rarest' butterflies; Hill and Michaelis (1988) assessed *A. illidgei* as threatened; Samson (1989) concluded that the restricted distribution in an area subject to development meant that its "status must therefore be classified as endangered". Subsequently, in 1990, *A. illidgei* became 'Permanently Protected Fauna' under the *Queensland Fauna Conservation Act 1974*. Dunn and Dunn (1991) considered *A. illidgei* to be threatened (endangered); Dunn *et al*. (1994) assessed *A. illidgei* as Vulnerable and of great conservation concern; Gimenez Dixon (1996) assessed *A. illidgei* for the IUCN and concluded the species to be Endangered under criteria B1+B2c. Braby (2000) considered *A. illidgei* to be a species of national conservation concern. In contrast, Sands and New (2002) considered *A. illidgei* to be a species of no conservation significance, with the NSW distribution to be 'data deficient'. However, at that time they did not take into account the likely impacts of global climate change, including sea level rise, and other threats on the old-growth mangrove habitat of the species. Valentine and Johnson (2012) provided a succinct overview of the threatened status of the species and outlined recovery efforts required to prevent the species from extinction.

The QLD Government Back on Track program lists *A. illidgei* as a 'critical' species Species profile | Environment, land and water | Queensland Government. Redland City Council manages the species in mangroves within the local government area Illidge's Ant-blue Butterfly | Redland City Council.

Conservation management and actions: There are currently no management plans or recovery teams overseeing threat abatement/mitigation actions (Valentine and Johnson 2012). In 1994, mangroves were protected in Queensland (*Fisheries Act 1994*) and NSW (*Fisheries Management Act 1994*) and permits are required to undertake works or activities that may cause harm. Mangrove communities are now considered to be expanding in south eastern Australia (Asbridge *et al.* 2015) due to the build up of sediments (from catchment clearing, development and stormwater run-off), salt marsh being invaded (including in Moreton Bay and NSW – Saintilan and Rogers 2013) and re-colonisation of some areas that were previously cleared. Increasing temperatures are implicated in the southerly expansion of mangroves (Asbridge *et al.* 2015). However, it will be many decades before newly established mangroves become suitable habitat for *A. illidgei*. A variety of strategies are now used by councils and others to replace broadscale insecticide spraying for mosquito control in mangroves, such as habitat manipulation (e.g. runnelling and infilling) and spraying mosquito larvicides (e.g. 'Bti', *Bacillus thuringiensis* var. *israelensis* and (S)-methoprene). A preliminary investigation on Coomera Island considered that these techniques would not affect the butterfly (Breitfuss and Dale 2004). Further research may be required because

some concerns remain regarding non-target impacts (Sands 2018). Surveys of intervening patches of mangroves (with attendant ants) between known locations of the butterfly are also required. The taxonomic identity, distribution, critical habitat and conservation status of the host ant *Crematogaster* sp. (*laeviceps* group) remain virtually unknown. Because the host ant is of major significance in developing conservation strategies for the butterfly, scientific research into the taxonomy and ecology of the ant is of fundamental importance.

Conservation status

International (IUCN Red List): Critically Endangered.

National (EPBC): Not listed.

State: Qld: Vulnerable (Nature Conservation Act 1992); NSW: not listed.

Proposed conservation status evaluation

We recommend that the taxon be listed nationally as **Endangered** according to IUCN Red List Criterion B2ab(iii). That is, the area of occupancy (AOO) is less than 500 km^2, the geographic range is severely fragmented, and the extent and/or quality of its habitat continues to decline.

The geographic range of *A. illidgei* is precarious due to its small EOO and AOO, severe fragmentation and continuing decline of its old-growth mangrove habitat. The few known populations of *A. illidgei* are severely fragmented. The density of individuals in all known populations is very low, with only about 2% of apparently suitable habitat occupied (Beale and Zalucki 1995, Beale 1998). Many mangrove areas do not appear to support populations of *A. illidgei* and the overall distribution of mangroves is also fragmented. Overlain on this fragmented pattern are the extreme levels of coastal development, with the Sunshine Coast, Brisbane, Gold Coast and Tweed Coast all further fragmenting the distribution of the species. Continuing decline is observed and projected in area, extent and quality of habitat. There has been historical and ongoing loss of old-growth mangrove habitat due primarily to coastal development, and there is the projected loss of habitat due to sea-level rise.

EOO: The extent of occurrence is estimated to be <20,000 km^2. The distribution map shows the minimum convex polygon used to estimate EOO (6,870 km^2). A second estimate (8,552 km^2) was obtained using the calculator available in the *Atlas of Living* Australia, which uses a minimum convex hull (though this dataset does not include records from Brunswick Heads).

AOO: The area of occupancy is estimated to be <500 km^2. Using the *Atlas of Living Australia* (0.02 degree grid), the AOO is estimated to be 64 km^2. However, with some records missing from this dataset, an alternative estimate was calculated by summing all mangrove mapping within the EOO. In QLD, the coarsely mapped Regional Ecosystem *Mangrove shrubland to low closed forest on marine clay plains and estuaries* in Southeast Queensland (minus the Burnett-Curtis Hills and Ranges IBRA Subregion, which results in a region from the NSW border to about Bundaberg) is 35,000 ha in extent (Environment and Science, QLD Government, Subregions-remnant vegetation, licensed under Creative

Commons Attribution 4.0, sourced on 28 February 2019; https://apps.des.qld.gov.au/regional-ecosystems/details/?re=12.1.3; Accad et al. 2019). In NSW, there are 773 ha of mangroves from Brunswick Heads to the QLD border, mapped at a very fine scale (Creese *et al.* 2009). Therefore, the total area of mangroves within the range of the butterfly is 35,773 ha or 358 km^2. This latter calculation of AOO vastly overestimates the amount of occupied mangrove habitat because it is well known that only a small proportion (c. 2%) of suitable mangroves are occupied, so the AOO for mangrove is likely to be substantially less than 358 km^2. However, this estimate does not include the adjacent non-mangrove breeding habitat.

Scientific and/or social value

Acrodipsas illidgei is dependent on old-growth habitats and thus is likely to be an indicator of mature functional mangrove ecosystems, containing a suite of wood boring insects and host ants that are the necessary precursors for occupancy of the butterfly.

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