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FINAL REPORT

Floral Resource Database for the NSW Apiary Industry

DAN 155A

February 1996 to June 1999

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PREFACE

Floral resources are the basis of the Australian beekeeping industry but there is increasing pressure on the beekeeping industry from:

- reduced physical resources due to forestry, land clearing, urban expansion, firewood cutting and biological control of weed species;
- reduced health of vegetation due to lack of regular flooding of western rivers, dieback, salt inundation, drought and fire;
- policy adverse to the farming of honey bees on National Park estate, Water Board and State recreation areas.

A Honey Bee Research and Development Council national workshop, held in Canberra in 1989, advocated documentation of the floral resources on which the beekeeping industry is dependent in each state.

This has been accomplished in NSW via this document and the creation of 26 reports on various state forest districts and three articles published in the Australasian Beekeeper magazine, stating the value of State Forests, National Parks and Rural Lands Protection Boards to beekeepers.

The completion of this report was very much a team effort involving NSW Agriculture staff and the cooperation of the majority of the NSW commercial beekeeping industry.

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EXECUTIVE SUMMARY

Floral Resource Database for the NSW Apiary Industry

OBJECTIVE
To create a database of floral resource information for the NSW apiary industry.

METHOD
Beekeepers with 200 or more hives registered with NSW Agriculture were surveyed for the purpose of collecting information on floral species of major importance to the beekeeping industry, including data on honey and pollen values, land tenure, location of sites, frequency of flowering and flowering period. Information was also collected on number of hives, nucleus colonies, yield per hive, total number of bee sites on various land tenures, persons employed and gross income distribution.

Three mailings were conducted, also supported by interviews of some non-respondents.

RESULTS
A total response of 81% was achieved, with a lower response for the group with 200–400 hives of 65%, to a 100% response for the group with 1501–2000 plus hives. Results, in point form, are as follows.

- There are 250 beekeepers with 200–400 hives, whereas there are only 163 beekeepers in the remainder of the commercial beekeepers owning 401–2000 plus hives. The total number of hives for all beekeepers surveyed was approximately 200,000 hives.

- The majority of beekeepers operated nucleus colonies in their beekeeping operation. The two groups who gave the greatest response indicating that they did not manage nucleus colonies were 30% of the group with 200–400 hives and 30% of the group with greater than 1000 hives.

- Average honey yields per hive per year increased with number of hives managed, with a production figure of 62 kg/hive for the 200–400 group, increasing to 111 kg/hive for the 801–1000 hive group. The average across all groups was 89.4 kg per hive per year.

- There was a considerable movement of bee hives across the Victorian and Queensland state borders. There was a general trend for Victorian beekeepers to move into New South Wales on a regular basis, and New South Wales based beekeepers to move into Queensland.

- An estimated 627 persons are actively employed in commercial beekeeping in NSW. This is the equivalent of 339 hives per person, although this will include persons working in other components of the beekeeping business rather than just those working bee hives.

- The majority of beekeepers relied on honey production for the bulk of their gross income. Beeswax production was also mentioned by the majority of beekeepers, but produced less than 10% of their gross income.

- Income derived from pollination was stated by 60 beekeepers (19% of the respondents). The majority of this group indicated that gross income from pollination was less than 25%, although 8 beekeepers indicated levels of between 30–50% of gross income.

- Gross income from package bees, comb honey and queen bee production was generally of lower importance, although there were a few beekeepers who relied on enterprises for a significant portion of their income.

- There were 23,479 bee sites. This figure includes adjusted number to include non-respondents. Adjusted bee site numbers for each land tenure are: 5,365 State Forests, 412 National Parks & Wildlife Service, 749 Crown Lands, 2,972 Rural Lands Protection Boards and 13,981 for private property.

- The top 10 primary floral species of importance to beekeeping in NSW are Patersons curse, Yellow box, Grey ironbark, Spotted gum, Canola, Red stringybark, River red gum, Mugga, White box, and White clover.

OUTCOMES

The results obtained give a clear picture of the significant floral resources of NSW as they relate to the beekeeping industry. This information will be used to illustrate the floral species of major importance on each land tenure and the characteristics of those floral resources as far as beekeeping activities are of concern.

The report will be readily used by new and existing beekeepers to assist them in their decision making processes and help minimise poor decision making and costly management strategies. The information collected can also be utilised by various land managers and land use planners to take beekeeping requirements into consideration.

The information will be of considerable benefit to those in the scientific community studying nectarivores and/or the general flowering characteristics of a range of floral species in the NSW landscape.

ACKNOWLEDGEMENTS

This project would not have been possible without the participation of 319 beekeepers who responded to the survey. This represents 81% return of surveys of all those beekeepers registered with the NSW Agriculture Beekeeping Registration System, with 200 hives or more.

Much of the information supplied is normally guarded by beekeepers as sites and information on floral resources are accumulated often after a lifetime in the business of a commercial beekeeper.

Due to diminishing resources and competition pressure from other commercial beekeepers, site specific information about floral resources is often an occupational secret. Also, the time taken to fill out the survey forms could well have been considerable for each beekeeper.

I acknowledge the combined effort of those beekeepers who assisted me in this project and in so doing, demonstrated that they share a common concern about the future floral resource base for the beekeeping industry.

This project initially began as a pilot project, number DAN 153A. At a steering committee meeting conducted on 1st February, 1996, much of the direction of this project was formulated. The steering committee comprised of:

- *Dr Roger Barlow* Chair, NSW Agriculture
- *Doug Somerville* Project Leader, NSW Agriculture
- *Dr Michael Hornitzky* Honey Bee Research & Development Committee - RIRDC
- *Keith McIlvride* NSW Apiarists' Association
- *Don Nicholson* State Forests
- *Andrew Leys* National Parks & Wildlife Service
- *Georgina Eldershaw* National Parks & Wildlife Service
- *Graeme Dudgeon* Geographic Information Systems, NSW Agriculture
- *Dr Gavin Melville* Biometrician, NSW Agriculture

The following are the main players in completing the final report (all NSW Agriculture staff).

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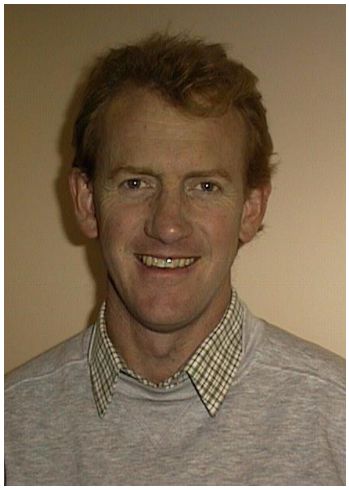

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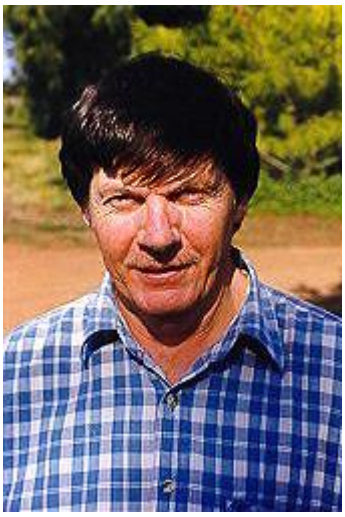

- Joanne Ottaway (Clerical Officer), for typing and preparation of this document for publishing, with assistance from Vicki Saville (Clerical Officer)—NSW Agriculture.

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1. INTRODUCTION

1.1 Background

There is little data available regarding the productivity, economic value and geographic significance of apiary sites in NSW. the documentation of this information is important to NSW apiarists in view of the ever-increasing demands being placed on land, both public and private. These changes in land usage are having an adverse impact on apiarists' access to apiary sites.

The loss of traditional nectar and pollen sources is recognised as a major problem confronting the beekeeping industry, not only in NSW, but in the rest of Australia. In 1989 this issue was the subject of a national workshop organised by the (then named) Honeybee Research Council. This forum brought together for the first time senior land managers from each of the state departments, apiary officers from the state departments, a wide range of scientists, the Honeybee Research Council and industry representatives to define the important issues surrounding access of commercial beekeeping to national parks and other public lands, and how to resolve these in a more informed and satisfactory manner.

One of the outcomes of this workshop was a recognition of the need to document the productivity, economic value and geographic significance of apiary sites throughout Australia so that this information could be included in considerations when proposals for such areas are promulgated for uses which might affect apiarists' beekeeping operations.

The commercial apicultural industry in NSW is suffering a serious lack of documented information on how the industry functions and what it specifically relies on to survive. Without access to flowering plants, the beekeeping industry would not exist. It has been stated that around 80% of the Australian honey crop is derived from Australian native species. On average, 70% of the NSW honey production is obtained from eucalypt species (Somerville & Moncur, 1997). The minor segments of the industry, e.g. queen rearers and package bee producers, rely heavily on breeding areas which, in most cases, are dominated by Australian native flora. The problem remains that information on floral resources is not comprehensive or complete across the State. There have been a few localised studies of beekeeping activities. One example is that conducted by Cocks & Dennis (1978) who surveyed 64 beekeepers on the south coast of NSW.

Various land tenures, e.g. those held by State Forests and National Parks are placing considerable pressure on beekeeping usage of these lands. Without a comprehensive and detailed report on the value of various floral types across NSW or specific regions, it is very difficult for the industry to adequately and professionally argue their case to the relevant authorities.

This research project addresses this shortfall by providing industry and various land managers with an overview of the important floral species beekeepers require to continue access to a vital agricultural industry.

Without such information, the beekeeping industry stands to continue to lose access to bee sites throughout the state. Even with such studies, the industry may lose access to conserved lands based on precautionary principles, but at least the industry will be able to clearly crystallise their concerns to the relevant authorities and relate their concerns with properly documented research findings.

Restricted access to conserved lands is only one threat to beekeepers concerning floral resources. A more complete list of threats to the floral resources applicable to the NSW beekeeping industry includes the following.

1. Government policy in relation to beekeeping on conserved lands.

2. Land clearing for agriculture.

3. Firewood cutting.

4. Forestry activities such as removal of mature high yielding honey trees.

5. Forest plantations – pines are not a beekeeping resource and many preferred eucalypt plantation species have a low value to beekeeping.

6. Fire retards growth, causes abortion of buds in eucalypts and seriously retards yielding capacity for five to seven years in heathlands.

7. Reduced regular flooding of River red gum, reducing bud initiation.

8. Salt inundation affecting the health of flora.

9. Dieback, which seriously reduces the capacity of eucalypts to initiate buds and yield nectar when flowering.

10. Droughts, which interrupt growth and flowering cycles.

11. Biocontrol of weed species that are of major benefit to honey bees, e.g. *Echium plantagineum* (Patersons curse).

12. Varieties of agricultural crops which vary in their ability to yield nectar, e.g. canola and lucerne. Over a generation of beekeeping beekeepers have observed a significant reduction in the reliability of lucerne to yield extractable honey crops.

13. Urban sprawl and rural subdivisions are an increasing problem in removing mature vegetation and reducing the number of physical sites available, particularly near some coastal vegetation types. Also there is the conflict of having large loads of commercial honey bees near people habitation areas.

These points are further discussed in Appendix 2.

1.2 Beekeeping in New South Wales

Honey bees were first introduced into NSW in 1810 (Barrett, 1995), but the modern beekeeping industry as we know it today probably had its beginnings in the 1930s. With the advent of better roads and the introduction of trucks, the ability of beekeepers to shift hives by truck or horse and dray to desirable honey flows gained favour. This has grown to an industry that can and does shift bees the length and breadth of NSW and across state borders to pursue reliable nectar and/or pollen sources to maintain bees in the best possible condition and to harvest surplus honey crops.

The NSW beekeeping industry is the largest of any of the Australian states, producing 45% of the Australian honey crop. Australia produces approximately 30,000 tonnes of honey each year of which 9,000 to 12,000 tonnes is exported (Gibbs; Muirhead, 1998). The major markets are the United Kingdom, Germany and Singapore. In 1992

Australia was rated as the ninth largest producer of honey in the world (AHB 1992).

There are approximately 4,500 registered beekeepers in NSW, managing approximately 250,000 bee hives. Of these, 400 beekeepers maintain more than 200 bee hives, representing 200,000 bee hives.

In a report produced by the Honeybee Research & Development Council (Hornitzky; McDonald; Kleinschmidt, 1993), the NSW commercial beekeeping industry was described as follows:

"Commercial beekeepers practise a migrating beekeeping pattern following significant flowerings, primarily of eucalyptus species. A full–time commercial beekeeping operation may manage between 350 and 700 hives, with an average of 500 hives per person. The production per hive for large scale beekeepers varies between 100 and 150 kg per year, with an average of 120 kg per hive for a skilled operator. Yields per hive for smaller operators are considerably less. To work the vast range of floral resources it is necessary for beekeepers to move loads of bees 4 to 6 times per year, often within a 200 km radius of their base and occasionally further afield, up to 1200 km. Most commercial beekeepers travel from 25,000 to 35,000 km per year. Loads of bees usually comprise 100 to 120 hives."

The number of beekeepers from whom the data is derived in this report of NSW beekeeping is not stated by the authors.

The main product of beekeeping in NSW is honey. The gross value of beekeeping products and services for Australia has been estimated at $60–$65 million with $49 million of this attributed to honey production (Gibbs; Muirhead, 1998). Honey production can occur over a 12-month period with favourable seasons. Approximately 70% of the NSW honey crop is derived from eucalyptus species. Major species of importance include Salvation Jane or Patersons curse (*Echium plantagineum*), Yellow box (*Eucalyptus melliodora*), Spotted gum (*Corymbia maculata*), White box (*Eucalyptus albens)*, Grey ironbark *(Eucalyptus paniculata)*, Brush box *(Lophostemon confertus)* and Coolibah *(Eucalyptus microtheca)* (Somerville; Moncur 1997).

The major contribution of honey bees to the wider community is through their role as pollination agents. Honey bees are used in NSW for a range of crops, particularly apples, pears, cherries, plums, kiwifruit, strawberries, blueberries, rockmelons, almonds, lucerne, faba beans, cotton, sunflower, white clover and canola.

1.3 Honey & Pollen Flora Literature

The intention of this project is to explore and document the floral resources of NSW as they relate to the beekeeping industry. It must be noted that previous authors have also contributed to this subject and their observations and views should be consulted along with this report. The following major references are known to the author; there may be other publications that also relate to the subject not as yet sighted by the author of this report.

Tarlton Rayment (1934) wrote the book *Profitable Honey Plants of Australasia*, in which much of the information relates to flora in New South Wales. Mr Rayment states that this handbook is "the first of its kind on Australasian plants that fill the treasury of the beehive, and render possible the financial success of the modern beefarm". The book includes contents covering honey flows and their sources, flowers and bees mutually dependent, and a list of honey and pollen plants.

This was improved on by WA Goodacre (1947) who wrote the book *The Honey and Pollen Flora of New South Wales*. Mr Goodacre states that "until recent years it seemed sufficient for a beekeeper to make a study of his own locality, since beekeeping was then conducted on permanent sites. With the advance of migratory work, however, bees are now moved long distances and a knowledge of the flora of the various plants of the state in which apiculture is carried on has become an important factor in successful operations." This publication deals with flora district by district, stating the relative honey and pollen values of the various species. Mr Goodacre does state that he "attempted" a survey of beekeepers over a three year period to collect information for his book but "the response was not as good as was anticipated". There were at least three impressions of Mr Goodacre's book.

The third significant and most recent publication detailing honey and pollen flora within NSW was that by Alan Clemson (1985) who compiled a lifetime of experience and knowledge into a book titled *Honey & Pollen Flora*. Mr Clemson's book briefly covered subjects on hive management and migration, difficulties associated with certain honey flows and detail on 298 species of flora of significance due to their honey and/or pollen values.

Thus, the creation of this research report is clearly part of an evolutionary process whereby each subsequent author builds on our knowledge and understanding of our complex and, at times, mysterious floral reservoir as it relates to honey bees.

2. OBJECTIVE

The objective of this project is to clearly document the floral resources on which the beekeeping industry is dependent: the distribution of the various species as they relate to beekeeping preferences, the frequency with which these resources are used, the land tenure on which they currently exist, and the relative values for honey and pollen levels of importance as they relate to honey bee nutritional requirements and honey production.

Specific outcomes of the project include:

a) Record the number of sites, floral species, flowering patterns and the overall value of all state forest districts in NSW; documented in 26 separate reports.

b) Record the number and distribution of sites used by beekeepers in Rural Lands Protection Boards – stock reserves and travelling stock routes.

c) Record the number of sites used by beekeepers in National Parks and their distribution.

d) Record the number of sites used by beekeepers on Crown Lands and private property and their distribution.

e) Identify the size of the NSW beekeeping industry via the number of working hives, number of nucleus colonies and the number of persons working within the industry as beekeepers (this relates to beekeepers managing 200 or more beehives).

f) Determine the degree to which NSW registered beekeepers rely on interstate resources, i.e., Queensland and Victorian flora, for a significant percentage of their honey crops.

g) Determine the honey yield per hive, which is important when determining the viability of various sized enterprises. Information on costs of production was not sought in this project.

h) Indicate the distribution of gross income distribution to beekeepers over the last five years. This includes income derived from honey production, comb honey, beeswax, pollination, queen bees and package bee production.

i) Detail the major pollen and honey floral species that commercial beekeepers identified in the surveys.

3. MATERIALS & METHODS

Preliminary discussions were held in February 1996 to define the objectives and scope of the survey and draft the initial questionnaire.

A pilot survey was then conducted in July 1996 when 20 NSW commercial beekeepers were sent survey forms. A 65% response was achieved from this project. As a result of feedback on survey design and the nature of the replies, the survey was modified.

After funding was approved from the HBRDC, survey forms (census forms) were sent to the 425 beekeepers on the NSW Agriculture Beekeeping Registration System with 200 hives or more registered. In this package mailed in April 1997 were covering letter, census form and reply paid envelope. A further copy of the same census form, a covering letter and reply paid envelope were again sent to non-respondents in August 1997. The second survey mailing included a tea bag with a note for the recipient to "sit down, have a cup of tea and take a few moments to consider the following".

This second mailing had a favourable reaction with a reasonable response. Some beekeepers returned the tea bag used and some sent beer bottle tops and coffee bags with a note to send coffee next time.

Following the mailed survey, many opportunities were taken to collect information from individual beekeepers at meetings from June 1997 to December 1998 and at the NSW beekeepers state conference in May 1998.

A "last chance" letter to beekeepers was sent in November 1998 with the census form and reply paid envelope.

Copies of the census form and the three covering letters appears in Appendix 1 of this report.

The data was entered into a program designed to operate on Microsoft Access '97 and Excel '97. To increase the security and integrity of the individual beekeeper detail within the NSW Beekeeper Census database, a password was used. This allowed only individuals with the correct password to access the information in the database.

Data entry began in mid-1998 and concluded in February 1999. Data was exported to ArcView GIS for the generation of maps.

For those beekeepers who failed to respond to the survey, estimates were derived for numbers of working hives, sites, nucleus colonies and persons employed.

This was done using a linear prediction model using number of registered hives as the predictor variable.

4. RESULTS

4.1 Response Rate to Survey

In the world of surveys, a 25% response is considered normal and 35% is considered very good. It was deemed from an early stage in this project that a very high response was necessary to gain a meaningful documentation of the entire state's floral resources as they relate to commercial beekeeping. Thus, the term census was adopted, as a survey indicates that only a sub-set of the population will be sampled and that this will be representative of the entire population.

All commercial beekeepers were asked to contribute to the exercise, thus the project was, in essence, a census of the beekeeping industry. Responses were varied: some beekeepers put incredible detail into their forms, whereas others gave the barest of information. A total response of 81% was achieved.

Table 1. Percentage response to the beekeeping census posted to 425 beekeepers with 200 beehives or more registered.

Response	Percentage
1st census mailing — April 1997, due June 1997	40
2nd census mailing — 1 August 1997, due 31 August 1997	18
Personal interview — July 1997 to December 1998	12
3rd census mailing — November 1998, due December 1998	11
Failed to respond to census	19

Table 2. Beekeepers responding to census from each category.

Hives Owned	Total No. of Beekeepers	No. of Beekeepers Returning Census	% of Beekeepers Responding to Census
200 – 400	230	150	65
401 – 600	73	58	79
601 – 800	39	36	92
801 – 1000	24	18	72
1001 – 1500	18	16	89
1501 – 2000	7	8	100
> 2000	2	3	100
Total	***393***	***319***	

The total of 393 beekeepers is down on the 425 beekeepers originally surveyed, due to amalgamation of data from beekeeping operations where more than one registration covered the one beekeeping enterprise, or the number of hives owned by a beekeeper fell below 200 by November 1998 from April 1997, or the beekeeper no longer kept bee hives.

4.2 Industry Specific Data

i) Number of working hives

Graph 1.
The following graph illustrates the distribution of beekeepers owning more than 200 hives from the census returns. The 200 to 400 hive category is by far the largest group.

Only 65% of beekeepers responded to the census in the 200 to 400 hives owned category. This graph would be even more pronounced if the graph took into consideration the total number of beekeepers directly from the NSW Agriculture Beekeeping Registration System.

The average response for all other categories with more than 400 hives 96%.

There is one beekeeper not illustrated on the graph with more than 4000 working hives.

ii) Average number of nucleus colonies

Beekeepers maintain nucleus colonies either for rearing queen bees for sale or for replacement of commercial colonies. Beekeepers who rely on queen bee production for a significant component of their income will maintain far more nucleus colonies than producers relying primarily on honey production.

The results of the census revealed that 17 producers relied, for part of their income, on queen bee production in the last five years.

Graph 2.
The following graph only includes nucleus colonies up to 400. There are another 16 beekeepers with 450 to 10,000 nucleus colonies which are very likely to be queen bee producers.

Table 3.
The following table includes the mean number of nucleus colonies per hives category, also an adjusted figure to remove producers with very high numbers of nucleus colonies. This adjusted mean is more representative of the number of nucleus colonies maintained by honey producers who do not rely on queen bee production as a component of their gross income. The percentage of beekeepers who stated that they do not operate any nucleus colonies is also listed.

Hives owned	Manage no nucleus colonies % of returns	Mean number of nucleus colonies	Adjusted mean
200–400	30%	58	43 *(1)*
401–600	17%	105	98 *(2)*
601–800	22%	222	120 *(3)*
801–1000	28%	197	173 *(4)*
> 1000	30%	801	305 *(5)*

(1) Nucleus numbers removed 250, 300, 600 and 1000
(2) Nucleus numbers removed 500
(3) Nucleus numbers removed 1200 and 1600
(4) Nucleus numbers removed 600
(5) Nucleus numbers removed 4000 and 10000

iii) Average honey production per hive

The average honey crop extracted per hive ranged from 41 kg per hive for beekeepers with less than 200 hives to 111 kg for beekeepers with hive numbers ranging from 801 to 1000.

The following graph and table indicate the average for each category of beekeeper.

Graph 3.

Table 4.

Average Honey Production Per Hive Per Year						
Hive category	<200	200–400	401–600	601–800	801–1000	>1000
Mean yield	41	62	88	92	111	94

The category of beekeepers owning less than 200 hives was from a sample of 30 beekeepers indicating that they were actually working less than the 200 hives registered with NSW Agriculture.

This figure only represents a small sample of this category and thus should not be viewed as a reliable representation of this group.

The average honey yield per hive for all commercial beekeepers with 200 hives or more who returned their census forms was 89.4 kg per hive per year.

iv) Interstate movement

Of the 319 beekeeper responses, 118 indicated that they periodically travelled across state borders.

- 61 NSW based beekeepers moved hives into Queensland and obtained, on average, 22% of their 5-year annual average honey crop in Queensland. The percentage ranged from 1% to 60%.

- 7 Queensland-based beekeepers moved hives into NSW and obtained, on average, 18% of their 5-year annual average honey crop in NSW. The percentage ranged from 5% to 50%.

- 9 NSW-based beekeepers moved hives into Victoria and obtained, on average, 12% of their 5-year annual average honey crop in Victoria. The percentage ranged from 3% to 33%.

- 41 Victorian-based beekeepers moved hives into NSW and obtained, on average, 35% of their 5-year annual average honey crop in NSW. The percentage ranged from 5% to 70%.

v) Employment figures

The question asked in the census form was "how many persons does your beekeeping business employ (including yourself)…?"

Of the 319 returns, a total of 495 persons are said to be working or employed in the beekeeping business.

The census accounts for 167,790 beehives, thus this equates to 339 hives per person.

If the figure is adjusted to remove the 200 to 400 hive group, which is not usually considered as commercially viable as a full time occupation, then the adjusted total number of hives is 121,250 which equates to 362 hives per person.

A calculated estimate for the non-respondents in the Bee Survey is 132 persons employed, thus it is possible that the total number of persons employed in the business of beekeeping in NSW is 627. This does not include persons managing less than 200 hives.

Table 5.
The following table indicates the number of hives per person for each of the hive categories.

Hive category	200–400	401–600	601–800	801–1000	>1000
Number of hives per person	247	337	346	382	383

vi) Distribution of gross income over the last 5 years

There is a very strong reliance on honey production as the primary source of income.

Graph 4.
The following graph illustrates the distribution of beekeepers' reliance on honey production.

Beeswax is a by product of honey production. It is impossible to produce honey without the need to process the wax cappings that are removed in the extraction process.

Although beeswax is a small percentage of total income, it is still significant, given the number of honey producers and the quantities of honey produced.

Graph 5.

Pollination is the next biggest category, with significant inputs into the gross income figure.

60 producers or 19% of the census returns stated pollination as a source of income.

Graph 6.

The production of package bees contributed to 34 producers' income over the 5-year period. Most of these beekeepers sell bees to specialist beekeepers who export live bees to a range of northern hemisphere countries.

The number of package bees produced in Australia for export is largely dependent on quarantine requirements of the importing countries, the profitability of the market, and the available air freight space leaving Australia.

Graph 7.

A few beekeepers supplement their income producings comb honey or cut comb.

Only 3 beekeepers rely on the production of comb honey for more than 20% of their income.

Graph 8.

Queen bee production is a very specialised field in the beekeeping industry. It is likely that this study did not give an opportunity to all full time commercial queen producers, as some would operate less than 200 hives, thus making them ineligible for the census. Even so, it is apparent that at least 10 responses relate to commercial queen producers relying on queen bee production for at least 20% of their gross income.

Graph 9.

4.3 Geographical Location of Sites According to Land Tenure

The geographic distribution and the land tenure on which apiary sites are located was stated by beekeepers by giving the nearest town, the distance and direction of the sites from that town.

The location of individual floral species and the land tenures of those sites are listed in 4.5.

Table 6.
The following table includes the total number of sites for each land tenure and an adjusted total to include estimates for non-respondents.

Total Number of Sites		
Land tenure	***Figure from census***	***Adjusted to include non-respondents***
State Forests	4,226	5,365
National Parks & Wildlife Service	333	412
Crown Land	569	749
Rural Lands Protection Boards	2,349	2,972
Private Property	11,039	13,981
Total	18,516	23,479

Map of the distribution of State Forest apiary sites, as stated by beekeepers in the census results.

Map of the distribution of National Parks and Wildlife Service apiary sites, as stated by beekeepers in the census results.

Map of the distribution of Crown Land apiary sites, as stated by beekeepers in the census results.

Map of the distribution of Rural Lands Protection Board apiary sites, as stated by beekeepers in the census results.

Map of the distribution of private property apiary sites, as stated by beekeepers in the census results.

4.4 General Summary of Floral Data

Common names:

The use of common names for floral species creates a major problem in deciphering what species each beekeeper is referring to. Where a beekeeper stated a common name that could refer to more than one species, the geographic location, values of honey and pollen and flowering times were used, where confident, to place the plant in a specific species.

For a completely reliable record of information, it is necessary to record scientific names and thus all common names have to be attributed to a specific species. This was not possible in some cases and the most obvious in the results is that of stringybarks. It was not possible, with a degree of confidence, to categorically state that when a beekeeper stated stringybark, they referred to any particular species.

Thus, in this case, a separate category was made just for stringybark and referred to as eucalyptus species, as the term stringybark could relate to any of 25 species of eucalypts in NSW.

Problems that were apparent in identifying the species name from the common names given can be summarised as follows.

- The one plant may be known by several common names.
- The one common name may refer to several different species.
- Some less known species may not have a readily used common name.

- the same common name may be used for the one group of species, e.g., *Dillwynia species* or Eggs & Bacon.

Major examples in this study include:

- **Red gum**, which may refer to:

➢ River red gum
(Eucalyptus camaldulensis)
➢ Forest red gum
(Eucalyptus tereticornis)
➢ Blakely's red gum
(Eucalyptus blakelyi)
➢ Hill gum *(Eucalyptus dealbata)*

- **Grey ironbark** may refer to:

➢ *Eucalyptus paniculata* or
➢ *Eucalyptus siderophloia*

- **Stringybark** may refer to:

➢ Red stringybark
(Eucalyptus macrohyncha)
[also Red stringybark is a common name given to Red mahogany *(Eucalyptus resinifera)* on the north coast]
➢ Broad-leaved stringybark
(Eucalyptus caliginosa)
➢ Yellow stringybark
(Eucalyptus muelleriana)
[also Yellow stringybark is a common name given to White mahogany *(Eucalyptus acmenoides)* on the north coast]
➢ White stringybark
(Eucalyptus globoidea)
➢ Silver-topped stringybark
(Eucalyptus laevopinea)
[also referred to as clean limb or white limb]
➢ Needlebark stringybark
(Eucalyptus planchoniana)
[also referred to as Planchon's stringybark]
➢ Blue-leaved stringybark
(Eucalyptus agglomerata)
➢ Thin-leaved stringybark
(Eucalyptus eugenioides)
➢ Grey stringybark
(Eucalyptus nigra)
[also referred to as White stringybark or Queensland stringybark]
➢ Narrow-leaved stringybark
(Eucalyptus oblonga)

Other species (Brooker & Kleinig, 1990) referred to as stringybarks, not stated in the results, include:

➢ Baileys stringybark
(Eucalyptus baileyana)
➢ Capertee stringybark
(Eucalyptus cannonii)
➢ Youmans stringybark
(Eucalyptus youmanii)
➢ Brown stringybark
(Eucalyptus baxteri)
➢ Blaxlands stringybark
(Eucalyptus blaxlandii)
➢ Camfields stringybark
(Eucalyptus camfieldii)
➢ Brown stringybark
(Eucalyptus capitellata)
➢ Tindale's stringybark
(Eucalyptus tindaliae)
➢ Diehard stringybark
(Eucalyptus cameronii)
➢ Privet-leaved stringybark
(Eucalyptus ligustrina)
➢ McKies stringybark
(Eucalyptus mckieana)
➢ Messmate stringybark
(Eucalyptus obliqua)
➢ Argyle apple or Mealy stringybark
(Eucalyptus cinerea)

- **Blackbutt** may refer to:

➢ Blackbutt *(Eucalyptus pilularis)*
[as occurs on the coast]
or
➢ New England blackbutt
(Eucalyptus andrewsii)

New England blackbutt can either be:

➢ *Eucalyptus andrewsii* subspecies *andrewsii*
or

- *Eucalyptus andrewsii* subspecies *campanulata*.

Subspecies *andrewsii* may also be referred to as Messmate.

- **Scribbly gum** can refer to:

- *Eucalyptus signatta*
- *Eucalyptus rossii*
- *Eucalyptus racemosa*
- *Eucalyptus haemastoma*
- *Eucalyptus sclerophylla*

- **Grey gum** can refer to:

- *Eucalyptus propinqua* [also referred to as Small-fruited grey gum.]
- *Eucalyptus punctata* [also referred to as Large-fruited grey gum.]
- *Eucalyptus canaliculata*
- *Eucalyptus biturbinata*
- *Eucalyptus major*

- **Turnip weed** is a common weed of farming areas in NSW. Other plants also bear a resemblance, or closely associated common names:

- Turnip weed *(Rapistrum rugosum)*
- Wild radish *(Raphanus raphanistrum)*
- Wild turnip *(Brassica fruticulosa)*
- Wild turnip *(Brassica tournefortii)*

- **Scotch thistle** is a common name given to a few thistles. *Onopordum acanthium* is a rather large thistle growing 1–2 m high, whereas *Cirsium vulgare* is a much smaller thistle. *C. vulgare* is also referred to as Black thistle or Spear thistle.

Table 7. List of honey and pollen flora stated by beekeepers in census by number of responses.

Scientific Name	Common Name	Responses
Echium plantagineum	Paterson's curse, Salvation jane	191
Eucalyptus melliodora	Yellow box	160
Eucalyptus paniculata	Grey ironbark	160
Corymbia maculata	Spotted gum	139
Brassica napus	Canola	113
Eucalyptus macrorhyncha	Red stringybark	104
Eucalyptus camaldulensis	River red gum	93
Eucalyptus sideroxylon	Mugga	91
Eucalyptus albens	White box	86
Trifolium repens	White clover	83
Lophostemon confertus	Brush box	78
Corymbia gummifera	Red boodwood	70
Eucalyptus pilularis	Blackbutt	64
Eucalyptus acmenoides	White mahogany	60
Eucalyptus fibrosa	Broad -leaved ironbark, Red ironbark	59
Eucalyptus dealbata	Hill gum, Smokey gum, Tumbledown gum, Ridge gum, Sand gum	59
Eucalyptus largiflorens	Black box	52
Rapistrum rugosum	Turnip weed	50

Scientific Name	Common Name	Responses
Corymbia trachyphloia	White bloodwood, Pilliga bloodwood	50
Eucalyptus bridgesiana	Apple box	49
Melaleuca quinquenervia	Broad leaved tea-tree, Belbowrie	48
Eucalyptus microtheca	Coolibah	45
Eucalyptus crebra	Narrow-leaved ironbark	44
Eucalyptus microcarpa	Western grey box, Brown box	43
Eucalyptus blakelyi	Blakely's red gum, Red gum	42
Centaurea solstitialis	St Barnaby's thistle, Yellow burr	38
Eucalyptus tereticornis	Forest red gum, Blue gum, Red gum	37
Eucalyptus viridis	Green mallee	34
Eucalyptus melanophloia	Silver-leaved ironbark	36
Eucalyptus caliginosa	Broad-leaved stringybark	35
Eucalyptus muelleriana	Yellow stringybark	35
Medicago sativa	Lucerne	33
Eucalyptus viminalis	Ribbon gum	33
Banksia ericifolia	Heath-leaved banksia	30
Onopordum acanthium	Scotch thistle	30
Angophora floribunda	Rough-barked apple	29
Eucalyptus globoidea	White stringybark	29
Arctotheca calendula	Cape weed	28
Eucalyptus moluccana	Grey box, Gum topped box	28
Eucalyptus saligna	Sydney blue gum	28
Eucalyptus andrewsii subsp. andrewsii	New England blackbutt	27
Eucalyptus socialis	Christmas mallee	24
Eucalyptus laevopinea	Silver-topped stringybark, Clean limb, White limb	24
Echium vulgare	Vipers bugloss	24
Dillwynia species	Eggs and Bacon	23
Eucalyptus propinqua, Eucalyptus punctata	Grey gum	23
Eucalyptus species	Stringybarks	23
Eucalyptus pauciflora	Snow gum	22
Eucalyptus caleyi	Caley's ironbark	20
Hypochoeris radicata	Flat weed	20
Eucalyptus resinifera	Red mahogany, Red stringybark	20
Citrus species	Citrus trees	19
Eucalyptus ochropholia	Napunyah	19
Eucalyptus populnea	Bimble box	18
Eucalyptus pilligaenis	Pilliga box, Narrow-leaved grey box	17
Eucalyptus longifolia	Woollybutt	17
Eucalyptus goniocalyx	Bundy	16
Micromyrtus ciliata, Calytrix tetragona	Fringed heath-myrtle, Hangdown, Goo-bush	16
Eucalyptus piperita	Sydney peppermint	16
Eucalyptus oleosa	Red mallee	15
Eucalyptus grandis	Flooded gum	14

Scientific Name	Common Name	Responses
Eucalyptus punctata	Large-fruited grey gum	14
Senecio madagascariensis	Fireweed	13
Eucalyptus stellulata	Black sally	11
Eucalyptus fastigata	Cut-tail, Brown barrell	11
Macadamia species	Macadamia	11
Eucalyptus robusta	Swamp mahogany	11
Eucalyptus microcroys	Tallowwood	11
Syncarpia glomulifera	Turpentine	11
Eucalyptus rubida	Candlebark gum	10
Eucalyptus signatta	Scribbly gum	10
Angophora costata	Smooth-barked apple, Rusty gum	10
Lophostemon suavelolens	Swamp turpentine, Water gum, Swamp box	10
Melaleuca species	Tea tree	10
Acacia species	Wattle	10
Eucalyptus dumosa	White mallee	10
Eucalyptus beyeri	Beyer's ironbark, Corky ironbark	9
Eucalyptus mannifera subsp. maculosa	Brittle gum	9
Tribulus terrestris	Caltrop, Cathead, Yellow vine	9
Guioa semiglauca	Crow's ash	9
Taraxacum officinale	Dandelion	8
Eucalyptus siderophioia	Grey ironbark	8
Eucalyptus planchoniana	Needlebark stringybark	8
Eucalyptus propinqua	Small-fruited grey gum	8
Cirsium vulgare	Spear thistle, Black thistle, Scotch thistle	8
Eucalyptus delegatensis	Alpine ash	7
Eucalyptus agglomerata	Blue-leaved stringybark	7
Eucalyptus intertexta	Gum-barked coolibah, Western red box	7
Corymbia henryi	Large-leaved spotted gum	7
Eucalyptus polyanthemos	Red box	7
Alphitonia excelsa	Soapbush, Mountain ash, Blackheart, Red ash	7
Eucalyptus botryoides	Bangalay	6
Banksia species	Banksia	6
Eucalyptus rossii	Scribbly gum	6
Eucalyptus sclerophylla	Scribbly gum	6
Corymbia eximia	Yellow bloodwood	6
Eucalyptus globulus	Blue gum, Eurabbie	5
Heliotropium amplexicaule	Caterpillar weed, Purple top	5
Leptospermum flavescens	Common tea-tree, Wild may, Jelly bush	5
Casuarina torulosa	Forest Oak	5
Eucalyptus conica	Fuzzy box	5
Muehlenbeckia	Lignum	5

Scientific Name	Common Name	Responses
cunninghamii		
Eucalyptus gracilis	Mallee gum	5
Eucalyptus sieberi	Silvertop ash	5
Chondrilla juncea	Skeleton weed	5
Eremophila sturtii	Turpentine bush, Sandalwood	5
Brassica tournefortii	Wild turnip, Wild radish	5
Acacia mearnsii	Black wattle	4
Bursaria spinosa	Blackthorn	4
Angophora subvelutina	Broad leaved apple	4
Eucalyptus obliqua	Broad-leaved messmate	4
Eucalyptus umbra	Broad-leaved white mahogany	4
Eremophila mitchellii	Budda	4
Eucalyptus amplifolia	Cabbage gum	4
Banksia integrifolia	Coast banksia	4
Eucalyptus bosistoana	Coast grey box	4
Myoporum deserti	Ellangowan	4
Eucalyptus incrassata	Giant, Yellow mallee	4
Avicennia marina	Grey mangrove, White mangrove	4
Dodonaea species	Hopbush	4
Casuarina species	Oak	4
Asphodelus fistulosus	Onion weed	4
Carthamus lanatus	Saffron thistle	4
Salix species	Willows	4
Trifolium balansae	Balansia Clover	3
Eucalyptus aggregata	Black gum	3
Eucalyptus oreades	Blue mountain ash	3
Olearia species, Pluchea species	Daisy-bushes	3
Jacksonia scoparia	Dogwood	3
Vicia faba	Faba beans	3
Banksia spinulosa	Hairpin banksia	3
Thryptomene micrantha	Heather bush	3
Banksia paludosa	Marsh banksia	3
Acacia anera	Mulga	3
Eucalyptus radiata	Narrow-leaved peppermint	3
Eucalyptus andrewsii subsp. campanulata	New England blackbutt	3
Eucalyptus parramattenis	Parramatta gum	3
Prunus species	Peach, Nectarine, Plum, Prune, Cherry	3
Eucryphia moorei	Pinkwood, Leatherwood	3
Melaleuca styphelioides	Prickly-leaved tea-tree	3
Banksia serrata	Saw banksia	3
Eucalyptus dawsonii	Slaty box	3
Helianthus annuus	Sunflower	3
Acacia longifolia	Sydney golden wattle	3
Eucalyptus eugenioides	Thin-leaved stringybark	3

Scientific Name	Common Name	Responses
Silybum marianum	Variegated thistle	3
Acacia collectioides	Wait-a-while	3
Polygonum aviculare	Wireweed, Hogweed	3
Chrysanthemoides monilifera	Bitou bush	2
Eucalyptus polybractea	Blue mallee	2
Eucalyptus fibrosia. subsp nubila	Blue-leaved iron bark	2
Myoporum montanum	Boobialla, Native daphne	2
Gossypium hirsutum	Cotton	2
Acacia doratoxylon	Currawong	2
Callistemon viminalis	Dropping bottlebrush, Red tea-tree	2
Sisymbrium officinale	Hedge mustard	2
Marrubium vulgare	Horehound	2
Pittosporum undulatum	Mock orange	2
Angophora bakeri	Narrow-leaved rough barked apple	2
Oxylobium lilicifolium	Native holly	2
Carduus nutans	Nodding thistle	2
Corymbia intermedia	Pink bloodwood	2
Eucalyptus camphora	Red sally	2
Aegiceras corniculatum	River mangrove, Black mangrove	2
Casuarina cunninghamiana	River oak	2
Cucmis melo	Rockmelon	2
Cassinia quinquefaria	Sifton bush, Chinese bush	2
Medicago polymorpha	Trefoil	2
Banksia serratifolia	Wallum banksia	2
Eucalyptus consideniana	Yertchuk	2
Malus domestica	Apple	1
Persea americana	Avocado	1
Ageratum conyzoides	Billygoat weed	1
Casuarina littoralis	Black she-oak	1
Rubus fruticosus	Blackberry	1
Eucalyptus nortonii	Blue apple, Long leaved box	1
Eucalyptus baueriana	Blue box	1
Boronia species	Boronia	1
Eucalyptus deanei	Brown gum, Deanes gum	1
Fagopyrum esculentum	Buckwheat	1
Eucalyptus behriana	Bull mallee, Broad leaved mallee box	1
Calotis cuneifolia	Burr Daisy	1
Cassia species	Butterbush	1
Angophora melanoxylon	Coolabah apple	1
Acacia baileyana	Cootamundra wattle	1
Ageratina adenophora	Crofton weed	1
Acacia tetragonophylla	Dead finish	1
Angophora hispida	Dwarf apple	1
Eremophila species	Emu-bush	1
Persoonia species	Geebung	1

Scientific Name	Common Name	Responses
Gompholobium latifolium	Giant wedge-pea	1
Ulex europaeus	Gorse	1
Daviesia ulicifolia	Gorse bitter-pea	1
Xanthorrhoea species	Grasstree	1
Backhousia myrtifolia	Grey myrtle	1
Eucalyptus nigra	Grey stringybark, White stringybark	1
Eremophila duttonii	Harlequin fuchsia-bush	1
Crataegus species	Hawthorn	1
Banksia collina	Hill Banksia	1
Eupatorium riparium	Mist flower	1
Acacia pendula	Myall	1
Eucalyptus seeana	Narrow leaf red gum, Mountain red gum	1
Eucalyptus oblonga	Narrow leaved stringybark	1
Ethretia membranifolia	Peach bush	1
Pyrus communis	Pear	1
Phebalium species	Phebalium	1
Myriocephalus stuartii	Poached egg daisy	1
Ligustrum species	Privet	1
Cucurbita maxima	Pumpkin	1
Ambrosia species	Ragweeds	1
Eucalyptus elata	River peppermint	1
Eucalyptus radiata subsp. robertsonii	Robertson's peppermint	1
Eucalyptus haemastoma	Scribbly gum	1
Eucalyptus racemosa	Scribbly gum	1
Glycine max	Soyabean	1
Bossiaea obcordata	Spiny bossiea	1
Saccharum officiarum	Sugar cane	1
Acacia elongata	Swamp wattle	1
Melilotus species	Sweet clover	1
Leptospermum species	Tea tree	1
Eremophila gilesii	Turkey bush	1
Vicia sativa	Vetch	1
Erisosteman species	Waxflowers	1
Callistemon salignus	White bottlebrush	1
Geijera parviflora	Wilga	1
Atalaya hemiglauca	Whitewood	1

4.5 Species Floral Information

Map & tables for each species mentioned in more than 20 survey returns, stating:

- land tenure of sites
- pollen values
- honey yields
- years between flows
- map of distribution
- months flowering.

Pollen

Pollen values have been given a rating from "1" (least level of importance) to a maximum of "5 (greatest level of importance). There is no regularly used unit associated with pollen values that could have been used in this study.

Honey yield

The figure is the mean yield, as obtained from this species expressed in kilograms per hive.

Land tenure

Sites on various land tenures, these figures are actual results and not adjusted to include non-respondents, thus they represent 81% of the commercial beekeepers with 200 or more hives.

SF = State Forests

NPWS = National Parks & Wildlife Service

CL = Crown Lands

RLPB = Rural Lands Protection Board

Flowering range

Major flowering

Minor flowering

Incidental flowering

Frequency of flowering

Mean years is the number of years between flows of nectar/pollen availability. For example, the mean years between flows for Patersons curse is 1.3, whereas this plant is an annual—what it means is that the plant does not flower and yield consistently every year, otherwise the figure would be 1, not 1.3.

Drought impacts on the flowering of this species, thus Patersons curse may not be a proposition as a major source of nectar every year even though it has an annual flowering pattern.

The frequency of flowering table indicates the major, minor and incidental years between significant flowering occurrences.

Major frequency of flowering

Minor frequency of flowering

Incidental (stated by only a few beekeepers)

Distribution

Locations plotted on map as stated by beekeepers—this does not represent the true distribution of the species, only the locations as stated by beekeepers in this study.

Paterson's curse - *Echium plantagineum*
(also referred to as Salvation jane)

Responses from 191 beekeepers.

Mean pollen value 4.75
Mean honey yield 44 kg
Mean years between flows 1.3

Level of importance of pollen Low → High				
1	2	3	4	5
2	1	11	26	220

Land tenure of sites with Patersons Curse					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
38	0	19	439	1602	2098

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

Yellow box - *Eucalyptus melliodora*

Responses from 160 beekeepers.

Mean pollen value 1.99
Mean honey yield 42 kg
Mean years between flows 2.9

Level of importance of pollen Low ➔ High				
1	2	3	4	5
24	5.5	7.5	2	4

Land tenure of sites with Yellow Box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
40	0	21	369	1440	1870

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering								
Years	1	2	3	4	5	6	7	10
Response Level								

Grey ironbark - *Eucalyptus paniculata*

Responses from 160 beekeepers.

Mean pollen value 1.76
Mean honey yield 54 kg
Mean years between flows 2.6

Level of importance of pollen Low ➔ High				
1	2	3	4	5
45	18.5	7.5	5	2

Land tenure of sites with Grey Ironbark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
975	23	6	53	572	1629

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Notes: The common name Grey ironbark may refer to two species in NSW. *Eucalyptus paniculata* and *Eucalyptus siderophioia*. Both species are similar in the values for pollen and honey. *E. paniculata* is the more southerly species extending north to Coffs Harbour on the north coast.

Spotted gum - *Corymbia maculata*

Responses from 139 beekeepers

Mean pollen value 4.37
Mean honey yield 34 kg
Mean years between flows 4

Level of importance of pollen Low ➔ High				
1	2	3	4	5
3	4	19	41	96

Land tenure of sites with Spotted Gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
823	25	5	19	403	1275

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Canola - *Brassica napus*

Responses from 121 beekeepers

Mean pollen value 4.34
Mean honey yield 21 kg
Mean years between flows 1.2

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	5	20.5	31.5	75

Land tenure of sites with Canola					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
8	0	0	107	831	946

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

Red stringybark - *Eucalyptus macrorhyncha*

Responses from 104 beekeepers

Mean pollen value 3.9
Mean honey yield 35 kg
Mean years between flows 3.6

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	7	38	46.5	40.5

Land tenure of sites with Red Stringybark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
106	16	13	61	722	918

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Red river gum - *Eucalyptus camaldulensis*

Responses from 93 beekeepers

Mean pollen value 4.56
Mean honey yield 39 kg
Mean years between flows 3.6

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	1	9	25.5	79.5

Land tenure of sites with Red River Gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
201	0	23	152	361	737

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Mugga ironbark - *Eucalypts sideroxylon*

Responses from 91 beekeepers

Mean pollen value 1.62
Mean honey yield 35 kg
Mean years between flows 2.9

Level of importance of pollen Low ➔ High				
1	2	3	4	5
18.5	3	2.5	0	2

Land tenure of sites with Mugga Ironbark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
168	18	2	49	539	776

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering						
Years	1	2	3	4	5	6
Response Level						

White box - *Eucalyptus albens*

Responses from 86 beekeepers

Mean pollen value 3
Mean honey yield 44 kg
Mean years between flows 2.7

Level of importance of pollen Low ➔ High				
1	2	3	4	5
12.5	17.5	38	15.5	12.5

Land tenure of sites with White Box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
44	15	24	220	914	1217

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

White clover - *Trifolium repens*

Responses from 83 beekeepers

Mean pollen value 4.59
Mean honey yield 32 kg
Mean years between flows 2.2

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	0	7	21.5	66.2

Land tenure of sites with White Clover					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
16	0	0	121	732	869

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering						
Years	1	2	3	4	5	6
Response Level						

Brush box - *Lophostemon confertus*

Responses from 78 beekeepers

Mean pollen value 3
Mean honey yield 47 kg
Mean years between flows 3.3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
4.5	16	35	16.5	5

Land tenure of sites with Brush Box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
509	38	0	18	238	803

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Red bloodwood - ***Corymbia gummifera***

Responses from 70 beekeepers

Mean pollen value 2.5
Mean honey yield 25 kg
Mean years between flows 2.7

Level of importance of pollen Low ➔ High				
1	2	3	4	5
13.5	29	24.5	7	4

Land tenure of sites with Red bloodwood					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
299	13	12	11	280	615

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering						
Years	1	2	3	4	5	6
Response Level						

Blackbutt - *Eucalyptus pilularis*

Responses from 64 beekeepers

Mean pollen value 2.8
Mean honey yield 27 kg
Mean years between flows 4

Level of importance of pollen Low ➔ High				
1	2	3	4	5
6.5	21	22	15.5	3

Land tenure of sites with Blackbutt					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
218	13	5	6	165	407

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

White mahogany - *Eucalyptus acmenoides*

Responses from 60 beekeepers

Mean pollen value 3.7
Mean honey yield 28 kg
Mean years between flows 2.6

Level of importance of pollen Low ➔ High				
1	2	3	4	5
2	6	20.5	27.5	17

Land tenure of sites with White Mahogany					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
350	17	3	35	325	730

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering							
Years	1	2	3	4	5	6	7
Response Level							

Hillgum - *Eucalyptus dealbata*
(also called Smokey gum, Tumble down gum, Ridge gum, Sand gum)

Responses from 59 beekeepers

Mean pollen value 4.4
Mean honey yield 27 kg
Mean years between flows 3.4

Level of importance of pollen Low → High				
1	2	3	4	5
0	1	7,5	23.5	39

Land tenure of sites with Hillgum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
78	13	9	68	290	458

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Broad-leaved ironbark - *Eucalyptus fibrosa*
(also called Red ironbark)

Responses from 59 beekeepers

Mean pollen value 2.1
Mean honey yield 40 kg
Mean years between flows 4

Level of importance of pollen Low → High				
1	2	3	4	5
15	7.5	9.5	6	0

Land tenure of sites with Broad-leaved ironbark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
261	29	2	8	177	477

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Black box - *Eucalyptus largiflorens*

Responses from 52 beekeepers

Mean pollen value 3
Mean honey yield 39 kg
Mean years between flows 3.1

Level of importance of pollen Low ➔ High				
1	2	3	4	5
6	11	18.5	6.5	8

Land tenure of sites with Black box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
36	22	38	61	280	437

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering						
Years	1	2	3	4	5	6
Response Level						

Turnip weed - *Rapistrum rugosum*

Responses from 50 beekeepers

Mean pollen value 4.76
Mean honey yield 16 kg
Mean years between flows 1.7

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	0	2	8.5	42.5

Land tenure of sites with Turnip weed					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
0	0	10	263	316	589

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

White bloodwood - *Corymbia trachyphloia*
(also referred to as Pilliga bloodwood)

Responses from 50 beekeepers

Mean pollen value 4.03
Mean honey yield 42 kg
Mean years between flows 2.9

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	2	11.5	20.5	17

Land tenure of sites with White bloodwood					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
204	25	2	9	158	398

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

Apple box - *Eucalyptus bridgesiana*

Responses from 49 beekeepers

Mean pollen value 4.36
Mean honey yield 30 kg
Mean years between flows 3.2

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	0	8	20.5	28.5

Land tenure of sites with Apple box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
34	1	2	22	336	395

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	2	3	4	5
Response Level				

Broad-leaved tea tree - *Melaleuca quinquenervia*
(also called Belbowrie)

Responses from 48 beekeepers

Mean pollen value 4.2
Mean honey yield 33 kg
Mean years between flows 1.3

Level of importance of pollen Low → High				
1	2	3	4	5
2	3	7	18	29

Land tenure of sites with Broad-leaved tea tree					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
40	37	17	5	179	278

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

Coolibah - *Eucalyptus microtheca*

Responses from 45 beekeepers

Mean pollen value 3.5
Mean honey yield 47 kg
Mean years between flows 2.8

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	5.5	21.5	10	11

Land tenure of sites with Coolibah					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
8	22	12	93	273	408

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

The common name "Coolibah" can refer to *Eucalyptus intertexta*. Their distributions overlap and thus, the use of common names makes it difficult to state absolutely which species each beekeeper is referring to. Brooker & Kleinig (1990) state the flowering period of *E.coolabah* as Dec to Feb, whereas *E.intertexta* is Mar to Sep. Blake & Roff (1988) state that *E.coolabah* is another botanical name for the same species, *E.microtheca*.

Narrow-leaved ironbark - *Eucalyptus crebra*

Responses from 44 beekeepers

Mean pollen value 2.87
Mean honey yield 35 kg
Mean years between flows 4

Level of importance of pollen Low ➔ High				
1	2	3	4	5
4	8	21.5	6.5	2

Land tenure of sites with Narrow-leaved ironbark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
191	29	26	30	192	468

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering							
Years	1	2	3	4	5	6	10
Response Level							

Western grey box - *Eucalyptus microcarpa*
(also referred to as Brown box)

Responses from 43 beekeepers

Mean pollen value 2.39
Mean honey yield 26 kg
Mean years between flows 4.2

Level of importance of pollen Low → High				
1	2	3	4	5
10.5	11	12.5	1	2

Land tenure of sites with Western grey box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
39	1	11	75	215	341

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Blakely's red gum - *Eucalyptus blakelyi*

Responses from 42 beekeepers

Mean pollen value 4.05
Mean honey yield 24 kg
Mean years between flows 4.2

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	1	13	13	17

Land tenure of sites with Blackely's red gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
15	11	18	59	242	345

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering									
Years	2	3	4	5	6	7	8	9	10
Response Level									

St Barnaby's thistle - *Centaurea solstitialia*
(also referred to as Yellow Burr)

Responses from 38 beekeepers

Mean pollen value 4.06
Mean honey yield 24 kg
Mean years between flows 1.8

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	1	7.5	17.5	15

Land tenure of sites with St Barnaby's thistle					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
0	0	1	79	259	339

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

Forest red gum - *Eucalyptus tereticornis*
(also referred to as Blue gum or Red gum)

Responses from 37 beekeepers

Mean pollen value 3.81
Mean honey yield 23
Mean years between flows 3.1

Level of importance of pollen Low → High				
1	2	3	4	5
2	1	16.5	11	15.5

Land tenure of sites with Forest red gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
150	2	6	28	218	404

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering							
Years	1	2	3	4	5	6	7
Response Level							

Silver-leaved ironbark - *Eucalyptus melanophloia*

Responses from 36 beekeepers

Mean pollen value 3.24
Mean honey yield 52 kg
Mean years between flows 4.1

Level of importance of pollen Low ➔ High				
1	2	3	4	5
3	5.5	13	10.5	5

Land tenure of sites with					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
19	5	0	113	267	404

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	2	3	4	5	6
Response Level					

Broad-leaved stringybark - *Eucalyptus caliginosa*

Responses from 35 beekeepers

Mean pollen value 3.95
Mean honey yield 33 kg
Mean years between flows 3.1

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	1.5	11.5	18	12

Land tenure of sites with Broad-leaved stringybark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
57	20	26	73	506	682

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

Yellow stringybark - *Eucalyptus muelleriana*

Responses from 35 beekeepers

Mean pollen value 3.8
Mean honey yield 38 kg
Mean years between flows 3.9

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	0.5	15	14.5	9

Land tenure of sites with					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
209	1	2	3	36	251

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering								
Years	1	2	3	4	5	6	7	8
Response Level								

Green mallee - *Eucalyptus viridis*

Responses from 34 beekeepers

Mean pollen value 2.33
Mean honey yield 53 kg
Mean years between flows 3.2

Level of importance of pollen Low ➔ High				
1	2	3	4	5
4	11	8	1	1

Land tenure of sites with Green Mallee					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
2	0	4	24	170	200

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering						
Years	1	2	3	4	5	6
Response Level						

Lucerne - ***Medicago sativa***

Responses from 33 beekeepers

Mean pollen value 1.91
Mean honey yield 26 kg
Mean years between flows 1.5

Level of importance of pollen Low ➔ High				
1	2	3	4	5
14	10.5	7.5	0	1

Land tenure of sites with Lucerne					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
0	0	1	33	170	204

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

Ribbon gum - *Eucalyptus viminalis*

Responses from 33 beekeepers

Mean pollen value 3.86
Mean honey yield 18 kg
Mean years between flows 3.9

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	2	10.5	13	9.5

Land tenure of sites with Ribbon gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
59	4	2	27	171	263

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	2	3	4	5	6
Response Level					

Scotch thistle - *Onopordum acanthium*

Responses from 30 beekeepers

Mean pollen value 3.06
Mean honey yield 29 kg
Mean years between flows 1.5

Level of importance of pollen Low ➔ High				
1	2	3	4	5
3	5.5	13	8.5	2

Land tenure of sites with Scotch thistle					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
0	0	1	23	171	195

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

Heath-leaved banksia - *Banksia ericifolia*

Responses from 30 beekeepers

Mean pollen value 3.47
Mean honey yield 25 kg
Mean years between flows 1.7

Level of importance of pollen Low ➔ High				
1	2	3	4	5
3.5	4.5	5.5	9	8.5

Land tenure of sites with Heath-leaved banksia					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
45	73	17	0	53	188

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

White stringybark - *Eucalyptus globoidea*

Responses from 29 beekeepers

Mean pollen value 3.62
Mean honey yield 19 kg
Mean years between flows 3.3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	3	9.5	12	3.5

Land tenure of sites with					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
148	1	9	2	51	211

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering						
Years	1	2	3	4	5	6
Response Level						

Rough-barked apple - *Angophora floribunda*

Responses from 29 beekeepers

Mean pollen value 4.13
Mean honey yield 22 kg
Mean years between flows 3.8

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	2.5	4.5	11.5	13.5

Land tenure of sites with Rough-barked apple					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
43	0	6	16	157	222

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering										
Years	1	2	3	4	5	6	7	8	9	10
Response Level										

Grey box - *Eucalyptus moluccana*
(also referred to as Gum topped box)

Responses from 28 beekeepers

Mean pollen value 1.72
Mean honey yield 31 kg
Mean years between flows 3.4

Level of importance of pollen Low → High				
1	2	3	4	5
12	6	5.5	1.5	0

Land tenure of sites with Grey box					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
81	0	2	14	127	224

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering							
Years	1	2	3	4	5	6	7
Response Level							

Sydney blue gum - *Eucalyptus saligna*

Responses from 28 beekeepers

Mean pollen value 3.67
Mean honey yield 32 kg
Mean years between flows 4.6

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	1	10.5	10.5	6

Land tenure of sites with Sydney blue gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
132	5	1	2	47	187

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	2	3	4	5
Response Level				

Capeweed - *Arctotheca calendula*

Responses from 28 beekeepers

Mean pollen value 4.1
Mean honey yield 17 kg
Mean years between flows 1.2

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	0	3	15	9

Land tenure of sites with					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
5	0	5	23	141	174

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering			
Years	1	2	3
Response Level			

New England blackbutt - *Eucalyptus andrewsii*

Responses from 27 beekeepers

Mean pollen value 3.6
Mean honey yield 42 kg
Mean years between flows 2.9

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	3	11.5	6.5	6

Land tenure of sites with New England blackbutt					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
45	35	5	34	166	285

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	2	3	4	5
Response Level				

Note: Both *Eucalyptus andrewsii* sub species *andrewsii* and *Eucalpytus andrewsii* subspecies *campanulata* are commonly known as New England blackbutt. Subspecies *andrewsii* is also known by beekeepers as Messmate.

Silver-topped stringybark - *Eucalyptus laevopinea*
(also referred to as Clean limb, White limb)

Responses from 24 beekeepers

Mean pollen value 3.78
Mean honey yield 31 kg
Mean years between flows 3.8

Level of importance of pollen Low → High				
1	2	3	4	5
0	2	10.5	9.5	8

Land tenure of sites with Silver-topped stringybark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
69	22	0	37	112	240

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	2	3	4	5	6
Response Level					

Christmas mallee - *Eucalyptus socialis*

Responses from 24 beekeepers

Mean pollen value 3.22
Mean honey yield 35 kg
Mean years between flows 4.3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	4.5	12	6.5	3

Land tenure of sites with Christmas mallee					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
24	0	8	9	93	134

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering									
Years	2	3	4	5	6	7	8	9	10
Response Level									

Vipers bugloss - *Echium vulgare*

Responses from 24 beekeepers

Mean pollen value 4.56
Mean honey yield 27 kg
Mean years between flows 1.8

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	0	1	9.5	15.5

Land tenure of sites with Vipers bugloss					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
14	0	2	25	137	178

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

Grey gum - *Eucalyptus propinqua/Eucalyptus punctata*

Responses from 23 beekeepers

Mean pollen value 1.76
Mean honey yield 28 kg
Mean years between flows 3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
3	9	13	6	3

Land tenure of sites with Grey gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
212	7	0	5	117	341

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	2	3	4	5
Response Level				

Notes: The common name Grey gum can refer to Small fruited grey gum, *Eucalyptus propinqua*, or Large fruited grey gum, *Eucalyptus punctata*. In the responses 16 beekeepers listed large fruited grey gum and 9 beekeepers listed small fruited grey gum. Where Grey gum was stated, it was not possible with a high degree of confidence to sort them into individual species. Grey gum's refer to: *E.canaliculata* (Dungog-Gloucester area), *E.biturbinata* (Gloucester to Kingaroy in QLD), *E.major* (SE QLD), *E.punctata* (Jervis Bay to Mudgee); *E.propinqua* (Wyong to SE QLD).

Eggs & bacon - *Dillwynia species*

Responses from 23 beekeepers

Mean pollen value 3.9
Mean honey yield 9 kg
Mean years between flows 1.3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	0	8	7.5	8.5

Land tenure of sites with					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
57	2	13	0	100	172

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering		
Years	1	2
Response Level		

Stringybark - *Eucalyptus species*

Responses from 23 beekeepers

Mean pollen value 3.71
Mean honey yield 22 kg
Mean years between flows 3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
1	2	6.5	10.5	6

Land tenure of sites with Stringybark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
57	7	0	2	91	157

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	1	2	3	4	5
Response Level					

Snow gum - *Eucalyptus pauciflora*

Responses from 22 beekeepers

Mean pollen value 4.22
Mean honey yield 35 kg
Mean years between flows 4

Level of importance of pollen Low ➔ High				
1	2	3	4	5
0	2	2.5	7	11.5

Land tenure of sites with Snow gum					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
41	4	0	11	89	145

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	2	3	4	5
Response Level				

Caley's ironbark - *Eucalyptus caleyi*

Responses from 20 beekeepers

Mean pollen value 2
Mean honey yield 36 kg
Mean years between flows 3.3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
3	1	0	0	1

Land tenure of sites with Caley's ironbark					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
22	0	12	27	120	181

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering					
Years	2	3	4	5	6
Response Level					

Red mahogany - *Eucalyptus resinifera*
(also referred to as Red stringybark on the north coast)

Responses from 20 beekeepers

Mean pollen value 3.22
Mean honey yield 17 kg
Mean years between flows 3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
2	1.5	7	7	1.5

Land tenure of sites with Red mahogany					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
64	1	0	4	77	146

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering				
Years	1	2	3	4
Response Level				

Flat weed - *Hypochoeris radicata*

Responses from 20 beekeepers

Mean pollen value 3.68
Mean honey yield 10 kg
Mean years between flows 1.3

Level of importance of pollen Low ➔ High				
1	2	3	4	5
2	0	6	9	5

Land tenure of sites with Flat weed					
SF	NPWS	CL	RLPB	Private property	Total no. of sites
13	0	1	5	81	100

Flowering range												
Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Response Level												

Frequency of Flowering		
Years	1	2
Response Level		

Table 8.

Mean values of honey yields, pollen values and years between flowering for species mentioned by less than 20 beekeepers and more than 9 beekeepers. The data for species mentioned by less than 10 beekeepers is not recorded in this report, as the accuracy is not as reliable as those species mentioned by 10 or more beekeepers. Full details are only given for species mentioned by 20 or more beekeepers due to its higher degree of accuracy.

SPECIES MENTIONED BY LESS THAN 20 & 10 OR MORE BEEKEEPERS. VALUES FOR POLLEN, HONEY & YEARS BETWEEN FLOWS					
Species	**Common Name**	**Responses**	**Mean Pollen Value**	**Mean Honey Yield (kg)**	**Mean Years Between Flow**
Citrus species	Citrus trees	19	3.34	32	1.6
Eucalyptus ochropholia	Napanyah	19	1.53	56	1.6
Eucalyptus populnea	Bimble box	18	3.24	39	3.3
Eucalyptus pilligaenis	Pilliga box, Narrow-leaved grey box	17	1.89	38	3.4
Eucalyptus longifolia	Woollybutt	17	3.05	24	4.6
Eucalyptus goniocalyx	Bundy	16	3.68	13	4.4
Micromyrtus ciliata, Calytrix tetragona	Fringed heath-myrtle, Hangdown, Goo-bush	16	3.92	20	2.2
Eucalyptus piperita	Sydney peppermint	16	2.69	24	4.2
Eucalyptus oleosa	Red mallee	15	3.22	35	4.6
Eucalyptus grandis	Flooded gum	14	3.46	17	2.8
Eucalyptus punctata	Large-fruited grey gum	14	3.60	24	3.9
Senecio madagascariensis	Fireweed	13	3.69	16	1.2
Eucalyptus stellulata	Black sally	11	3.41	12	3.3
Eucalyptus fastigata	Cut-tail, Brown barrel	11	3.73	23	5.3
Macadamia species	Macadamia	11	3.41	26	1.3
Eucalyptus robusta	Swamp mahogany	11	2.70	17	2.1
Eucalyptus microcroys	Tallowwood	11	2.88	8	8.3
Syncarpia glomulifera	Turpentine	11	3.25	26	3.2
Eucalyptus rubida	Candlebark gum	10	3.50	16	4.2
Eucalyptus signatta	Scribbly gum	10	3.14	26	3.2
Angophora costata	Smooth-barked apple, Rusty gum	10	3.60	24	3.3
Lophostemon suavelolens	Swamp turpentine, Water gum, Swamp box	10	2.88	26	3
Melaleuca species	Tea tree	10	3.2	18	2.2
Acacia species	Wattle	10	3.73	0	1.5
Eucalyptus dumosa	White mallee	10	2.88	37	4.5

5. DISCUSSION

a) State Forests

The value and importance of NSW State Forests has been documented and published by Somerville (1998) in an article titled "State Forests—A Valuable Beekeeping Resource" (refer to appendix 3).

There is also a comprehensive set of 26 studies that highlight the values of the various state forest districts to beekeeping in NSW. A list of these publications is to be found in the references of appendix 3.

State forests have traditionally been a source of floral resources for the beekeeping industry. Many state forests are heavily utilised for various species when in flower. For a beekeeper to utilise state forests, they must first obtain an occupation permit. This allows a beekeeper access to an area on which they can place their bee hives. In the past, bee sites were one square mile (1.61 km x 1.61 km) or 260 ha. This area measurement has been largely kept by most of the state forest districts. A fee is paid by beekeepers to State Forests for either a 6-month or a 12-month permit. Many sites are booked by beekeepers on a 12-month basis and the permit is maintained from year to year, even though the sites may only be utilised every two or four years for any specific floral species by beekeepers.

Some forestry districts are only used periodically and the reduced regularity of use does not justify the ongoing expense of continually paying for the occupation permit outside of the years in which the areas are utilised.

In each occupation permit area, usually the beekeeper has a single location on which to place bee hives, although, in some circumstances, two locations on the one permit area may exist.

According to a State Forest report, only 17% of the state forest area within NSW is used by apiarists, with a further 17% identified as bee sites, but not used on a regular basis (State Forests, 1996). However, the same report states that "more than 80% of state forests are not used for beekeeping because of unsuitable floristic species, inaccessibility and, to a lesser extent, management decisions over reserved areas, e.g. some flora reserves".

The total number of sites, adjusted to include those beekeepers who did not respond to the census, was 5,365, whereas the total number of sites for which permits were issues in 1995/96 was 3,749 (State Forests, 1996). The difference of 1,616 sites could be due to two sites on the one permit or, more likely, the temporary use of some sites within state forests due to varying floral prospects over the last five years.

The context of the question to beekeepers in the census was, "how many sites in total have you occupied . . in the last five years?". In this case, a beekeeper may have occupied a site and paid for that permit for only a one year period during that time frame.

From the various studies on beekeeping in state forest districts, most permits were for a 12-month period. Even so, from the results of this census, there is an indication that possibly 1,500 sites in state forests are paid for and occupied on a casual basis over a five year period. State forests represent 23% of all bee sites in NSW.

Species that are of major importance to beekeeping with significant numbers of sites (expressed as a percentage) in state forests include: Grey ironbark (60%); Spotted gum (65%); River red gum

(27%); Brush box (63%); Red bloodwood (49%); White mahogany (48%); Blackbutt (54%); Broad-leaved ironbark (55%); White bloodwood (51%); Narrow-leaved ironbark (41%); Forest red gum (37%); Yellow stringybark (83%); Grey box (36%); Grey gum (62%); Sydney blue gum (71%); White stringybark (70%); Silver-topped stringybark (29%); Stringybark (36%); Eggs & bacon (33%); Snowgum (28%); Red mahogany (44%); Woollybutt (78%).

b) Rural Lands Protection Boards

The number and distribution of bee sites by Board areas has been documented and published in an article, "Bee Sites & Rural Lands Protection Boards in NSW—A Major Resource" (refer to appendix 4).

A phone and fax survey was conducted of all Rural Lands Protection Boards in mid-1997. A total of 2,889 sites were leased to beekeepers at that time. The results of this study indicate much the same number of sites on travelling stock routes and reserves managed by RLPBs with an adjusted figure of 2,972 sites. The difference of 83 sites is not significantly different from that previously determined. Beekeepers pay an annual fee to the Boards for use of these sites. Some Board areas are only occasionally used by commercial beekeepers due to lack of suitable floristic species for beekeeping.

Table 9.
Of the species mentioned by 20 or more beekeepers, eight species have at least 20% of the sites on which they are worked by commercial beekeepers on RLPB sites.

RLPBs & MAIN FLORISTIC SPECIES		
Species	**Sites on RLPBs**	**Percentage of Total Sites**
Patersons curse	439	21
Yellow box	369	20
River red gum	152	21
Turnip weed	263	45
Coolibah	93	23
Western grey box	75	22
St Barnaby's thistle	79	23
Silver-leaved ironbark	113	28

Other species with over 100 sites on RLPB sites, but with less than 20%, but more than 10% of the total number of sites for these species include: Canola (107 sites); White box (220 sites); White clover (121 sites).

Although Canola is not grown on the RLPB land tenure, bees access Canola blossom from neighbouring private property.
One point worthy of note is that RLPB sites are often used due to their accessibility by bee trucks from roadways.

The flora on which honey bees forage ranges up to two or more kilometres from each apiary, depending on climatic factors and the relative strength of the bee colonies. This is significant, as bees frequently access flora outside the reserves or stock routes to access available blossom.

c) National Parks

The issue of commercial honey bees in National Parks is a significant one for the beekeeping industry in NSW. The historical context is discussed in appendix 6.

The number of sites used by beekeepers has been stated by National Parks to be 163 in August 1995 and 319 in February 1998. The collection of data for this report was conducted between mid-1997 and late 1998. It is possible, and highly probable, that more areas of land tenure have been added to the National Park estate over the duration of this study and thus, the adjusted figure of 412 bee sites on National Parks is probable. Even so, the total of 333 sites collected from census returns is closer to previous figures stated from NPWS sources. It is possible that the remaining beekeepers who did not respond to the census had significantly less than the 79 sites combined. Also, some bee sites on Water Board land tenure are managed by National Parks which may increase the number of sites stated as National Park sites by some beekeepers.

One floristic species stands out as a major resource with a large number of bee sites within National Parks. There are 73 bee sites on Heath-leaved banksia *(B.ericifolia)* in National Parks, representing 39% of all sites available for this species. If beekeepers are eventually removed from National Parks, then they stand to lose access to just under half of the available sites of this species.

Quite a number of other species are listed by beekeepers to be accessed in National Parks, but not to the same reliance, on a state basis, as Heath-leaved banksia.

The following floral species have 20 or more sites accessed by beekeepers from National Parks: Grey ironbark; Broad-leaved ironbark; Broad-leaved tea tree; White bloodwood; New England blackbutt; Spotted gum; Brush box; Black box; Coolibah; Narrow-leaved ironbark; Broad-leaved stringybark and Silver-topped stringybark.

On a statewide basis, access to Heath-leaved banksia is significantly accessed through NPWS bee sites. Of the remaining floral resources, beekeepers at a local level would regard National Park sites as a valuable resource due to the maturity of the vegetation and reliability of the areas to yield nectar and pollen due to their relatively undisturbed state.

d) Crown Lands & Private Property Sites

Crown lands encompass many different land tenures. The primary ones would be crown land sites as administered by State Forests, usually owned by the Department of Land & Water Conservation; Western Lands leases; Roads & Traffic Authority; town commons; and Water Board sites. Some crown lands are periodically transferred to State Forests and National Parks.

Where there are more than 20 crown land lease sites for the one flowering species in western NSW, it is likely that many of these sites are Western Lands leases.

There are more than 20 crown land sites with the following floral species: River red gum; White box; Black box; Narrow-leaved ironbark; Broad-leaved stringybark; Napunyah; and Bimble box.

Private property sites: This group of sites is by far the most important land tenure. The health and diversity of flora attractive to honey bees occupying private property has major implications for commercial beekeeping activity in NSW.

The total adjusted number of private property sites is 13,981, which represents 60% of all bee sites in NSW.

Of the species mentioned by 20 or more beekeepers, 33 out of 51 have over 50% of these sites on private property. River red gum is on the border, with 49% of the sites on private property.

Bee sites working pasture weeds and agricultural crops are dominantly private property.

Floristic species with over 80% of their sites on private property include: Canola; Lucerne; Scotch thistle; White clover; Flatweed; Capeweed; and Apple box.

It is interesting to note that Apple box sites largely (85%) occur on private property—the greatest level for any Australian native species of major importance to commercial beekeeping interests in NSW.

e) NSW Apiary Industry

Working hives. Commercial beekeepers or those managing 200 hives or more only represent 10–11% of all the registered beekeepers in NSW.

This study is primarily concerned with the group owning 200 hives or greater, as their mobility, use of and reliance on floral resources is far greater than the 1–199 hive groups. Although beekeepers who own 40–199 hives can be and are, in many cases, mobile, their individual reliance on floral resources is not as significant as larger scale commercial operators. This group (40–199 hives) manages approximately 15% of the bee hives within NSW.

Beekeepers with less than 40 hives manage 9% of the state's bee hives and their overall production per hive is considered to be very low, probably less than 20 kg per hive per annum.

The results of the survey represent 167,790 bee hives—an adjusted figure for non-respondents in the bee survey is 206,522 bee hives for the group of beekeepers with 200 plus hives. This compares very well with the figures from the NSW Agriculture Beekeeping Registration System in 1997 and 1999 with only a 2% to 3% variation between the three figures.

Table 10. Data obtained from the NSW Agriculture beekeeping registration system is as follows.

NSW AGRICULTURE BEEKEEPING REGISTRATION SYSTEM				
	7 January 1997		**21 April 1999**	
Hive Category	***Producers***	***Total Hive Numbers***	***Producers***	***Total Hive Numbers***
<40	3,180	24,458	2,889	23,010
40–200	499	41,158	476	40,030
200–500	253	75,636	265	79,328
500+	160	124,382	150	121,677
Totals	**4,092**	**265,634**	**3,780**	**264,045**

Nucleus colonies. At least 70% of commercial beekeepers own and manage nucleus colonies either as replacement hives or to rear their own queen bees.

Persons working in apiculture. The results of this question challenge previous assumptions that one commercial beekeeper, on average, manages 350 to 700 hives, with a mid point of 500 hives (Hornitzky, McDonald & Kleinschmidt, 1993).

These figures may have focussed on the number of hives a single operator can effectively work in the field and not in the context of all components of the operation. Often when honey is extracted or there is maintenance of bee boxes, etc., non-skilled (non-beekeepers) persons assist. These persons are often family members and their involvement has not always been considered in previous estimates.

This study indicated that there were 495 persons actively employed by 319 beekeeper operations, an average of 1.6 persons per operation.

An estimate for the non-respondents for persons employed is 132, thus it is possible that the commercial beekeeping industry in NSW has 627 persons gainfully employed. Most of these would be owner/operators and family members. This figure would be greater if the beekeepers with 40 to 199 hives were included.

f) Interstate Movement of Bees

Interstate movement of bee hives has been occurring ever since beekeepers had access to trucks and escalated as roads improved and trucks became bigger and more affordable.

It is important to recognise the use of floral resources by interstate beekeepers, for a study of the distribution of residential addresses of beekeepers does not indicate the geographic distribution of the floral resources of significance to commercial beekeepers.

From the results, it is interesting to note that there is a general movement of southern based beekeepers north, and significantly less movement south. There were 61 NSW-based beekeepers who obtained, on average, 22% of their five year average honey crop from Queensland floral resources. Yet, there was only seven Queensland-based beekeepers who obtained, on average, 18% of their five year average honey crop in NSW.

Likewise, a similar situation occurs on the southern border with Victoria. There were 41 Victorian-based beekeepers who obtained 35% of their five year average honey crop in NSW, whereas only nine NSW-based beekeepers obtained 12% of their five year average honey crop in Victoria.

The Victoria-based beekeepers working NSW floral resources is very significant, given that there were 41 responses and, on average, 35% of their honey crop was obtained in NSW. This would indicate that the floral resources in the Riverina area of southern NSW are utilised extensively by beekeepers not residing in NSW.

g) Honey Yields per Hive

Honey yields per hive will vary according to seasonal conditions such as drought; the beekeepers' management abilities/strategies; and the available floral resources within economic travelling range.

Yields will vary from operator to operator and from apiary to apiary. Certainly each bee hive's ability to collect and store surplus honey crops

will vary and sometimes significantly within the one apiary, even if all other external factors on bee hives are similar if not the same.

The results indicate that the average honey yield per hive increases with the number of hives managed, which is not surprising given that it should take more expertise to manage a greater number of colonies profitably than a smaller number of hives.

A larger operation would have less time to devote to other business enterprises, thus the time spent on managing and moving bee hives should be greater if the operator is solely reliant on income from honey bees. Also, where the operator is fully reliant on honey bees they are more inclined to move bee colonies more frequently to maximise production.

If labour is being employed, some moves may simply be to create ongoing cash flow to ensure the viability of the business and retain skilled labour.

Production per hive has been stated as being 100 to 150 kg per hive per year, with an average production per hive of 120 kg for a skilled operator (Hornitzky, McDonald, Kleinschmidt, 1993), whereas reports from the Australian Honey Board indicate a much lower yield per hive.

The results show that the beekeepers managing 200 to 400 hives average 62 kg per hive, whereas the top figure was 111 kg per hive managed by operators with 801 to 1000 bee hives. The average across all groups was 89.4 kg per hive.

The number of operators within the 200 to 400 range is far greater than that of the other groups with more than 400 hives, thus when the averages are included for all hive number levels, the mean is drawn closer to the 200 to 400 hive category than the high hive categories.

There is certainly a definite range of average yields per hive, depending on the source of information. Given the need to determine an average for budgeting purposes or for those persons considering entering the beekeeping industry, a reasonable estimated production per hive will be 60 kg to 90 kg per year. In good years better managers may be expected to obtain up to 150 kg per hive.

Table 11. Average production per hive.

AUSTRALIAN HONEY BOARD REPORTS		
Report	**No. of Beekeepers Relating to Data**	**Average Production Per Productive Hive (kg)**
91/92	256	75.5
90/91	333	67.8
89/90	348	75.9

h) Gross Income Distributions

Honey/Beeswax. The bulk of commercial beekeepers in NSW rely on honey production for the majority of their gross income. Beeswax is a necessary by-product of honey production, so it is not surprising that this area of production was also listed by the majority of the beekeepers.

Pollination. The role of honey bees as agents of pollination is well recognised and researched world wide. Beekeepers provide bee colonies to growers of horticultural and agronomic crops in exchange for a fee for service or as an agreement whereby beekeepers utilise the growers' property for other floristic species for honey production.

Increasingly beekeepers are charging a fee for the hiring of bee hives in the provision of pollination services. This also induces the beekeeper to become more professional in providing a pollination service.

Of the commercial beekeepers who responded to this study, 19% were involved in crop pollination as a component of their gross income, although only eight beekeepers or 2.5% obtained more than 20% of their gross income from pollination. No beekeepers obtained more than 50% of their income from pollination.

Comb honey. A total of 25 producers or 8% of the beekeepers in this study derived a portion of their gross income from comb honey production. Three producers obtained between 20% and 45% of their income from comb honey production.

The production of comb honey is very specialised and labour intensive. The development of suitable markets and the continuity of production of a marketable product from year to year are probably the main constraints to the development of this area of beekeeping activity in NSW.

Package bee production. A total of 34 producers or 11% of beekeepers derived a component of their gross income from package bee production. The production of package bees has been expressly for the export markets, primarily Canada, Korea, and some Asian, Arabic and, more recently, European destinations.

The markets for such products are extremely seasonal. Most packages are produced for the northern hemispheres' early spring period which relates to our early autumn period.

Two of the major restrictions on the development and expansion of this area of beekeeping enterprise in NSW is the restricted number of suitable flights leaving Australia and the restrictions on imports of live bees mainly based on quarantine concerns by the importing countries.

Most of the 34 beekeepers in this study do not export in their own right, only a few are primarily involved in this role organising markets, transport, coordinating the removal and packaging of bees, etc. Most of the 34 beekeepers sell bees based on weight to these specialists who coordinate the whole process.

Queen bee production. This area of beekeeping is highly skilled and specialised. Queen bees are produced for both the domestic and export markets. Beekeepers concentrating on honey production often will not have the time, resources or skills necessary to breed and produce their own queen bee requirements, so specialists in this area are necessary to fulfil this market niche.

The number of nucleus colonies owned and operated by queen producers is

quite considerable as compared to the number of nucleus colonies managed by other types of beekeeping enterprises. Nucleus colonies in essence are the production colonies, i.e. they produce mated queen bees for sale. Honey production can be quite incidental and, at times, a nuisance for these types of enterprises.

Good breeding conditions in the form of an adequate quality pollen source and nectar supply are essential for the successful and profitable production of queen bees on an ongoing basis.

This study possibly did not allow some queen bee producers the opportunity to contribute, as some queen bee producers manage less than 200 full sized hives, but perhaps many hundreds of nucleus colonies. The numbers of beekeepers deriving a percentage of their gross income from queen bee production is probably not a comprehensive representation of the commercial queen bee industry in NSW.

i) Major Pollen & Honey Flora in the Survey

A total of 227 species were mentioned by one or more beekeepers, although only 51 species were mentioned by more than 20 beekeepers. This core group of floral species may well be the focus of the NSW beekeeping industry, but a beekeeping business requires access to a diverse range of floral species, many of which may be confined to regions or even localised areas.

What the list of species of importance states is those floral species that produce reliable and significant quantities of pollen and/or nectar, and also those species that are relatively abundant. Plants with very localised distributions may not be prominent in a statewide study, but may be highly significant to one or two beekeepers. Thus this study and other publications on the values of flora to yield honey and pollen may well be indicating the abundance of a species, as listed by beekeepers, combined with their honey producing capacity.

This study primarily focussed on the primary species of importance to beekeepers and, in most cases, only the major species of importance were listed by beekeepers. It would be very difficult, if not impossible, to obtain an extensive list of all floral resources worked by every beekeeper, as this will vary significantly between locations of apiaries, even in the same year and season. The best that can be achieved is to state the primary species on which the beekeeping industry is dependent and highlight the impact of the loss of these species to the NSW beekeeping industry.

Commercial beekeepers are constantly changing and adapting their practices for a range of reasons, not least due to seasonal changes, climatic influences and their resultant impact on flowering occurrence availability.

Honey. How does the information in this study compare with other data collections? An examination of the honey delivery data from the largest honey packer in NSW, Capilano Honey (Somerville & Moncur, 1997) supports the results of the census. (Refer to appendix 5.)

Yellow box and Patersons curse featured as the most important species in the Capilano Honey delivery data for NSW beekeepers from 1989 to 1994, and both these species were the most mentioned in the results of this survey with 191 responses for Patersons curse and 160 responses for Yellow box. Of the rest of the species listed by Somerville and Moncur (1997), a total of 14 species, only Napunyah was not

stated by more than 20 beekeepers in the results. (Napunyah is primarily a Queensland floral resource.)

A report on the important floral species contained in State Forest land tenure of significant value to beekeepers (Somerville 1998) also supports the list of species of primary importance in the results.

All the primary species of importance to beekeeping in NSW state forest districts are also prominent in the most mentioned 51 species listed in the results. Species that can be expected, on average, to yield more than 40 kg per hive are as stated in the following table, although the accuracy would be expected to diminish with reducing beekeeper responses.

Table 12.
The following table is in order of responses, with Patersons curse with 191 responses to New England blackbutt with 27 responses.

Species With Honey Yields Above 40 kg	
Paterson's curse	44
Yellow box	42
Grey ironbark	54
White box	44
Brush box	47
Broad-leaved ironbark	40
Coolibah	47
White bloodwood	42
Silver-leaved ironbark	52
Green mallee	53
New England blackbutt	42

Pollen. Pollen values as stated in this study can have various interpretations. When a beekeeper was asked what value they gave pollen from a particular species, they may have been referring to the quantity of the pollen available to the foraging bees or the quality of the pollen, i.e. its crude protein and other nutritional attributes, or a combination of both, i.e. its overall impact on colony health. It may also refer to the availability of pollen at times of the year when pollen sources are scarce.

It is more likely that the majority of beekeepers' pollen values are expressed as a combination of both quality and quantity.

Some beekeepers gave values for pollen from medium to high for some species when the majority of responses were very low or non-existent for the same pollen source. Yellow box and most of the ironbarks were among the very low values for pollen group.

The few beekeepers who gave values of medium to high for these species may have been referring to the support floral species that flower with these poor pollen sources.

The Ironbark and Yellow box group also obtained a very low number of responses for the value of pollen question, indicating that many beekeepers regarded this group to have a zero value for pollen which is not indicated in the results. Pollen sources with values from 4 to 5 could be regarded as very valuable for their contribution to honey bee nutritional requirements.

Of the species mentioned by more than 20 beekeepers16 floral species or 31% of the top 51 species were regarded as being of high significance as a source of pollen. Seven of these 16 species were introduced plants either considered agricultural crops (Canola), pasture plants (White clover) or agricultural weeds (Patersons curse, Turnip weed, St Barnaby's thistle, Capeweed and Vipers bugloss).

Eight species were eucalypts or related species and Broad-leaved tea tree made up the 16 species.

Table 13.
The following table is in order of responses, with Paterson's curse with 191 responses to Snow gum with 22 responses.

SPECIES WITH POLLEN VALUES ABOVE 4 FROM 20 OR MORE RESPONSES		
Species	***Pollen Value***	***Comments from Clemson (1985)***
Patersons curse	4.75	Major source
Spotted gum	4.37	Heavy supplies of pollen
Canola	4.34	Pollen attractive to bees
River red gum	4.56	Major source
White clover	4.59	Moderate to large quantities
Hill gum	4.4	Major importance
Broad-leaved tea tree	4.2	Major source
Apple box	4.36	Abundance of pollen
Turnip weed	4.76	Major source
White bloodwood	4.03	Medium to major source
Blakely's red gum	4.05	Major source
St Barnaby's thistle	4.06	Excellent source
Rough-barked apple	4.13	Major source
Capeweed	4.1	Bees gather giant loads
Vipers bugloss	4.56	Good source
Snow gum	4.22	Good supplies

Flowering months. Three levels of flowering incidence have been indicated by various shades in the flowering range tables. The flowering period, as stated by over half the responses for those months, was considered to be the main flowering period, the next level is still a significant flowering period, although represented by less than half the responses, and the lowest level is where more than one beekeeper suggested flowering may occur.

The third level is of no major significance to the primary periods of honey and/or pollen availability in the majority of years in which flowering occurs.

Flowering range will also vary with geography and location. Some species will flower at later dates at higher altitudes and earlier in the lower altitudes. Grey ironbark is characteristic of this flowering pattern on the north coast.

Flowering range will also change with longitude. Spotted gum on the north coast may flower from December to March, whereas Spotted gum on the south coast may flower from April to December. Flowering may also vary in its intensity for different months according to seasonal factors. Dry or drought conditions may speed up the flowering or slow it down, depending on the species.

Flowering cycle. The attributes of the Australian climate and patterns of flowering of our major floral resources, mainly eucalypts, make commercial beekeeping in Australia rather unique.

No one year is identical and frequently the bulk of the floral sources worked by commercial beekeepers are significantly different from year to year. Many eucalypt species have a flowering cycle that extends over two or more years. Even the herbaceous plants such as agricultural weeds and crop species are not consistently reliable, as weather influences have a large impact on the health and nectar secretion ability of the plants.

Beekeepers have been asked in this study to state the "years between flows". The results could be interpreted a few different ways.

Many eucalypts flower on a two or more year cycle, thus it would be expected that the majority of responses for this question will reflect the actual flowering cycle of the species, although the reliability of the species to yield quantities of nectar and pollen may vary due to other factors such as drought or excessive growth, both potentially reducing yields obtained by honey bees.

A plant may not be actively sought by beekeepers on every occasion on which it flowers, thus some beekeepers may have approached this question by stating the period of years between reliable or worthwhile nectar flows when they have worked this floral source.

Another aspect is also worth considering. Certainly there is a variation in the flowering patterns of the one species from location to location and it is possible that the frequency and reliability of a species to flower and yield nectar will be greater in one location than in another location, due possibly to climatic variables and soil type/fertility. Some species, e.g. Spotted gum, initiate buds and flower some 18 months later. This species has not been observed to carry two sets of buds, so it is not possible for the same tree to flower each year, whereas if different trees are budding in different years in the same area, then it is possible that beekeepers could have access to the one species on consecutive years. Some eucalypt species do have the capacity to carry sets of buds for consecutive years.

One of the major attributes of a successful commercial beekeeper in Australia is to establish an understanding and knowledge of flora and the impacts of climatic changes and weather on the flowering cycles and resultant nectar yields of individual species. Yellow box and Patersons curse are two of the most important plant species for commercial beekeepers in NSW. Even so, this does not automatically mean that wherever these species occur, they will be a reliable source of nectar or that they will have a regular flowering frequency similar to other regions.

Beekeepers in Australia need to have a rather deep and unique knowledge of flora and the various influences that impact on nectar and pollen availability.

The pressure under which beekeepers are being placed due to diminishing resources has to be recognised, not simply for the continued survival and viability of the beekeeping industry, but also to preserve our unique floral heritage.

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7. INDEX OF SCIENTIFIC & COMMON NAMES

APPENDIX 1

Survey Forms & Letters to Beekeepers

- Letter to beekeepers (23 April, 1997)
- Covering note (23 April, 1997)
- Census forms
- Second letter to beekeepers (1 August, 1997)
- Third letter to beekeepers (25 November, 1998)

Letter to beekeepers (23 April 1997) – NOT AVAILABLE ELECTRONICALLY

Covering note (23 April 1997) – NOT AVAILABLE ELECTRONICALLY

Census forms – NOT AVAILABLE ELECTRONICALLY

Census forms cont. – NOT AVAILABLE ELECTRONICALLY

Second letter to beekeepers (1 Aug 1997) – NOT AVAILABLE ELECTRONICALLY

Third letter to beekeepers (25 Nov 1998) – NOT AVAILABLE ELECTRONICALLY

APPENDIX 2

Somerville, D (1998)
Floral Resource Database
New South Wales Apiarists Association Newsletter
September-October 1998. pp 9-12.

Appendix 2 – NOT AVAILABLE ELECTRONICALLY

Appendix 2 cont. – NOT AVAILABLE ELECTRONICALLY

Appendix 2 cont.– NOT AVAILABLE ELECTRONICALLY

Appendix 2 cont.– NOT AVAILABLE ELECTRONICALLY

Somerville, DC (1998)
State Forests - A Valuable Beekeeping Resource
The Australasian Beekeeper
September 1998. Vol 100, No 3, pp 96-101.

STATE FORESTS
A VALUABLE BEEKEEPING RESOURCE

Somerville, DC
NSW Agriculture, PO Box 389, Goulburn, NSW, Australia, 2580
Presentation - NSW Apiarists Association Conference - 22nd May 1998 Glen Innes

ABSTRACT

The NSW State Forests occur over a range of geographic locations and offer a wide diversity of floristic species that are of a major benefit to NSW commercial beekeeping industry. There were 3,749 occupation permits for bee farming in the 1995/96 period, issues by NSW State Forests. A survey of beekeepers using various forestry districts was conducted in January 1997 and data on the prime species of value to beekeepers was collected as well as information on values for honey and pollen production, flowering times, years between flowerings, length of time buds are carried on each species, stocking rates of bees, and a number of other factors that illustrate the use and interest beekeepers have in each State Forest district.

The prime species of importance identified in the surveys from 25 forest districts, included *Banksia ericifolia*, *Corymbia maculata, C. trachyphloia, Dillwynia species, Eucalyptus camaldulensis, E.crebra, E.largiflorens, E. macrorhynha, E.melanophloia, E. muelleriana, E.paniculata E.pauciflora, E.sideroxylon, Lophostemon confertus*.

INTRODUCTION

The State Forests of NSW represent an extremely important resource for the NSW beekeeping industry.

On average, 70% of the honey crop obtained by beekeepers is derived from eucalyptus species in New South Wales (Somerville, DC & Moncur, MW, 1997) (this also includes Corymbia species). Much of the accessible forested lands of NSW are located in NSW State Forests.

Commercial beekeepers manage, on average, 500 bee hives varying from 350 to 700 hives. An average production level for a skilled operator is 100 to 120 kilograms per year per hive. To achieve this, bee hives are trucked from one location to the next. Most beekeepers operate within 200 km from home base for most of the year, with occasional trips outside of this range to particularly good and reliable honey flows or for overwintering conditions or to escape drought conditions closer to home base. Bee hives may be shifted four to six times per year on average onto surplus nectar producing flora (Hornitzky, McDonald, Kleinschmidt, 1993). Commercial beekeeping is a family based rural industry and highly labour intensive.

Commercial beekeepers require access to an extensive network of floral sources to be able to move bees onto nectar producing flowering plants on a regular basis. Beehives are normally placed in loads of 100 to 120 hives per site at least 1.5 km apart, depending on availability of sites and truck access.

Many eucalyptus, from which nectar is periodically harvested by bees only flower on a two to four year cycle. Some eucalypts, according to beekeeper observation, have a longer flowering cycle. Even though a floral species is flowering and the species has been identified as a useful floral resource for beekeeping purposes, the conditions may not be suitable for nectar secretion.

Thus beekeepers may only work a particular floral species every second or third flowering period. Yields from the one species will also vary according to location, climatic factors, and strength of the foraging force of the beehive.

Careful management decisions have to be continually made in relation to honey bee nutrition requirements. Bees obtain their carbohydrate from nectar which they convert into honey, whereas their protein source is primarily derived from pollen and varies considerably in quality. A number of important nectar floral resources notably do not produce pollen that is attractive to foraging honey bees. Some classic eucalypt examples are *Eucalyptus paniculata* (Grey ironbark), *Eucalyptus sideroxylon* (Mugga ironbark) and *Eucalyptus melliodora* (Yellow box). Yet other eucalypts provide pollen that is attractive to honey bees but is of poor quality in relation to minimum honey bee nutritional requirements. An example is *Eucalyptus albens* (White box) which is a very important nectar producing tree for beekeepers on the northern tablelands of NSW. Eucalypt crude protein levels as low as 17% have been recorded, when 20% is stated as a minimum level (Kleinschmidt & Kondos 1976).

Many eucalypt pollens range between 20% and 25% crude protein and a few as high as 33%. Many of the Eucalypt pollens are also deficient in one or more amino acids identified as essential requirements for honey bee nutrition (Somerville & Peasley 1996).

Thus a diverse mix of floral resources within forests is important for honey bee nutrition management.

Beekeepers require a diverse range of accessible bee sites to place commercial loads of beehives. A commercial beekeeper with 500 to 600 bee hives will require five or six sites for each floral resource. State forests offer a network of suitable sites where often more than one species can be worked in different years, concurrently, or at the same time.

It is normal for beekeepers in the north coast State forests to locate bee hives on sites when *Eucalyptus paniculata* (Grey ironbark) and *Eucalyptus acmenoides* (White mahogany) are flowering at similar times as *E.paniculata* is a particularly reliable producer of honey, but no pollen is collected from this tree, whereas *E.acmenoides* is not a particularly heavy yielder of nectar but does provide abundant quantities of pollen suitable to meet honey bee nutritional requirements.

To be successful at commercial beekeeping, the operator requires a series of apiary sites across a range of floral species with variations in flowering times and locations. If one area is experiencing poor nectar yielding conditions such as due to drought conditions, then the beekeeper needs to have sufficient flexibility to move to alternate floral resources elsewhere.

The network of a well maintained roading system offers beekeepers good access to State forests.

Commercial beekeepers require all weather truck access to be able to adequately manage bee hives and State Forests provide the best set of circumstances as a by-product of their management of forests for wood production. The extensive network of sites allows adequate access for bee trucks and old log dumps offer excellent sites for the location of commercial loads of bee hives. The use of these sites will vary in intensity, depending on the floral mix and distance the site is located from the beekeepers' base.

Declining floral resources for honey production are a major problem for the beekeeping industry. Activities such as land clearing, urban sprawl, firewood cutting have had a major impact. Soil salinity and eucalypt dieback has affected the health of native vegetation and reduced its reliability to initiate buds, flower and yield nectar. Government regulations have also discouraged or precluded the use of various land tenures for commercial beekeeping activities eg National Parks and Wildlife service and Water Board.

As at 1995/96 there were 3,749 occupation permits for bee farming taken up by beekeepers in NSW State Forests (*State Forest 1996).* Information obtained from various State Forest offices while surveying beekeepers during 1997 indicates little change from this figure.

By contrast there where 319 beekeeping permits in National Parks and Wildlife Service lands (*per com NPWS Feb 1998).*

The value and importance of State Forests to beekeeping is highlighted by the similar land area both government departments administer.

The following table illustrates the areas of forest in each land tenure as at 30 June 1997.

Table 1.

	Approximate Total Area Ha.	Approximate Total With Native Forest Cover Ha
State Forests	3,355,133	2,989,000
National Parks State Recreation Areas	4,543,923	2,826,000
Water Boards etc	-	220,000

(*Source NSW State Forests May 1998)*

Thus the total area of forested lands in reserves is 3,046,000 ha. Highlighting the value and importance of State Forests to be the Beekeeping Industry.

SURVEY OF BEEKEEPERS

Prior to 1997 reports on, six State Forest districts in NSW were published. These reports included information on the use of these forestry districts by beekeepers. Five reports

published by D. Somerville plus various co-authors (1990,1994,1995, 1995, 1995) and one report was published on the value of the Pilliga State Forests by *P. Stace (1996)*. During 1997 surveys of beekeepers were conducted of all the remaining forestry districts in NSW, with 10 State Forest district reports published and data collected for another nine State Forest districts to be published later in 1998.

Data collected included information on the important floral species to beekeeping in each State forest, the level of importance of the honey and pollen, time of year the species flowers, duration buds are carried, how many years between honey or pollen flows and any variation to stocking rates associated with different species. Other questions asked included:

- information of history of usage;
- comments on forestry practices, as they relate to beekeeping activities;
- number of sites in and adjoining State forests;
- observed changes in flowering or yielding patterns in the forest flora;
- how the forests fit into the annual bee hive movements;
- other comments, where appropriate.

RESULTS

The following is a summary of the results of 25 reports on beekeepers in various state forest districts in NSW. In most cases a 70 to 80% response to the various surveys were obtained, initially by a mail survey then follow up by personal interview or phone survey to achieve this level of return.

Table 2.

CATEGORY OF BEEKEEPER USING NSW STATE FORESTS - 1997				
	Amateur *1-39 Hives*	**Part Time** *40-199 Hives*	**Full Time** *200-399 Hives*	**Full Time** *400 Hives Plus*
Beekeepers (24 Districts)	**3% (20)**	**14% (91)**	**23% (148)**	**60% (393)**
Sites	**<1%**	**9%**	**23%**	**67%**

Stocking rates varied considerably from 35 to 300 hives per site. By far the main stocking rate varied between 100 and 120 bee hives per site. Only a few beekeepers varied the stocking rates according to varying species in flowering.

Of prime importance to beekeepers are the main floral species in each State forest district. The most frequently stated species can be attributed to either the abundance of that species through a particular area or the high level of reliability of that species for honey production.

The following table indicates the three main species in each forestry district:

Table 3. Three Most Frequently Stated Species of Importance to Beekeeping in each State Forest District

Forestry District	1st	2nd	3rd
South Coast:			
Eden/ Bombala	*Eucalyptus muelleriana* Yellow stringybark	*E.globoidea* White stringybark	*E.longifolia* Woollybutt
Narooma	*E.muelleriana* Yellow stringybark	*Corymbia maculata* Spotted gum	*E.longifolia* Woollybutt
Batemans Bay	*C.maculata* Spotted gum	*E.paniculata* Grey ironbark	*E.saligna* Sydney blue gum
Nowra	*Banksia ericifolia* Heath leaved banksia	*C.gummifera* Red bloodwood	*C.maculata* Spotted gum
Tablelands:			
Tumut/ Tumbarumba	*E.pauciflora* Snow gum	*E.delegatensis* Alpine ash (equal 1st)	*E.viminalis* Manna gum
Queanbeyan/ Badja	*E.pauciflora* Snow gum	*E.viminalis* Manna gum	*E.fastigata* Brown barrel
Bathurst/ Oberon	*E.macrorhyncha* Red stringybark	*E.viminalis* Manna gum	*Echium vulgare* Blue Flower
Inverell	*E.melanophloia* Silver leaf ironbark	*E.albens* White box	*E.crebra* Narrow leaf ironbark
Western Region:			
Central Murray	*E.camaldulensis* River red gum	*E.largiflorens* Black box	*Echium plantagineum* Patersons curse
Mildura	*E.largiflorens* Black box	*E.camaldulensis* River red gum	*E.dumosa* or *E.incrassata* Yellow mallee
Narrandera	*E.camaldulensis* River red gum	*E.melliodora* Yellow box	*Echium plantagineum* Patersons curse
Forbes	*E.sideroxylon* Mugga ironbark	*E.microcarpa* Grey box	*E.fibrosa* Broad leaf ironbark
Dubbo	*E.crebra* Narrow leaf ironbark	*E.beyeri* Corky ironbark	*E.sideroxylon* Mugga ironbark
Baradine (Pilliga)	*C. trachyphloia* Pilliga Bloodwood	*E. fibrosa* Broad leaved ironbark	*E. crebra* Narrow leaf ironbark
Central Coast:			
Morisset	*Dillwynia species* Eggs & Bacon	*C.gummifera* Red bloodwood	*C.eximia* Yellow bloodwood
Bulahdelah	*E.paniculata* Grey ironbark	*E.acmenoides* White mahogany	*C.maculata* Spotted gum
Taree	*E.paniculata* Grey ironbark	*E.acmenoides* White mahogany	*E.punctata* or *E.propinqua* Grey gum

Forestry District	1st	2nd	3rd
Wauchope	*E.paniculata* Grey ironbark	*E.pilularis* Blackbutt	*E.acmenoides* White mahogany
Kempsey	*E.paniculata* Grey ironbark	*C.maculata* Spotted gum	*E.acmenoides* White mahogany
North Coast:			
Urunga	*E.paniculata* Grey ironbark	*E.acmenoides* White mahogany	*C.maculata* Spotted gum
Dorrigo	*Lophostemon confertus* Brush box	*E.paniculata* Grey ironbark	*C.maculata* Spotted gum
Grafton	*E.paniculata* Grey ironbark	*Lophostemon confertus* Brush box	*C.maculata* Spotted gum
Casino	*E.paniculata* Grey ironbark	*C.maculata* Spotted gum	*E.tereticornis* Forest red gum
Urbenville	*E.siderophloia* Grey ironbark	*Lophostemon confertus* Brush box	*E.moluccana* Grey box
Glen Innes	*Lophostemon confertus* Brush box	*E.paniculata* Grey ironbark	*E.andrewsii* New England Blackbutt

The relative values for honey, pollen, time of year flowering occurs, length of time buds are carried and the years between flowering occurrences for the floral species of major importance mentioned first in the various studies is set out in the table 4.

Table 4.

Major Honey & Pollen Flora Species in NSW State Forests					
Species	**Level of Honey Importance**	**Level of Pollen Importance**	**Time of Year Flowering Occurs**	**Buds Carried for Months**	**Years Between Flowering**
Banksia ericifolia	High-Med	High	May-Aug	3-4	Annual
Corymbia maculata	High	High	Apr-Sep	18-20	4
C.trachyphloia	High	High	Feb-April	3-4	2
E.camaldulensis	High	High	Dec-Jan	0-12	2-4
E.crebra	High	Med-High	Oct-Dec	6-12	2-3
E.delegatensis	Med-High	High	Jan-Mar	12	2
E.largiflorens	High	Low-Med	Jan-Apr	2-5	3
E.macrorhyncha	Med-High	High	Feb-Mar	15-24	3-4
E.melanophloia	High	Med	Dec-Jan	1½-2	3-5
Eucalyptus muelleriana	High	High	Dec-Mar	18-24	3-5
E.paniculata	High	Nil	Nov-Jan	8-12	1-3
E.pauciflora	Med-High	Med-High	Nov-Feb	9-12	2-3
E.sideroxylon	Med-High	Nil	Apr-Sep	4	2-3

Major Honey & Pollen Flora Species in NSW State Forests					
Species	**Level of Honey Importance**	**Level of Pollen Importance**	**Time of Year Flowering Occurs**	**Buds Carried for Months**	**Years Between Flowering**
Lophostemon confertus	High	Med-High	Dec-Jan	1½	2-4

Yields of honey in kilograms for the top species in each forestry district vary, as illustrated in Table 5.

Table 5.

Species	Average Honey Yield Per Hive (kg)	Range - Kg Honey
Banksia ericifolia	20	5-40
Corymbia maculata	30	10-50
C. trachyphloia	50	40-100
E.camaldulensis	40	27-135
E.crebra	30	15-108
E.delegatensis	40	20-60
E.largiflorens	20	10-30
E.macrorhyncha	50	15-108
E.melanophloia	60	50-135
E.muelleriana	40	10-80
E.paniculata	80	30-162
E.pauciflora	30	20-50
E.sideroxylon	30	14-93
Lophostemon confertus	80	27-135

The expected yields of honey, as reported by beekeepers, tends to reflect the better years in which these floral resources are worked by commercial beekeepers. The flowering periods often do not occur on a regular three or four year cycle. There may be a period of regular flowerings and thus honey flows every second year for eight or ten years then drought or some other factor may interrupt the flowering cycle and the species may not initiate buds for three or four years.

The yields of honey will also vary for example a species may in one year produce 20 to 30 kilograms and two years later may produce 50 to 60 kilograms per hive from the same floral species on the same geographic location. This variation is due to the variable nectar yielding capacity of the flora often due to climatic variables and the number of honey bees in each hive available to collect and store the surplus nectar resource.

The number of years beekeepers have used forestry bee sites on a periodic basis varied from recently acquired permits to families who have had access to sites over two generations of family beekeeping. Forty years was mentioned by a number of beekeepers.

Generally beekeepers worked well with forestry management activities, as there is a general acknowledgment by beekeepers that the road access and old log dumps created

for extracting native hardwood also offer beekeepers an excellent road network and suitable locations to place apiaries within forests. The main dilemma is that many tree species require a considerable period of growth and maturity prior to producing reliable quantities of nectar. Even though some eucalypt species flower in their juvenile stages, they are not seen as reliable by beekeepers in relation to nectar secretion and thus honey production. *Eucalyptus paniculata* is rated as a highly important species for honey production within the coastal forests of NSW, yet it is commonly believed by beekeepers a tree needs to be at least 20 years old before it begins to yield significant honey crops. Thus, logging mature species of important nectar and pollen producing trees detracts from the value of any given site for beekeeping purposes.

There were 3,749 bee permits issued by State Forests for the period 1995-96. Data collected from eighteen of the forestry district offices in 1997 indicates little change in the number of permits issued by State Forests. The number of sites adjacent to State forests where bees can fly onto State forest flora varied from district to district depending on the size of the individual forests and accessibility to private property.

Of the bee sites within State forests and adjacent to State forests allowing honey bees to forage the available floral species within State forests, the proportion of private property sites was greater in the tablelands and western forested lands than in the coastal forested lands.

The percentage of sites on private property adjacent to State forests varied from 22% to 40%, with an average of 31% for the coastal forest systems, whereas the tablelands and western forests varied from 42% to 53% with an average of 47%.

Observed changes by beekeepers in flowering patterns were due to a number of reasons:

- Drought affecting flowering patterns and capacity of trees to grow and initiate buds.
- Age of trees impacted on potential for honey production for various sites. Older trees were preferable and more reliable.
- Lack of regular flooding specifically the River red gum forests in the Riverina reduced the growth, bud initiation and ultimately the honey yields obtained from this once very reliable species.
- Fire, either deliberate management practises or by other means, reduced an areas value to beekeeping. Classically, *Banksia ericifolia* the most important floral species identified in the Nowra forestry area (1990) is reported by beekeepers to be of no value for seven years after a fire, allowing time for the species to regenerate and mature.

The frequency with which forests were used by beekeepers varied according to the distances beekeepers lived from forests within which they held permits and the reliability of the flora for honey and pollen production. Thus, some sites were only used every three or four years whereas other sites may be utilised for two or three floral species within the one year.

CONCLUSION/DISCUSSION

The future viability of the New South Wales commercial beekeeping industry relies on obtaining suitable access to a range of floral species that regularly and reliably produce nectar and pollen for foraging honey bees.

The diversity of flora within our native forest communities enables beekeepers to source a range of species within the one region which enables bee hives to be transported to various nectar surpluses as they occur.

Beekeeping is a low impact sustainable use of native forests. The action of honey bees foraging on eucalypt blossom has been demonstrated to adequately effect pollination of eucalyptus species. This may well benefit some "shy" eucalypt seeding species such as *Eucalyptus nitens*.

It could well be argued with some forest species that the value of the bee products derived from State forests exceeds over time the value of wood related products as a result of forestry operations. This could apply to slower growing tree species that are particularly reliable honey producing species. *Eucalyptus paniculata* (Grey ironbark) is of particular interest to beekeepers on the central and north coast and the honey yields over time may rival the market value of any timber production.

The future of the beekeeping industry in NSW is very much dependent on continued access to native flora and thus State Forests. Any reduction in the area of state forests or restrictions on the number of sites within forests will have a major impact on the viability of the NSW beekeeping industry.

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APPENDIX 4

Somerville, D (1997)
Bee Sites & Rural Lands Protection Boards in NSW - A Major Resource.
The Australasian Beekeeper, October 1997.
Vol 99, No 4, pp 142-143.

Bee Sites & Rural Lands Protection Boards in NSW - A Major Resource

Doug Somerville, Apiary Officer, NSW Agriculture, Goulburn

Background

Rural Lands Protection Boards (RLPBs) formerly called the Pastures Protection Boards, manage a vast number of reserves throughout country NSW which are regularly utilised by the Apicultural Industry. The extent and structure of the NSW RLPBs is probably unique in Australia. There are 57 RLPBs in NSW providing a wide range of services to the rural community.

The Boards offer advisory and regulatory functions for their respective management areas, benefiting farmers, graziers and rural landholders generally. Each Board is controlled by an elected committee (honorary directors) of eight. The Boards employ secretaries, district veterinarians, rangers, noxious animal inspectors, labourers and office assistants.

Boards provide the official front line animal disease control service in NSW. They administer stock brands and tail tags identification systems. Monitoring and control of noxious animals including rabbits, feral pigs and wild dogs are a major function of Boards. At times Boards are also involved in the campaigns to control bands and hatchings of the Australian plague locust.

Apiary Sites

NSW RLPBs have been around for almost 100 years and would have been used over that period of time extensively by the commercial beekeeping industry.

The significant role RLPBs play for the benefit of beekeepers is in the management and provision of a network of travelling stock routes and reserves. The 57 Boards combined, manage approximately 3% of the State in the form of reserves and travelling stock routes.

All the Boards in NSW were contacted either by a faxed questionnaire or directly phoned for details on the cost of sites, number available and number actually taken up by beekeepers. This information is summarised in the table, listing costs and numbers of sites.

Costs: The fee charged by each Board varies from $2.00 to $50.00, depending on the Boards' policy. The Goulburn Board leases the first site for $10.00 with subsequent sites at a cost of $2.00. A total of eight Boards lease sites for $10.00 or less, whereas eight Boards lease sites for $50.00 each, which is the highest value for a bee site between the Boards. The mid point in relation to charges for Board reserves is $30.00 per site. Thirteen Boards charge a figure greater than $30.00 and 21 Boards are less than $30.00 per site. Eleven Boards charge $30 per site.
From the information gathered from Boards for the 1996/97 period, beekeepers paid a total of $72,857 in site fees to RLPBs.

Total Number of Sites Leased

The total number of sites currently leased is 2,889. This figure will vary to a degree, but is largely dependent on what suitable sites remain available and unbooked.
The cost of RLPB sites is such that sites will be rarely let go by practising commercial beekeepers. Many RLPB sites not currently taken up by beekeepers would be due to a number of reasons.

- Board discourages bee sites or reserves near or in close proximity to urban areas.
- The reserve is deemed too small.
- Inadequate access for bee truck.
- Board simply discourages the use of reserves for beekeeping, e.g., Scone Board.
- Inadequate flora suitable for bee forage.
- No shade or water, particularly western areas of the State.

Thus the figure of 2,889 bee sites on RLPBs probably represents most of the available, useful and accessible sites across the State on reserves and travelling stock routes.

Discussion

A number of factors are currently affecting RLPBs. Land claims are impacting on reserves in some Boards. In the event these claims are successful, then access by beekeepers to the relevant reserves will have to be renegotiated.

The Scone Board simply does not allow commercial beekeepers the use of their 60 reserves, based on the presumption that the reserves are simply not big enough to accommodate both stock which they are intended for and loads of bees.

The Walgett Board stated that a third of their area is Western Lands Lease and no bee sites are issued for these areas, whereas much of the rest of their management area is prone to periodic flooding, making sites inaccessible.

Some Boards suggested very little or no interest in many sites due to inadequate flora suitable for beekeeping.

The Moss Vale Board has no reserves within their Board and thus the potential for bee sites does not exist.

Conclusion

Rural Lands Protection Boards represent a body that manages an important resource for the NSW commercial beekeeping industry. Of the 57 Boards, 44

lease sites on an annual basis to beekeepers. As of April/May 1997, there are 2,889 bee sites in the NSW RLPBs currently being leased by beekeepers, with an average annual fee of $30.00 per site with a range of $2.00 to $50.00 per site. Beekeepers contributed $72,857 for these sites in 1996.

Reserves are usually readily accessible by trucks. Shade and water is also, in many cases, present. The reserves are usually spread throughout a Boards' management area and the attraction of being able to secure more than one bee site with the one body, all combines to make RLPB reserves a very valuable resource for the apicultural industry.

Note for Beekeepers Using RLPB Sites

You must first contact the local RLPB and ascertain whether the site is available for use before moving bee hives onto the site. Many Boards number their reserves. The appropriate licence or fee must also be paid.

Do not put hives close to gates or laneways and consider other users of the reserves. Always close the gate! RLPBs and reserves are a valuable resource for the industry - look after them.

Acknowledgements

Clyde Alchin, Rural Lands Protection Officer (NSW Agriculture) and Joanne Edwards, Clerical Officer (NSW Agriculture).

RLPB	ANNUAL LEASE FEE PER SITE	TOTAL NUMBER OF POTENTIAL BEE SITES	TOTAL NUMBER OF SITES LEASED - 1996/97
Albury	20	60	45
Armidale	20	641	219
Balranald	TSR's in Western Division not under control of RLPB's.		
Bathurst	30	115	30
Bega	20	57	2
Bombala		40	0
Bourke	NI	NI	NI
Braidwood	50	40	2
Brewarrina	10		2
Broken Hill	No Charge	100's	0
Carcoar	20	90	38
Casino	40	35	5

RLPB	ANNUAL LEASE FEE PER SITE	TOTAL NUMBER OF POTENTIAL BEE SITES	TOTAL NUMBER OF SITES LEASED - 1996/97
Cobar	No control over TSR's.		
Condobolin	4	132	70
Cooma	20	80	40
Coonabarabran	30	78	40
Coonamble	NI	NI	NI
Corowa	15	45	37
Deniliquin	30	45	33
Denman/ Singleton	30	58	2
Dubbo	25	82	71
Forbes	15	200	120
Glen Innes	30	130	108
Gloucester	10	120	10
Goulburn	10	50	20
Grafton	40	120	69
Gundagai	50	75	40
Hay	50	100's	60
Hillston	Western Lands Commission - don't lease bee sites.		
Holbrook	40	80	15
Inverell	25	245	245
Jerilderie	30	29	23
Kempsey	50	78	10
Maitland	20	4	3
Merriwa	8	22	19
Milparinka	Western Lands Commission - don't lease bee sites.		
Molong	50	78	56
Moree	30	600	258
Moss Vale	No reserves in this Board.		
Moulamein	50	20	15
Mudgee	20	110	46

RLPB	ANNUAL LEASE FEE PER SITE	TOTAL NUMBER OF POTENTIAL BEE SITES	TOTAL NUMBER OF SITES LEASED - 1996/97
Narrabri	30	122	89
Narrandera	30	48	25
Nyngan	10	74	19
Scone	No reserves leased to beekeepers.		
Tamworth	30	209	130
Tenterfield	25	194	164
Tweed/Lismore	40	15	3
Urana	50	7	6
Wagga Wagga	25	150	100
Walgett	10	120	61
Wanaaring	TSR's in Western Division not under control of RLPB's.		
Warialda	20	755	395
Wentworth	TSR's in Western Division not under control of RLPB's.		
Wilcannia	Western Lands Commission - don't lease bee sites.		
Yass	50	60	39
Young	30	120	103

NI = No Information

APPENDIX 5

Somerville, DC & Moncur, MW (1997)
The Importance of Eucalypt Species for Honey Production in New South Wales, Australia. **Paper for XXXVth International Apicultural Congress, Antwerp, Belgium. 1-6 September 1997.**

Appendix 5 – NOT AVAILABLE ELECTRONICALLY

Appendix 5 cont.– NOT AVAILABLE ELECTRONICALLY

Appendix 5 cont.– NOT AVAILABLE ELECTRONICALLY

Appendix 5 cont.– NOT AVAILABLE ELECTRONICALLY

Appendix 5 cont.– NOT AVAILABLE ELECTRONICALLY

Appendix 5 cont.– NOT AVAILABLE ELECTRONICALLY

APPENDIX 6

Somerville, DC (1999)
NSW National Parks & Beekeeping. **The Australasian Beekeeper, April 1999. Vol 100, No 10, pp 404-407.**

NSW NATIONAL PARKS & BEEKEEPING

Doug Somerville, Apiary Officer, NSW Agriculture, Goulburn

There has been a major focus by the NSW beekeeping industry on the adverse policies of the NSW National Parks & Wildlife Service (NPWS) to the keeping of honey bees in parks for some 15 years, due to the gradual and sometimes immediate phasing out of bee sites. The area of National Parks has grown considerably, particularly in recent years. This combined with the poor light in which National Park management have viewed the beekeeping industry , has increased the intensity of the concerns expressed by the beekeeping industry. But the exclusion and general unwelcome attitude by NPWS management has been experienced for many years.

History

Cocks and Dennis (1978), in a CSIRO study of the land use options on the south coast of NSW, indicated that the NPWS did not have a policy concerning apiculture and that beekeepers may apply for permission to work in a National Park. Often there was a long delay before approval was granted, by which time the flowering may have finished. Some beekeepers in the survey for this CSIRO study indicated that the NPWS were basically unsympathetic to beekeepers using their areas.

Interviews with veteran beekeepers have indicated similar stories of sites lost to beekeeping in National Parks. Roy King (Somerville, 1997a) relays a story of when he obtained "a hell of a crop of honey off Snow gum", in what is now the Kosciusko National Park about 40 years ago.

Cyril Temple (Somerville 1997b) also relates a story of a "beautiful Yellow box honey flow in the Jacobs River area", now the Kosciusko National Park, back in the 1950s or early 1960s.

Stan Bettini (Somerville 1997c) relates a story of losing "good sites" in the now Deua National Park, where he could put four loads of bees. Stan tried persistently to talk to NPWS staff and wrote to the local member, with a negative response.

George Roots (Somerville 1998a), a veteran second generation beekeeper of 74 years, indicated that he also lost sites in National Parks, mainly in Banksia areas of the north coast.

Stan Bennett (Somerville 1999) relates a story of being given two weeks to vacate 4 or 5 sites in the Munghorn Gap Reserve north of Mudgee in the early 1960's when the land was changed from Forestry to Park management. The sites were excellent for the Winter-Spring period and at the time it was a real loss to Stan's operation.

All these are examples of sites no longer available to beekeepers. Many beekeepers with significant years of experience in the beekeeping industry can also relate similar stories of the loss of sites in National Parks.

In 1984 Keith McIlvride, the then secretary of the NSW Apiarists' Association, obtained copies of all the National Parks Management Plans. The general theme throughout these documents was for the immediate or gradual phasing out of bee sites on all Parks' lands. Dr Mullette, Chief Scientist of the NPWS was asked to give an address to the 52nd Annual Conference of the Commercial Apiarists Association of NSW in Dubbo in 1984,

explaining the policies of the NPWS concerning apiculture in National Parks and other reserves.

Dr Mullette (1985) stated that the NPWS area had doubled in the last ten years since 1974, but that the policy adopted at that time permitted beekeeping by placing the final decision in the hands of the local officer-in-charge. The officer-in-charge was to permit beekeeping activities only if there was no public risk or environmental damage. Thus local managers were asked to make a valued decision on whether honeybees posed a risk to the local environments that they managed. It was relatively easy for local park managers to discourage beekeeping, as beekeepers required physical access for their truck, apiary sites needed to be cleaned before placing hives, and managers could also base their decisions on the concept of what long term environmental changes were possibly occurring to the flora and fauna.

Dr Mullette stated that the service was not against beekeeping but the strong conservation objective expressed in the National Parks and Wildlife Act caused officers-in-charge of the various districts "to have second thoughts about issuing bee licences in National Parks and Nature Reserves".

Dr Mullette also listed six points which had emerged over the five to ten years prior to his address that are cause for concern to the NPWS.

1. Large numbers of honey bees in a commercial setting have a significant measurable effect on the availability of food resources for a range of nectar feeding animals.
2. Transmission of bee diseases onto native bees.
3. Changes in pollination of many native plant species caused by the presence of the honey bee.
4. Increased levels of hybridisation in some species.
5. Honeybees show aggression against native bees which adds to the pollination problem.
6. Competition for nesting sites used by small animals and birds.

All these points were based on limited research, or simply speculation, and since this address further reviews of research do not support this general view. A review of the impact of managed honey bees on native Australian plants by Seeman (1994) concluded that the long-term impact of commercial bees on Australian native plants is minimal.

Manning (1997) in a critique of scientific studies of honey bees and their alleged impact on Australian wildlife concluded that "there is no conclusive proof that honey bees have a significant effect on wildlife and that any interaction which can be found could arguably be a normal reaction in a complex ecosystem that has it's primary food source as nectar and pollen ."

Paton (1998) even indicated that honey bees were beneficial in some National Parks in retaining a balance, citing *Banksia ornata* in Ngarkat Conservation Park , where seed production was severely limited by a lack of natural pollinators and the presence of honey bees resulted in an increase in seed production.

Some of the points listed by Dr Mullette were purely speculative. There is no evidence that diseases impacting on *Apis mellifera* (honey bees) are or ever have been transmitted to unrelated native bee species. The chances of this occurring are extremely unlikely. Honey bees have an extremely high fidelity to foraging on the one species. Also , given that there are quite a number of native pollinating agents that are more capable of travelling larger distances, the chance of honey bees increasing the levels of hybridisation above previous levels is most unlikely.

It has been stated by other authors and inferred by Dr Mullette that honey bees reduce the reproductive success of native flora. This point is difficult to accept as there is a massive body of research indicating the value of honey bees as pollinators. The role of honey bees in crop pollination has been well researched and proven beyond doubt. Honey bees are easily the single most prominent, and thus important flower visitor, of cultivated agricultural and horticultural crops.

From 1984 the NSW beekeeping industry actively lobbied the National Parks Ministers and Department with little success. Although in 1989 the industry did gain a few concessions; that i) from 31 December 1989 bee sites will be retained for the term of the life of the beekeeper, and ii) activities in parks will be governed by a code of conduct determined jointly between the NPWS and the NSW Beekeeping Industry.

NPWS Policy

In April 1990, the National Parks Operational Policy manual stated the following:

2.4.3. No new bee hive sites will be permitted in areas reserved or dedicated under the National Parks and Wildlife Act, 1974.

2.4.4 All sites in Service areas current as of 31st December, 1989 will be retained for the term of the life of the licensee (or in the case of a company, for the life of its nominee) or until surrendered. (It should be noted that such sites may be retained by the licensee whether or not the land was protected under the National Parks and Wildlife Act as at 31st December 1989).

2.4.5 Licensed sites cannot be exchanged or traded.

2.4.6 Any existing sites in Service areas which seriously compromise the environmental values of the area will, with the approval of the Minister, be modified or relocated at the direction of an authorised officer of the Service.

2.4.7 Occupation and use of sites will be governed by a code of conduct to be determined by the Service, in consultation with the Commercial Apiarists' Association of NSW.

2.4.8 Licences will commence from a common date of 31st December, 1989, and are to be subject to realistic, annually reviewed fees.

Since 1989 the number of bee sites in National Parks increased, due to the expanding areas of park management. Even so , many sites continued to be lost.

Beekeepers were still able to be excluded under this policy as roads were closed or previous bee sites became public picnic or camping grounds. There may have been very few, if any, options for an alternative site and if the Parks management were reluctant to find an alternative site , the beekeeper may well have found the experience unrewarding and sought poorer sites outside of the park boundaries if available.

Bee sites

The following table illustrates the number of bee sites and number of beekeepers with sites in NSW National Parks in August 1995 and February 1998.

APIARY SITES IN NATIONAL PARK ESTATE					
Region/ District	**Park or Reserve**	**No. sites 1995**	**No. of apiarists 1995**	**No. sites 1998**	**No. of apiarists 1998**
Central Region					
Bathurst	Goobang NP		-	15	5
	Nanga NP	-	-	1	1
Blue Mountains	Abercrombie River NP	-	-	2	1
	Gardens of Stone	-	-	1	1
Hunter	Myall Lakes NP	3	1	3	1
Upper Hunter	Coolah Tops NP			37	7
	Yengo NP	8	1		
Metropolitan Region					
Southern Metro.	Royal NP	2	2	3	2
Northern Region					
Dorrigo	Chaelundi NP			22	unknown
Glen Innes	Gibraltar Range NP	9	1	2	unknown
	Torrington SRA			41	unknown
	Washpool NP	6	3	5	unknown
Grafton	Bundjalung NP	10	1	3	1
	Fortis Creek NP			11	4
	Nymboi-Binderay NP			23	7
	Yuraygir NP	13	4	15	5
Lismore	Broadwater NP	21	8	19	6
	Bundajalung NP	30	4	29	5
	Tooloom NP			4	1
	Toonumbar NP			8	4
	Tyagarah NR	1	1	1	1
Port Macquarie	Hat Head NP			1	1
Southern Region					
Narooma	Eurobadalla NP			4	3
Nowra	Budawang NP			3	1
	Morton NP**			16	4
	Jervis Bay**			12	6
	Murramarung NP	1	1		
Western Region					
Cobar	Nocholeche NR	22	1	22	1
Coonabarabran	Pilliga NR	25	5	5	5
Narrabri	Mt Kaputar NP	11	1	11	1
Central/ Coast	Yengo NP	1	1		
TOTAL		163	35	319	74

** There were a number of sites in areas identified as additions to Morton NP and Jervis Bay NP. These were not included in this table.

A beekeeper may have sites in more than one national park, so it is possible that there were less than 35 beekeepers in 1995 and less than 74 beekeepers in 1998 with bee sites in National Parks. Even so the number of beekeepers with National Parks sites due to the

transfer of land tenure from State Forests and Crown Lands into National Parks doubled over a two and half year period. In the same period 50 sites were lost, that is, sites recorded in August 1995 but no longer recorded as bee sites in February 1998. This is a 31% reduction in National Parks sites held by beekeepers in August 1995 to February 1998. Over this period 204 new sites were transferred to National Parks from other land tenures. This is quite a considerable addition.

It is possible that the number of sites beekeepers have access to in National Parks could reach 500 in the next year or two. If this is the case then based on the loss of 31% of sites over the period August 1995 to February 1998, it is possible within 8 to 10 years there will be very few bee sites in National Parks if the current policy on transferability is not significantly changed.

As old beekeepers ceased to keep bees in these areas, these sites were also lost to the overall use by the beekeeping industry at large.

Future

A report prepared by the NSW Apiarists' Association, November 1998 "Beekeeping Policy Statement" indicated their desired policy initiatives as:

- Beekeepers to be assured of continued access to conserved areas.
- Transferability of apiary sites to other industry members.
- Reinstatement of sites lost.

One of these desired outcomes was partly achieved in May 1998 when the Minister for the Environment announced at the annual NSW Apiarists' Conference that bee site licences in parks will be transferable between family generations.

Whatever the success of this desired policy it is unlikely that NPWS lands will be utilised to the same extent as NSW State Forests. Even though it was estimated in June 1997 that the total area of forested lands in National Parks was similar to that in State Forests (Somerville 1998b).

The nature of the main activities in State Forests is to harvest timber. In doing so, an extensive network of roads and log dumps are created. Old log dumps present excellent locations on which to locate apiaries.

The National Parks do not have a need for such an extensive network of roads and old log dumps eventually regenerate. Thus the physical access to parks and the number of locations on which to locate beehives will be significantly less than that in State Forests over time.

It is possible the beekeeping industry has lost over 3,000 bee sites already, given that the number of sites in State Forests is approx. 4000 and, that the area of National Park is now greater than State Forests .

If there was a turn around in the policy of beekeeping in National Parks, then it is possible that the management of honey bees could co-exist in some parks. It is not feasible or possible to expect to regain access to all lost sites, but there is scope in some National

Parks for the co-existence of commercial honey bees and park activities. We have seen from research conducted in the Ngarkat Conservation Park where this could well help to keep a natural balance of the floral mix in pre-existing condition.

National Parks are an important floral resource for the honey bee industry. It is ironic that beekeepers have been talking and actively lobbying for 100 years for conservation of our native flora and when the area of conserved land significantly increases, beekeeping is generally discouraged. Old bee journals are very interesting documents expressing demise of our honey and pollen flora and voicing industry concern over the issue. There is a certain amount of irony as beekeepers were most probably the original conservationists well before it became trendy, as their livelihoods depended on the health, diversity and well-being of Australian native flora.

The attitudes and polices expressed by the NPWS is also the more disappointing given that it has not been clearly demonstrated that honey bees are a major threat to the Australian ecology.

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