

Chapter 2

Environments for Butterflies in South Eastern Australia

2.1 Introduction

The East Bassian Province is among the most varied parts of Australia and is also that most changed by intensive human activities. It contains the restricted alpine/subalpine regions as the southernmost parts of the Great Dividing Range, forests dominated by sclerophyll eucalypts, southern temperate rainforests with *Nothofagus*, formerly extensive lowland grasslands, upland grasslands above the treeline, a diversity of sedgelands and coastal dune systems, and a generally rich and varied vegetation. Each of the above biotopes, and others, supports butterfly taxa largely dependent on, and limited to, it. Each also gives conservation concerns due to anthropogenic changes, many of them severe, over the last century or so. The climate is 'cool temperate' with evident seasonality, and a trend to being warmer and dryer inland than near the coast. Three major thermal zones are sometimes recognized; warm temperate, such as along the coastal plains; cool temperate, the highlands; and cold temperate, the alpine areas. The region includes Australia's largest cities (Sydney, Melbourne), the nation's capital (Canberra), other state capitals (Adelaide, Hobart) and a number of substantial regional centres, and well over half of Australia's rapidly increasing human population live within this area. Catering for the needs of increasing urbanisation and residential land use, together with recreation, industry and agriculture has led to substantial and rapid changes, and the entire region falls into Graetz et al.'s (1995) broad category of 'intensive land use'.

2.2 Environmental Change

Anthropogenic changes, many of them known or suspected threats to native biota, are the major cause of conservation concerns in the region, as elsewhere. The nine broad threats to butterflies listed by Sands and New (2002, Table 2.1) are each exemplified in the cases discussed later, but these commonly occur (in many unpredictable combinations) in concert, with the different primary disturbances later confounding to cause unanticipated synergistic effects. Aspects of land management, vegetation

Table 2.1 The major broad categories of threats listed for Australian butterflies by Sands and New (2002)

Habitat destruction
Impacts of land management
Agricultural and forestry practices
Clearing/leveling of hilltops
Pesticides
Weeds
Exotic arthropods
Climate change
Over-collecting

removal, agricultural and forestry practices, weed control and climate change, for example, may all also involve fire in some planned capacity as well as this being a potential threat when not planned. As discussed later, there is sometimes a very fine (and usually unknown) line between ‘beneficial management’ and ‘damaging threat’ to butterflies from practices such as burning or grazing, and much of their use in conservation programmes is still untried and experimental. Vegetation clearing and wetland draining for the above purposes constitute the major threat to native biota, and results in direct and ‘cascade’ losses and changes to natural habitats, often augmented and confounded by effects of alien species whose entry may be facilitated by the primary changes. They are the paramount cause of butterfly decline in the region, and changes to habitats are the major basis for conservation concerns.

Many of the key specialised habitats for butterflies appear always to have been rather limited in extent, but rapid and intensifying degradation over the last century or so has (1) led to loss and marked decrease in quality of most key biomes, with some disappearing completely, and (2) fragmentation of those habitats so that remaining populations of many butterflies are increasingly isolated within a presumed formerly much broader range. As for other specialised insect herbivores, specific larval foodplants may occur only in particular vegetation associations and microclimates, and the single main threat additional to habitat loss is progressive invasion by alien species, such as aggressively competitive weeds. Evaluating threats to species requires careful thought to optimise the criteria used, and the possible outcomes that may be informative if monitored (Table 2.2). Whatever the primary cause, many formerly extensive vegetation types now occur only as small remnants. Lowland native grasslands in the south east, for example, have been described as ‘Australia’s most endangered ecosystem’ (Kirkpatrick et al. 1995), with well over 99% of this having been lost to development and pasture improvement. Many of the remnants are small, and most are inadequately protected. Many of these are now valued as refuges, such as for grassland species now extirpated from the wider landscapes. Other important refuges, in demand for formal protection through being declared reserves, include small pioneer cemeteries, road and roadside reserves, and some lightly grazed areas. Many of these areas, and others such as the ‘roughs’ of country golf courses (New 2005) have been preserved fortuitously rather than by conservation design, and are very small – indeed,

Table 2.2 Significant impact criteria for evaluating threats to species. An action is likely to have a significant impact (and, so, be a threat) if there is a real chance or probability that it will cause one or more of the following outcomes (After DEH 2006) (IUCN categories for species are given as EW (Extinct in the Wild), CR (Critically Endangered), E (Endangered), V (Vulnerable))

Lead to a long-term decrease in the size of a population (CR, E) or important population (V)
Reduce the area of occupancy of a species (CR, E) or important population (V)
Fragment an existing population (CR, E) or important population (V) into two or more populations
Adversely affect habitat critical to the survival of the species (CR, E, V)
Disrupt the breeding cycle of a population (CR, ER) or important population (V)
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline (CR, E, V)
Result in invasive species that are harmful through becoming established in the species' habitat (CR, E, V)
Introduce disease that may cause the species to decline (CR, E, V)
Interfere (CR, E) or interfere substantially (V) with the recovery of a species
Interfere with a reintroduction into the wild (EW)
Adversely affect a captive or propagated population or one recently introduced/reintroduced to the wild (EW)

commonly too small to be considered significant for conservation of many threatened vertebrates and thus disregarded by land managers, although perhaps of critical value for insects. Clearance of native forests for plantations, either of eucalypts or alien softwood (mainly *Pinus radiata*) has also been a major influence. Despoliation of alpine systems, including upland grassland, for recreational developments has also been extensive, paralleling resort development along the coast with losses of mangroves and other coastal vegetation. Many similar examples can be cited, and particular cases recur in this book.

Vegetation associations in Australia are complex. Broad categories of habitat based in vegetation types (as in the five adopted by Kitching et al. 1978 for butterflies of the Australian Capital Territory – Table 2.3) may each include numerous distinct plant alliances, but remain useful broad descriptors that may help to characterise resident butterfly assemblages. Often, separation of vagrants from scarce resident species may be difficult, with the latter the major possible targets for conservation.

For the lowland grasslands mentioned above, Kirkpatrick et al. (1995) succinctly commented 'Ecologically complex and species-rich natural systems dominated by local grasses and herbs have been replaced by simple and species-poor systems dominated by a few species of grass, mostly from the northern hemisphere'. Butterflies are certainly not the only, even the predominant, native taxa to suffer, but the above quotation mirrors processes widely evident across numerous Australian biomes. The demise of grasslands, however, is particularly significant in that treeless 'plains' and open grassy woodlands were understandably attractive for growing crops and grazing stock, and were the earliest terrestrial biomes to be transformed extensively by European settlement. The latter facilitated introduction and spread of European weeds in feed and faeces, and the hard-hooved stock compact soils and lead to losses of deep-rooted native herbs.

These trends are brought into more specific focus by examples below.

Table 2.3 Major habitats of butterflies in the Australian Capital Territory, with number of species recorded in each (Kitching et al. 1978)

Habitat	Characteristics	No. of species
Lowland savanna	Original grasslands, now much disturbed by development	20
Savanna woodland	Two eucalypt alliances at different altitudes	37
Dry sclerophyll forest	Predominant forest below 610m, mainly eucalypts	30
Wet sclerophyll forest	Predominant forest at higher altitudes	40
Alpine zone	Subalpine/alpine woodland With grassland/herbfields, etc.	20

2.3 Threats and Butterfly Declines

Concern for butterflies in southern Australia has arisen both from perceived declines of taxa, and losses of sites that previously supported species sought by hobbyists. No full species has been documented as extinct so, as far as is known, no species of butterfly in the region has become extinct in the last century or so. Local extirpations, however, are frequent. Most conservation concerns have come from losses or increased vulnerability of subspecies, particularly those close to expanding urban areas – initially Sydney and Melbourne, but now encompassing other capital cities and regional centres. One of the earliest reports of such local loss was for the satyrine species *Heteronympha banksii*, which Waterhouse (1897) noted as formerly common at Mosman's Bay (Sydney) but '... now, owing to the progress of settlement, is rarely seen there.' The small patches (fragments, remnants) of native vegetation left in urban areas include some recognised as vital reservoirs of butterflies that have disappeared from the wider landscape in the region; several cases are discussed later. More generally, the importance of urban remnants for butterfly diversity has been emphasised by surveys around Adelaide (Collier et al. 2006) and in Western Australia (Williams 2009). Following Koh and Sodhi (2004), Williams distinguished two categories of butterflies on remnants: (1) resident species or urban avoiders, resident on remnant native vegetation and restricted to natural bushland areas, and (2) non-resident species or urban adaptors which breed primarily on introduced plants and sometimes visit more natural bushland areas. In some features, these categories parallel the division noted by Pollard and Eversham (1995) for British butterflies, and reflecting ecological amplitude, but with the added implications of the effects of landscape connectivity. Those categories ('habitat specialists', 'wider countryside specialists') are broad, but a useful partitioning, whereby the former includes most of the taxa of conservation interest.

However, habitat remnants are by no means confined to the urban environment. The large scale of clearing native vegetation in Australia has led, for example, to largely agricultural landscapes in which small patches of native vegetation remain, sometimes purposefully but commonly because the ground is unsuitable for cultivation by being too steep or rocky, or adjacent to watercourses. In general only

small proportions of such landscapes are preserved predominantly for conservation. The example of the Griffith region of western New South Wales (Braby and Edwards 2006) is not unusual. There, extensive clearing occurred following establishment of soldier settlements after the First World War, so that the present fragmented landscape is predominantly a product of changes over about 80–90 years. Nineteen of the 33 butterfly species reported are breeding residents and several ecologically specialised species (mainly *Lycaenidae*) are restricted to small natural remnants – with the assumption that they may previously have been more widespread on the region. As one example discussed by Braby and Edwards (2006), *Candalides hyacinthinus simplex* is threatened locally. It was found only in one locality near Griffith, breeding in a small roadside remnant of degraded mallee shrubland. This vegetation type was formerly widespread, but was largely cleared in the middle decades of the twentieth century so that only small roadside strips now remain. Elsewhere in the East Bassian, roadside reserves are important remnant habitats for butterflies and other wildlife, and many are valued as botanical enclaves – together with linear railside reserves in which, at least for the time being, native vegetation persists largely unchanged.

The scale of vegetation clearance in Australia is high: Sattler and Creighton (2002) estimated that more than half a million hectares were cleared a year and, despite progressive concerns over this, the process is continuing and has probably led to massive losses of native biodiversity – although much of this has not been documented in detail. Vegetation clearing on this scale has effects on butterflies well beyond increasing the vulnerability of already localised or rare taxa. Braby and Edwards (2006) noted the importance of remnant cypress pine woodland supporting the larval food plant of the migratory pierid *Belenois java teutonia*. This butterfly, the caper white, undertakes long migrations from north to south, and the foodplants in the Binya State Forest of New South Wales are heavily colonised when the butterflies arrive in spring. Should these remnants be lost, it is likely that important migratory pathways of the butterfly may be disrupted, as has apparently already occurred from similar causes in Queensland for the migratory skipper *Badamia exclamationis* (Valentine 2004).

An allied concern is loss of small areas of key vegetation associations through succession. One of the most localised butterflies in Victoria, *Candalides noelkeri* (noted above), is known predominantly from two small sites bordering inland salt lakes, and about 3 km apart (Braby & Douglas 2004). In those flood plains, it is restricted to sunny areas supporting the sole larval food plant, *Myoporum parvifolium*, itself subject to loss through invasion by the shrub *Melaleuca halmaturorum*. This susceptibility to succession by loss of larval food is enhanced by the shading decreasing the attractiveness of the remaining *Myoporum*, and the butterfly is regarded as Endangered. The breeding areas cover only 2–3 ha, and extensive searches have not revealed further colonies nearby. Although possibly more widely distributed in the past, Braby and Douglas (2004) suggested that it may always have had a very restricted range in western Victoria and, possibly, in adjacent southern South Australia (where Grund 2004, advocated further searches), reflected in its very specialised ecological needs. Flood plains bordering natural salt lakes are a threatened ecosystem in the region, and for which agricultural conversion has been a driver of loss, with domestic stock probably also instrumental in conserving remnants of *M. parvifolium* by restricting establishment and spread of the

Melaleuca (Braby and Douglas 2004). Habitat restoration involving replanting of *Myoporum* may be a practical conservation option for this butterfly.

Wetland despoliation and drainage in the region has had severe effects also on other butterflies. One of the taxa of greatest concern is the satyrine *Heteronympha cordace wilsoni* (the westernmost of the five named subspecies of the Bright-eyed brown, found in sedgeland, and three of them endemic to Tasmania: p. 17) which, despite targeted searches in far south western Victoria and adjacent parts of South Australia had not until recently been viewed for more than 20 years. Indeed the first confirmed sightings from South Australia occurred only in 2004 (Haywood and Natt 2006). Although the specimens appeared freshly emerged, the major foodplant was not seen at that site. Adults appear to disperse little from the swampy areas supporting the main larval food plant – the sedge *Carex appressa*. Decline has followed drainage of the habitat for agricultural changes. Following failures to find the butterfly in South Australia (Grund and Hunt 2000), a small colony was discovered there in 2004–2005 (Grund 2006). Described as ‘precarious’, this was followed by finding in Victoria in 2005, but with numbers declining substantially in 2007–2008. In the small area where the butterfly has been recorded, *Carex* sites have been extensively cleared and degraded, with existing remnants highly fragmented across the Glenelg River area; many such swamps about timber plantations and are subject to pesticide drift from measures to protect the trees. Survival of *H. c. wilsoni* is likely to depend on protection and restoration of *Carex* wetlands within the areas that the butterflies can colonise. It seems certain that surviving populations may be very isolated, and fostering connectivity may be a key conservation need, in addition to protecting and enhancing all existing colonies together with establishing adequate buffer zones around them.

However, with the exception of such ecologically restricted taxa, many butterflies are not so clearly restricted to particular vegetation-based habitats and range more widely over the landscape. Topographic features, such as those used for hill-topping may be important also. A number of scarce Australian Lycaenidae, and others, are rarely observed other than on the summits of particular hills, which have become ‘classic’ localities for collectors seeking specimens. For many of those species, biological knowledge remains fragmentary, and a number of examples are discussed later

2.4 Urbanisation

‘Urbanisation is widely recognised as having the most intense and concentrated of human impacts on the natural environment’ (Bridgman et al. 1995) and, as these authors emphasised, the process of urbanisation in Australia differed considerably from that in Europe, because it was primary rather than a consequence of migration from rural areas to towns or cities to attain improved lifestyles. Australia’s major cities were founded *de novo* by settlers, initially convicts and their guards, and the workforce later augmented by free immigrants. Their foundation sites were selected on practical criteria to be able to accommodate arrivals from Britain. Hofmeister (1988) listed five major prerequisites for favourable settlement sites in Australia as:

1. A good anchorage to facilitate trade from overseas
2. Safety from flooding, so not the most low-lying or flood-prone areas
3. Availability of a sufficient fresh water supply
4. Presence of clay for brick manufacture
5. Fertile soil for farming

All early capital cities were thereby coastal settlements, with the inland federal capital, Canberra, a much later development.

These major settlements have increased vastly in population and extent, and a high proportion of Australia's almost 22 million people (as at early 2009) live in major cities or regional urban centres. This concentration is reflected in (1) intensified development of the older inner urban areas, with increasing pressures on open space and conversion of many single-domicile plots to multiple occupancy through the construction of apartments or townhouses on large blocks (so that formerly extensive home gardens are lost), and (2) expansion around perimeters to incorporate additional land for housing and related industrial uses (New and Sands 2003a). Closely linked with this, expansion of recreational needs for an increasing population has led to massively increased coastal development (including new suburbs and extensive landscaping) in accessible areas. These changes variously incorporate:

1. Increased incidence of alien species, including many nursery-grown plants for domestic and amenity plantings, some associated with establishment of open areas attractive to house purchasers
2. Loss of more natural environments, and increasingly impenetrable barriers between remaining fragments, so that many remnants are increasingly isolated and, in many instances, vulnerable to edge effects, resulting in
3. need for site specific management for conservation of resident species that are deemed threatened

Threats related to urbanisation are important in declines of almost 40 Australian butterflies, many of them in the south east (Table 2.4, New and Sands 2003a), with conservation of some of these taxa a major local focus, together with the constraints imposed by small isolated sites. However, in addition to these, the incidence of other ecologically specialised butterflies on urban or periurban sites has led to pre-emptive measures to safeguard them before substantial declines have occurred.

Some populations of the Victorian subspecies of the swordgrass brown, *Tisiphone abeona albifascia* (Fig. 2.1) are threatened by urban development, whereby supply of the larval foodplant, the sedge *Gahnia sieberiana*, has been reduced. Restoration plantings of sedges have been important in providing for the butterfly's future (Belvedere et al. 1998), and countering such local vulnerability has been an important 'rallying point' for conservation interest in some outer Melbourne sites.

The 'Sword-grass Brown Butterfly Project' was initiated by a concerned local group, the Knox Environment Society in 1993, and led to support for the butterfly from many community sectors. Concerns arose from the loss of habitat supporting *Gahnia sieberiana* in this municipal region of eastern Melbourne, and conservation measures were formulated to enrich and extend habitat by plantings. The four sites

Table 2.4 Butterflies believed to be threatened by urban development and related processes in south east Australia (From New and Sands 2003). States where threatened noted in parentheses as: NSW (New South Wales), VIC (Victoria), SA (South Australia), TAS (Tasmania)

Hesperiidae (Australian taxa threatened by urbanisation: 18)

Regional: 16

Anisynta cynone cynone (SA); *Antipodia chaostola chares* (VIC); *A. c. leucophaea* (TAS); *Herimosa albovenata albovenata* (SA); *Hesperilla chrysotricha leucosia* (SA, VIC); *H. c. nana* (SA); *H. donmysa delos* (SA, VIC); *H. d. diluta* (SA); *H. flavescens flavescens* (VIC); *H. f. flavia* (SA); *H. idothea clara* (SA); *Ocybadistes knightorum* (NSW); *Oreisplanus munionga larana* (TAS); *Telicota anisodesma* (NSW); *T. eurychlora* (NSW, VIC); *Trapezites luteus luteus* (NSW, SA, VIC)

Papilionidae (Australian taxa threatened by urbanisation : 2)

Regional: 0

Pieridae (Australian taxa threatened by urbanisation: 0)

Nymphalidae (Australian taxa threatened by urbanisation: 2)

Regional: 1

Tisiphone abeona joanna (NSW)

Lycaenidae (Australian taxa threatened by urbanisation: 17)

Regional: 10

Acrodipsas brisbanensis brisbanensis (NSW, VIC); *A. b. cyrilus* (VIC); *Hypochrysops apelles apelles* (NSW); *H. digglesii* (NSW); *H. epicurus* (NSW); *H. ignitus ignitus* (SA, VIC); *Jalmenus lithochroa* (SA); *Paralucia pyrodiscus lucida* (VIC); *Pseudalmenus chlorinda zephyrus* (TAS); *Pseudodipsas cephenes* (NSW)



Fig. 2.1 *Tisiphone abeona albifascia* (Photo: I.M. Coupar)

occupied by the brown were all small and isolated, and promoting connectivity through additional plantings between them was also an anticipated outcome. Seeds of *Gahnia* were propagated through the Society's community nursery, with smoke and acid treatments facilitating germination. Local schools aided by involving children in plantings in school yards, and home garden plantings were also fostered. Signage and ornamental bollards, carved with motifs of the adult butterfly, its early stages and *Gahnia*, were especially produced for publicity and have been deployed at five restoration sites (Knox Environment Society 2006) (Figs 2.2 and 2.3). Those



Fig. 2.2 *Tisiphone abeona albifascia*: replanted sedge and attendant signage at one of the sites restored through Knox Environment Society project (see text)



Fig. 2.3 One of the ornamental carved bollards placed at sedge-planted sites to advertise the *Tisiphone abeona* project (see text)

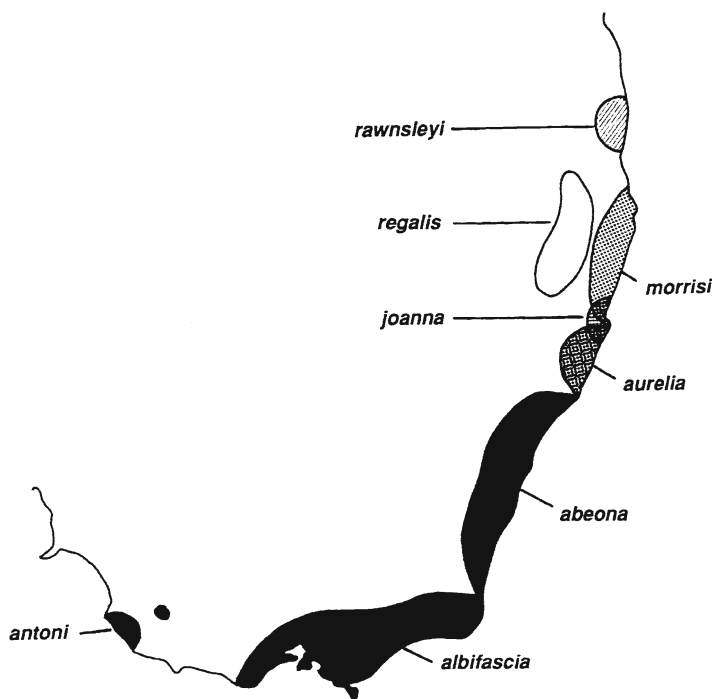


Fig. 2.4 *Tisiphone abeona*: distribution of the various named subspecies in eastern Australia. Note the narrow zone of hybridisation resulting in *T. joanna* (see text)

sites, all of them small, were selected to facilitate connectivity between two known *Tisiphone* populations almost 3 km apart.

Early trial translocations of caterpillars apparently failed, but monitoring continued to assess the values of habitat enrichment for the butterfly. The group's newsletter ('Gahnia') reported progress and also helped to foster wider awareness of butterflies in the area. *T. abeona* is a complex and variable species in eastern Australia, with several of the named subspecies very local in incidence (Fig. 2.4), and one notable form (*T. a. joanna*) is a natural hybrid between two parental subspecies (*T. a. aurelia*, *T. a. morrisi*) near Port Macquarie, New South Wales. Areas bordering the narrow hybrid zone have been degraded substantially, and the prime conservation need is to help counter alienation of the very limited area in which the parental forms come into contact. This case is unusual in representing need to conserve a hybrid form. To the north, *T. a. morrisi* has apparently been reduced by habitat losses from coastal developments, and the practical restoration techniques pioneered for *T. a. albifascia* near Melbourne may have much wider application to other forms of the swordgrass brown.

Practical conservation measures for butterflies near urban areas have considerable potential to increase public awareness of wider needs for conservation, and to involve people in the continuing programmes. Several notable examples in Australia are outlined in some of the case histories which follow.

Butterfly Conservation in South-Eastern Australia:
Progress and Prospects

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2011, X, 190 p., Hardcover

ISBN: 978-90-481-9925-9