Conservation Forests & Lands
NATIONAL PARKS AND WILDLIFE DIVISION
VICTORIA.

ARTHUR RYLAH INSTITUTE FOR ENVIRONMENTAL RESEARCH

TECHNICAL REPORT SERIES No.81

The Conservation status of the Eltham Copper Butterfly (*Paralucia pyrodiscus lucida* Crosby) (Lepidoptera: Lycaenidae)

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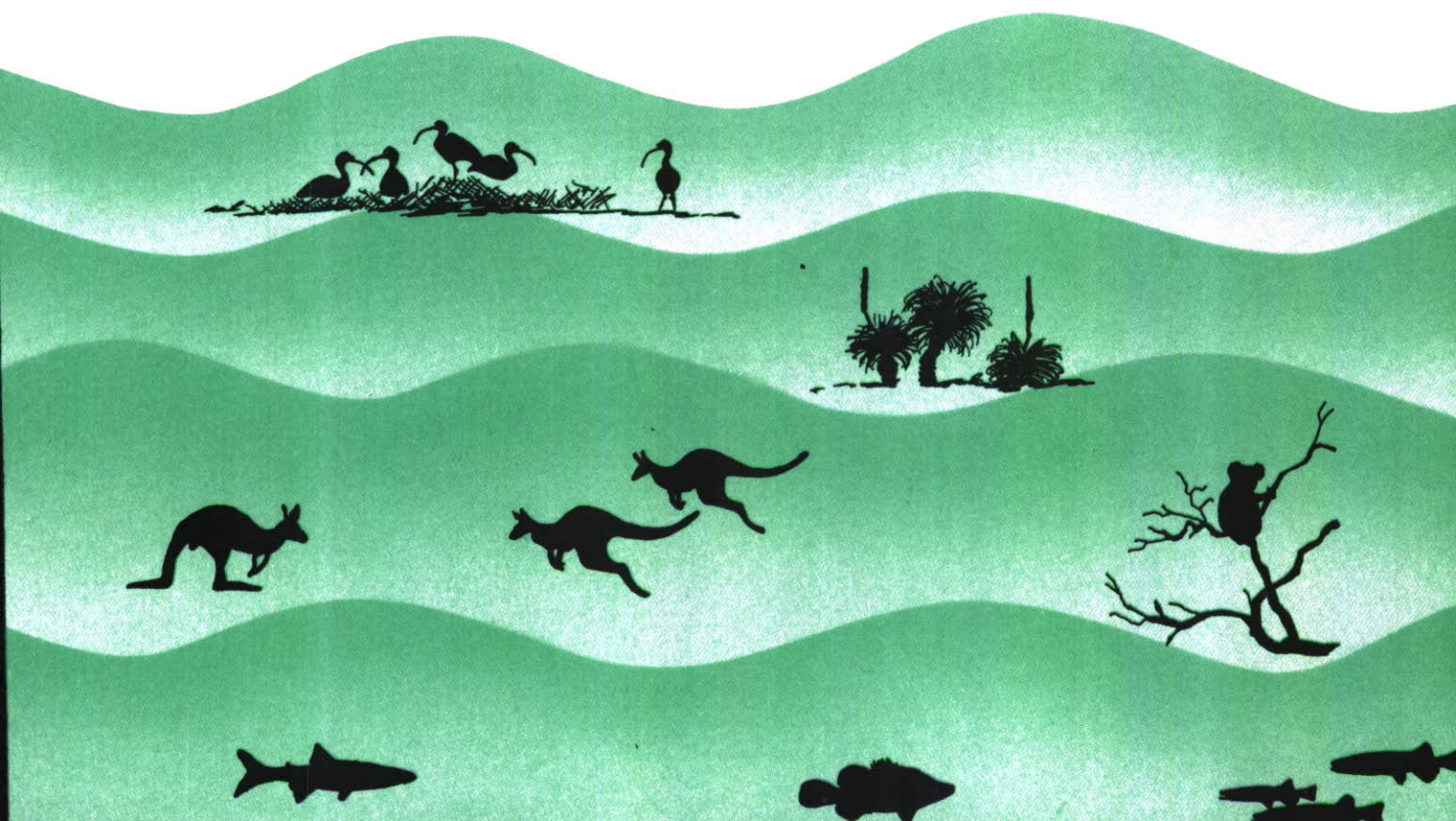
December 1987



Arthur Rylah Institute for Environmental Research

Technical Report Series No. 81 December 1987

THE CONSERVATION STATUS OF THE ELTHAM COPPER BUTTERFLY *PARALUCIA PYRODISCUS LUCIDA* CROSBY (LEPIDOPTERA: LYCAENIDAE)

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A report to National Parks and Wildlife Division

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ISSN 0810-5774

PREFACE

The survey which forms the subject of this report was planned and carried out at short notice and under tight time constraints, as was preparation of the report itself. The National Parks and Wildlife Division is indebted to the author, David Crosby, for undertaking the task under these difficult conditions. The urgency for basic details regarding the status of the Eltham Copper Butterfly related to the imminence of housing development at one major (freehold) colony site at Eltham.

Between preparation and publication of this preliminary report, further survey work on the Eltham Copper Butterfly has ensued. For this reason, some of the information and assessments contained in the report have now been superceded, due to an improved knowledge of the species distribution and abundance within Victoria.

The reader is therefore advised to consider, in conjunction with this report, additional information on the Eltham Copper Butterfly, and its management in Victoria, which can be found in Vaughan, 1988 (see under REFERENCES).

The views expressed by the author in this report are not necessarily those of the Department of Conservation, Forests and Lands.

CONTENTS

INTRODUCTION

This report has been compiled at the request of Mr D Saunders, Director, National Parks and Wildlife Division, Department of Conservation, Forests and Lands, Victoria. It follows the discovery, at Eltham, of what is believed to be the only major remaining breeding colony of the Eltham Copper Butterfly. This colony is located on a block of private land which is subject to imminent subdivisional development.

The nomenclature adopted for scientific plant names in this report follows Willis (1972).

BACKGROUND

The Dull Copper *Paralucia pyrodiscus* (Rosenstock) is a small, brightly-coloured butterfly confined to eastern Australia. It has been known in Victoria for about 100 years. Anderson and Spry (1893) stated that it occurred in the Goulburn Valley, but no specimens have been located to confirm this. Waterhouse and Lyell (1914) recorded it from Dimboola and Castlemaine. The Museum of Victoria has the Dimboola specimens, collected in 1907, and also specimens caught at Keilor in 1920.

In a comprehensive review of the Australian Butterflies, Waterhouse (1938) argued that the correct name for this species was *P. aenea* Miskin, 1890, and this was accepted by subsequent authors.

F.E. Wilson, A.N. Burns and J.C. Le Souef caught specimens at Eltham from 1938 to about 1953, and a colony at Greensborough was discovered in 1946, at which time the author took specimens. In 1950, a comparison of the status of these and later specimens with examples caught at Nowa Nowa, Victoria, indicated that the Greensborough specimens were separable as a distinct sub-species. This sub-species was subsequently described as *Paralucia pyrodiscus lucida* (Crosby 1951), since specimens from Nowa Nowa more closely resembled the typical sub-species *P. p. pyrodiscus*, which extended from central Queensland, through coastal New South Wales, to eastern Victoria. Specimens from Dimboola and Keilor were assigned to *P.p. lucida*.

From 1950, specimens were taken at Kiata, Victoria, by K. Hateley and others. These specimens closely resemble those from Eltham, and were also regarded by Crosby as *P. p. lucida*.

McCubbin (1971) assigned the Eltham-Greensborough specimens to *P. aenea lucida* and felt that the Kiata and Dimboola examples may also belong to this sub-species.

In 1971, an amateur naturalist in Montmorency noted a colony in the bush near his home, and carefully recorded subsequent sightings of the butterflies. This colony, which may have existed for many years, has been very substantially reduced by housing development in 1985 and only a very small part now remains.

In 1979 the author felt that, as no records of the Eltham Copper (*P. p. lucida*) had been obtained since 1956, it may have been wiped out, as considerable housing development had taken place in the Eltham-Greensborough district during that period, and the Kiata colony was believed to have died out around 1956. Further searches in the Eltham district, up to 1981, failed to produce any colonies. However, in 1982, a small colony was discovered by the author at Greensborough, at a site which seemed similar to the type locality for *P. p. lucida*. Late that year, this colony was reduced substantially by fire and Council slashing and its future viability was seriously doubted. McCubbin's (1971) statement that "this race may soon be extinct since the restricted area where it is found is being developed for housing" then seemed a distinct possibility. Further searches failed to reveal other colonies.

Unknown to the author at the time, C. Beardsell found a colony at Yarrambat in 1983 and expressed concern about its likely future (Pugh et al. 1983).

In January 1986, M. Braby discovered a very small colony on some Eltham Council land, and in January 1987 he found a major breeding colony on private land, and another minor one nearby on public land, both in Eltham.

BIOLOGY OF THE ELTHAM COPPER

Colonies of the Eltham Copper Butterfly are very closely associated with the larval foodplant Sweet Bursaria (*Bursaria spinosa*). This plant appears to have two distinct local forms, one growing rapidly to a height of 3-4 m, and another which is conspicuously stunted and rarely exceeds 30 cm in height. The butterfly favours the latter for egg-laying and a high percentage of small bushes appears to be essential for a viable colony. These small bushes appear to retain their low stature for some years. This may be attributed to root competition for water and nutrients with larger plants and trees, foliage consumption by larvae, the debilitating effects of sucking bugs and scale insects (together with secondary fungal attack due to these insects), and the possible impact of ant colonies on the root system.

Eggs have now been found to be laid on fresh terminal shoots, or sometimes on the stems of the plants and even on the leaf litter on the ground close to the plants. The larvae are attended by a small black ant, about 5-6 mm long, of the genus *Notoncus*, probably *N. enormis*. These ants build a small nest by hollowing out the soil around the main root of the plant for a depth of up to 5 cm. The larvae rest by day on the root just below ground level and the ants appear to protect them in a symbiotic relationship. This ant/butterfly-larva relationship is very interesting and exclusive to a number of Lycaenid butterflies. It is thought that the ants collect the minute larvae on emergence from the egg and take them to the nest. They guard the larvae and help prevent both predation by jumping spiders, certain wasps, and lacewing larvae, and parasitism by other wasps and flies. They may also help to keep the larvae free from fungal, viral and bacterial disease.

Thus the habitat must be able to support both the ant colonies and the butterflies, and the habitat requirements appear to limit appreciably the acceptable range of a number of parameters of the habitat, including moisture status of the site, and the light, temperature and humidity regimes.

The eggs probably hatch within about 10-14 days and the larvae over-winter in the ants' nest, feeding slowly, at night, when the temperature and humidity are acceptable. Larvae pupate in the ants' nest and are attached to the root just below the surface. Adults emerge from late November to mid-February, although the season can extend, unusually, to late March, depending mainly on the weather conditions.

The association with ants requires much more detailed study. It is known that many Lycaenid larvae have an organ on the rear dorsal area which, when stroked or otherwise stimulated by the ants, will secrete a solution of sugars and amino-acids which the ants devour eagerly (Common & Waterhouse 1981). It is probably for this reason that the ants collect and protect the larvae. Whether the ants are always present on the food plants first has not been proved, although it is generally agreed to be so. The same ants also "farm" scale insect larvae for their secretion, and certain white scale insect larvae are frequently found on the bushes chosen by the butterflies, or even in the ants' nests with the larvae. Sometimes a different pink-shelled hard scale insect is also present on the same Sweet Bursaria plants.

It is believed that there is only one generation of the butterfly each year, but the flight season is extended. Appearance of fresh adults in 1987 at the newly discovered major colonies in early March seems unusual and may point to a second generation. This requires further research, as does the duration of the egg, larval and pupal stages, together with the influence of weather on these phases of the life cycle.

The specific nature of the habitat is particularly relevant to the distribution of the butterfly. The colony appears to require a gentle slope, for good drainage, facing towards north or west. There is a sparse cover of eucalypts, mainly Red Stringybark (*Eucalyptus macrorhyncha*), Long-leaf Box (*E. polyanthemos*) and Candlebark (*E. rubida*). Conspicuous shrubs in the understory include Hedge Wattle (*Acacia paradoxa*) and Shiny Cassinia (*Cassinia longifolia*) in addition to the Sweet Bursaria. Native grasses are the most conspicuous component of the herb layer.

The soil is a poor grey loam, typical of Silurian sediments throughout the district. There is often a small amount of moss near or around the small Sweet Bursaria plants and usually grass is growing close by. The leaf litter and the slope appear to inhibit wetting of the soil in the vicinity of the Sweet Bursaria, a factor which may limit the introduction and spread of bacterial, fungal and viral diseases within the ants' nests.

The acceptability of the habitat to the butterflies appears to decline rapidly if any of the constituent factors in the balance are changed, for example, the felling of trees or removal of ground litter. The requirement for the attendant

ant colonies necessitates a habitat that can provide their food needs (for example, rotting vegetable matter, dead insects, fallen flowers and pollen) together with the right microclimate for their existence. Excessive dryness is as detrimental as excessive moisture.

CONSERVATION SIGNIFICANCE OF THE ELTHAM COPPER

The very restricted current distribution indicates that the insect is "threatened", as known colonies are likely to be subject to early habitat disturbance/destruction and their small size will result in population collapse.

Loss of the Eltham Copper would represent the first documented case of an insect's demise in Australia. Its importance lies as much with the principles of conservation as with the specific insect itself. There is a growing awareness in the zoological community that maintenance of genetic diversity in such creatures as insects is now very important. Key (1978) and New (1984) have highlighted the need to conserve our local insect fauna, particularly through habitat retention. The preservation only of beautiful or scientifically interesting or important species now appears indefensible. Insects generally are very abundant, but perform an immensely important ecological role, often in the food chains of the more glamorous and well-known vertebrates, and in the recycling of vast quantities of otherwise unusable vegetable and animal matter.

The very specific requirements of the habitat of insects such as the Eltham Copper put particular pressure upon them, compared with those insects whose needs are more flexible. Subtle changes made in the physical or biological components of the habitat can be fatal. In England, for example, four species out of a total of only 63 resident butterfly species have been exterminated since 1850, almost exclusively due to habitat alteration. (This compares with 382 known butterfly species in Australia). The last one of these, the large blue, *Maculinea arion* (Linnaeus), became extinct in 1979, as a result of the loss of the ant colonies in which its larvae lived.

The field survey for this report was undertaken to determine whether other major colonies of the Eltham Copper could be found in the Eltham area. If such colonies could be located, the necessity to maintain the major new colonies may be reduced or removed and, although still "vulnerable", the

insect would not be "endangered" (I.U.C.N. categories, see Collins and Morris, 1985).

CURRENT DISTRIBUTION SURVEY

In order to ascertain, as far as possible, the total extent of the distribution of the Eltham Copper in the Eltham-Greensborough district, a field survey was implemented. This was carried out over the period 7-21 April 1987.

OBJECTIVES:

(a) To survey the existing colonies and determine their viability.
(b) To determine whether any additional colonies exist or are likely to exist in the district.
(c) To advise on possible conservation strategies.

METHODS:

(a) The known colonies were inspected carefully to obtain an overall appreciation of what constituted the habitat.
(b) Detailed aerial photographs were inspected and all areas which appeared suitable were checked in the field, to determine whether they had any potential for colonies.
(c) Potential sites, mainly those with a reasonable number of small Sweet Bursaria bushes, were checked fully for ants' nests and larvae by searching a selection of the most likely-looking plants. Those sites which lacked ants, but still appeared to have potential, were noted so that they could be further checked during the adult flight season. (It should be pointed out that trying to locate colonies by checking for ants' nests and larvae is the more difficult procedure as both are difficult to find, particularly in cool or cold weather when both ants and larvae become inactive and retreat lower into the ground. Time constraints also prevented every bush from being investigated).
(d) Finally, the existing colonies were studied carefully to estimate the population size, dimensions, and general condition of each.

RESULTS:

In total 49 hours of field work was performed, involving about 500 km of road travel to about 50 sites. Included were a number of sites suggested by interested parties where colonies were thought to exist.

This survey covered the Shires of Eltham and Diamond Valley, generally east of the Plenty River and north of the Yarra River, and the southern section of the Shire of Whittlesea, together with several locations in adjoining Shires. Included were most State Government and Council lands, and all the major accessible private blocks.

Principle findings of this survey can be summarised as follows:

(a) One new colony of the butterfly was identified through confidential advice from a resident who was interested in butterflies and had studied a very small colony near his home in Montmorency.

(b) One additional site with ant colonies but no butterfly larvae was discovered on private land.

(c) Apart from (a) above, no additional colonies were discovered. However, several sites worth investigating during the next butterfly adult flight season (November 1987 to February 1988) were noted. These are listed in Appendix 1.

(d) The principal site was surveyed and a further, small colony was found, additional to the two previously known major colonies. All three were checked and their locations are as shown in Figure 1. Comments on their status are included in Appendix 2. No colonies were found on the cleared S.E.C.V. transmission line easement or in the forest area between this and Reynolds Road to the east.

(e) The status of the four minor colonies on the other sites was surveyed and the results included in Appendix 3. These are all considered to be very small colonies, and due to this and their locations cannot be regarded as viable in the long-term.

(f) It was disappointing to find that the butterfly colony discovered by C. Beardsell in 1983 at Yarrambat (Pugh et al., 1983) had been completely exterminated by stock, which have destroyed all the Sweet Bursaria bushes. There appeared to be no other potential sites nearby.

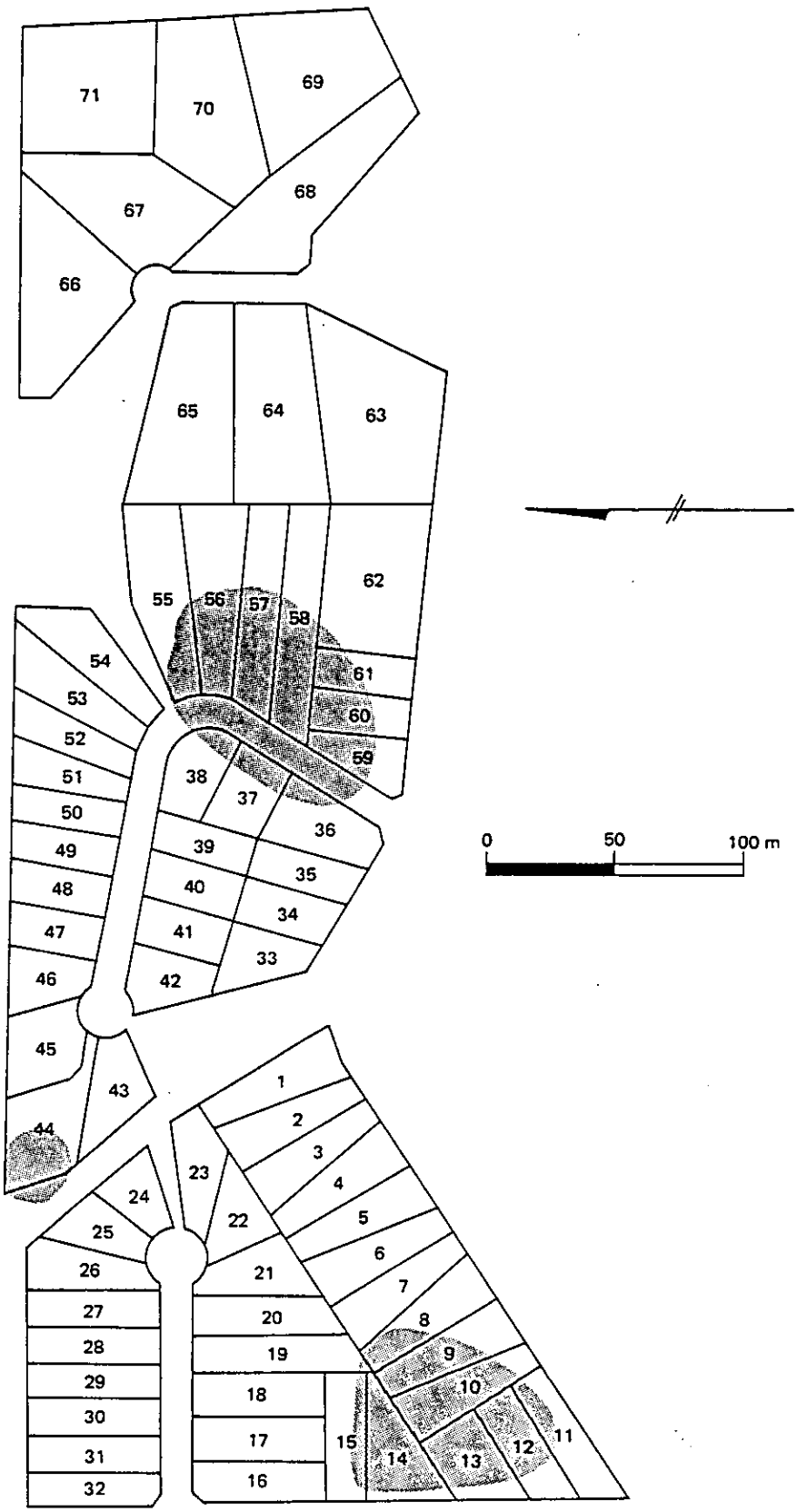

Figure 1. Site plan showing location of Eltham Copper Butterfly Colonies (shaded), Diosma Road, Eltham.

In consequence, the only sites at which the Eltham Copper Butterfly is now known to survive are:

1.	Diosma Road, Eltham	3 colonies
2.	Eucalyptus Road, Eltham	1 colony
3.	Council land, Greensborough	1 colony
4.	Council land, Eltham	1 colony
5.	Private land, Montmorency	1 colony

The precise details of the locations of these sites are being kept as confidential as possible in an attempt to minimize the adverse impact of excessive public scrutiny and the risk of vandalism. Details will be provided to the Department as required for bona fide conservation or management purposes.

OPTIONS FOR COLONY RETENTION

Having demonstrated that the land at the corner of Diosma Road and Eucalyptus Road contains the only known surviving viable colonies of the Eltham Copper Butterfly, options for the conservation of this insect include:

1. Retention of lots 1 to 62 inclusive (constituting the first three stages of the proposed subdivision) as a butterfly sanctuary. This option would permit development of lots 63 to 71 (stage 4) to proceed as planned.

2. Retention of lots 1 to 32 inclusive (stages 1 and 2) in their present condition as butterfly sanctuary (western colony).

3. Retention of lots 34 to 40 plus 49 to 62 in their present condition as a butterfly sanctuary (eastern colony). This option would involve solving potentially harmful drainage problems.

   (Appendix 2 presents a comparison of the respective characteristics of the western and eastern colonies).

4. Permit the subdivision to proceed as planned, with the inevitable loss of all three colonies on the land, in which case the survival of the butterfly would depend on the protection of the habitat of the four minor colonies listed under Results, above.

In the event of options 2, 3 or 4 being implemented, it has been suggested that interim protection of the butterfly colonies on subdivisional allotments may be possible by instituting an education program for prospective home owners. This option has been suggested as an interim stage in a translocation program, captive breeding program or artificial re-establishment program for the Eltham Copper. However, this suggestion is not considered feasible in view of the delicate habitat requirements of the butterfly and the vulnerability of its habitat to degradation by unavoidable consequences of urban development, including weed invasion, altered hydrology, genetic isolation and trampling.

OTHER CONSERVATION OPTIONS

1. Translocation of colonies.
   Removal of existing plants together with their associated ants and butterfly larvae is not accepted as a viable short term option due to the following difficulties which would be encountered:

   (a) Obtaining a suitable alternative site. Any completely suitable site would probably have been colonized already, and where this is not the case some important element is probably lacking. A review of the sites mentioned in Appendix 1 should provide further indications as to whether alternative sites could be developed.

   (b) The transfer of a complete plant with ant nest and butterfly larvae. The act of digging up such a plant would inevitably disturb the ants, which would be prone to desert it. It is felt that, as no brood (i.e. ant eggs, larvae and pupae) was found in any of the ant nests located at the bases of Sweet Bursaria plants, these nests may be purely specialized cells for the purpose of "farming" the butterfly and scale insect larvae, some distance away from the main nest. Further, ant nests can never be moved unless the colony queen is taken too (A. Yen., pers. comm.). This requires location of the nest and identification of the queen. These requirements, together with the physical problems, virtually make it impossible to translocate ants' nests. Even if this

was possible, ants, like many insects, are very territorial. Thus the inhabitants of any super-imposed colony would be attacked immediately by the resident ants, which by weight of numbers would almost certainly wipe the introduced colony out quickly. In addition, any butterfly larvae associated with the introduced ants would be quickly eradicated by the resident ants.

(c) Effects on the plants. The small Sweet Bursaria bushes have a very deep tap-root system together with extensive shallow lateral roots, which make the plants difficult to move. Some botanists have expressed the view that the small, but probably quite old, plants will, when moved, revert to the rapidly growing larger variety. This variety is never used by the butterflies, possibly because of the much greater exposure of the larvae to predation and parasitism when they are required to move much greater distances to feed on the fresh foliage. This would also require a much greater energy consumption.

(d) The verification time involved. Ascertaining whether translocation is feasible through the development and testing of appropriate transfer methods would take some years, and even then may still end with a negative result. Such time is not available.

2. Captive breeding program.
Artificial maintenance of a colony in a facility similar to that at the Melbourne Zoo butterfly house may be possible, even without ants, but it also would take some years to develop and considerable cost to implement. This time is not available.

3. Artificial establishment of new colonies.
The problems mentioned above in respect to the attendant ants would require nests to already be in existence at the translocation site. Adult male and female butterflies would then be released at such a site. The results of the survey confirm the difficulty in finding such sites, but this alternative still remains a valid option.

Nevertheless, some years observation would be required to confirm the establishment of a viable colony of butterflies. The acquisition of the site would incur a cost if private land was required.

RECOMMENDATIONS

As a result of the survey, and the associated factors mentioned in this report, the following recommendations for action are suggested:

1. That the preferred conservation option (Option 1) of those listed above be implemented. In conjunction with this option, it is suggested that the State Government investigate a land swap as a means of compensating the developer for the cost of lots 1 to 62 of the proposed subdivision, or for corporate (or individual) sponsorship.

2. That a Committee of Management, including representatives of the local community, be established as soon as possible to oversee the management of the sanctuary and to monitor the butterfly colonies. Urgent consideration should be given to fencing the sanctuary to avoid habitat degradation and vandalism.

3. That the State Government take steps to protect the butterfly colony and the associated population of the rare shrub *Dodonaea cuneata* (Wedge-leaf Hop-bush) on the Ministry of Education land on Eucalyptus Road, adjacent to the Eltham Shire "linear reserve".

4. That the Shire Councils of Eltham and Diamond Valley be urged to take appropriate action to conserve the butterfly colonies on their lands.

5. That any appropriate assistance required by the property owner in Montmorency be provided by Eltham Shire Council (and the State Government, if applicable) in order to maintain his colony as a private sanctuary.

6. That further surveys be implemented during the next flight period of the butterfly (November 1987 to February 1988) in an attempt to locate additional viable colonies in the district and to further ascertain the conservation status of the known colonies.

7. That urgent research be commence on the study of the attendant ant and its association with the Eltham Copper Butterfly.

COMMENTS

It is felt that, unless the major site in Diosma Road is retained intact (Option 1), there is a high degree of probability that the Eltham Copper Butterfly will become extinct in the foreseeable future. The continuity of habitat between the three colonies on this site is regarded as essential, not only to maintain the habitat itself, but to allow some degree of genetic interchange between the populations. This would be lost if the colonies were left isolated by residential development between them, or only a single colony was conserved.

It should be noted that, notwithstanding the above action being taken, there is no way to ensure absolutely that the colonies on the subdivision land remain viable indefinitely. However, this can be encouraged through appropriate management action, the consequences of which will have to be carefully considered before implementation. For example, excessive grass growth will have to be controlled and possibly some Sweet Bursaria bushes pruned to encourage new growth. Much of this work will be experimental and must be fully documented.

Finally, it is a recognised principle of biological conservation that one does not "put all one's eggs in one basket". The importance of protecting both major colonies on the Diosma Road site, backed up by protection of all known minor colonies, cannot be overstated as an insurance against accidental loss of any individual colony. Any conservation program which fails to achieve these objectives cannot guarantee the survival of the Eltham Copper Butterfly.

ACKNOWLEDGEMENTS

The author wishes to thank the following people for their help, guidance, support and advice:

Mrs P. Toner, Messrs D. Cameron, M. Braby, C. Beardsell, T. New, N. Walsh, A. Yen, N. Quick, C. McCubbin, I. Endersby, T. Pearce, J. Landy.

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APPENDIX 1

LIST OF POTENTIAL LOCALITIES TO BE VISITED IN FLIGHT TIME

- Block opposite Eltham College, Research (?Education Department)
- Aqeduct Road, Diamond Creek - 1 site north*, 2 sites south (private).
- Block north of Janefield colony, Plenty - 2 possible sites (private).
- Heard Road, Yarrambat (Council or private?).
- Heather Road, Wattle Glen (private).
- Silver Street (at Vine Street) Eltham (private).
- Patullos Road, Nutfield (Council verge).
- The Hundred Acres, Park Orchards (Council).
- Ryans Road (near Serena Court), Eltham North (private or Council?).
- Wooded Way Park, Eltham.

* This was the only site where ants' nests were found (but without butterfly colonies).

APPENDIX 2

COLONIES OF THE ELTHAM COPPER AT DIOSMA ROAD SITE

Western Colony

Area approx. 7000M^2
Bursaria - possibly 1000
Larvae - 300/500
Condition - some trampled, some slashed, some paths.

Comments

-This is the best site.
-More open, better for adult flight.
-Needs more care due to proximity to main road (trampling, rubbish).
-High percentage of small bursaria plants.
-Less grass.
-Dry site.
-Good N orientation.
-This colony comprises a discrete catchment area controllable as a unit (no external drainage problems).

Eastern Colony

Area approx. 8500M^2
Bursaria - over 1000
Larvae - 200/300
Condition - fairly natural, some paths.

Comments

-Slightly denser tree and bush cover.
-Not so open for flight.
-Higher percentage of larger bursaria plants.
-Generally a damper site with small N-S gully near centre.
-Orientation not as good (main area NW aspect).
-Mainly clear of rubbish and trampling.
-Damaged by surveyors.
-This colony is subject to drainage (sullage etc.) from Diosma Road and adjacent properties (very undesirable).

Northern Colony

Area approx. 1000m^2
Bursaria - 20-30
Larvae - 50?
Condition, slightly trampled, no paths.

Comments

-Very small colony.
-Vulnerable due to proximity to houses (trampling and rubbish).
-Useful mainly as a back-up supply.
-On N sloping area on ridge line.
- Bursaria bushes likely to soon be over-grown with grass.

APPENDIX 3

MINOR COLONIES OF THE ELTHAM COPPER

No.	Location	Comments
Site 1	Council land, Greensborough	This site is approx. 100m by 40m and runs E-W. The butterfly has colonized principally the E and W ends of the site. The whole site is degraded with much rubbish and weed infestation. It has been badly slashed and part recently burnt, with signs of earlier burns. The better eastern end has about 30 bursaria bushes and possibly 100 larvae. It is exposed and undergrowth is a problem. The western end has scattered plants (possibly 20 suitable), some slashed, estimated larvae 50. Some plants are on the "footpath" outside the reserve. Long-term viability - Nil, without dramatic changes in management.
Site 2	Education Dept, Eucalyptus Rd, Eltham	This site consists of two small areas with a total of about 300m by 10m, separated by unmade roads. It has been badly slashed in parts and is generally in poor condition. There are few small plants and few ants' nests. Approximate population around 50 larvae. Long-term viability - Nil, without dramatic changes in management. Excessive moisture is a potential problem as site is in deep gully.

Site 3	Council Land, Eltham	This is a very restricted site, subject to both severe trampling and grass overgrowth. Probably only about 20/30 usable plants exist and no larvae could be found. However, 5 specimens were caught here in January 1987. Long-term viability - Nil, probably even with dramatic changes in management. Loss imminent.
Site 4	Private land, Montmorency	Colony only about 5m by 20m. Number of plants about 20. Larvae not counted so as not to disturb them. Viability questionable as Council has pressed for slashing of site. Owner has refused admission to Council employees, but did not indicate reason. Viability questionable due to small size, but apparently has existed as part of larger colony (remainder since cleared) for some time. Genetic collapse likely. Careful management and possible transfer of adults from main site may help. Total colony probably less than 100 larvae.