SE 4.2

APICULTURE

QUEENSLAND CRA/RFA STEERING COMMITTEE

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FINAL REPORT

QUEENSLAND CRA/RFA STEERING COMMITTEE

For more information contact:

Regional Forest Assessments, Department of Natural Resources

Block C, 80 Meiers Road
INDOOROOPILLY QLD 4068

phone: 07 3896 9836
fax: 07 3896 9858

Forests Taskforce, Department of Prime Minister and Cabinet

3–5 National Circuit
BARTON ACT 2600

phone: 02 6271 5181
fax: 02 6271 5511

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Don Keith, Chairman, Resource Committee, QBA
Department of Primary Industries Intensive Livestock Services
Peter Warhust, Hamish Lamb & John Rhodes, Department of Primary Industries
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SUMMARY

This report has been prepared for the joint Commonwealth/State Steering Committee, which oversees the Comprehensive Regional Assessment (CRA) of forests in the South East Queensland CRA region. The CRA provides the scientific basis on which the State and Commonwealth governments will sign a Regional Forest Agreement (RFA) for the forests of the South East Queensland CRA region. This agreement will determine the future of the region's forests, providing a balance between conservation and ecologically sustainable use of forest resources.

The apiculture project was undertaken to describe the nature of the apiary industry, describe the significance of State forests, timber reserves and State reserves to the industry in SEQ, provide sufficient quantitative data to summarise its economic significance, and to estimate impacts of land use changes.

Forty three percent of Queensland honey production occurs in SEQ making it a major honey producing area within the State. There are currently 3300 beekeepers registered in Queensland, 139 beekeepers with over 200 hives including 54 beekeepers (with over 500 hives) that obtain most of their income from beekeeping.

Honey is the main source of income for Australian apiarists and represents the major product produced by apiarists on State forests and timber reserves. Apiarists move their hives great distances hence the apiarists that rely on State forests and timber reserves are widely spread. Increased use and value to the apiary industry of State forests and timber reserves has resulted from the continued clearing of freehold land. Approximately 2200 apiary sites are used on average in State forests and timber reserves in Queensland. State forests and timber reserves are also utilised for build sites where bee numbers and strength are increased. Build sites have an inherent value to the industry as without access to these sites, honey production and other hive uses would be limited.

A few studies have attempted to measure the impacts of feral and managed honey bees with native flora and fauna. Most research to date has failed to prove categorically that European honey bees are having a significant impact on Australian wildlife.

State forests and timber reserves account for greater than 40 per cent of honey and 17 per cent of queen bee production in SEQ. The greatest density of apiary sites occurs centrally in the SEQ RFA region with this area also shown to contain the most productive floral species. The annual turnover from honey production in Queensland is reported to be $8.4 million. It is estimated that the actual production for the SEQ RFA region is between 1700 and 4100 tonnes of honey per annum. State forests and timber reserves within the SEQ RFA region are estimated to produce between 710 and 1700 tonnes of honey per annum giving an annual turnover range between $1.2 million and $2.8 million.

In addition to information on use and production from existing sites, a method was developed to assess the productive potential of forests to the apiary industry irrespective of tenure. Two workshops were conducted over three days, involving representatives of the Queensland Beekeepers Association (QBA) and Department of Natural Resources (DNR). Vegetation types were assessed to estimate potential production for honey and build site use. Information collected at the workshops included how often the vegetation type produces a honey crop and the average production of that crop when it produces. Other valuable information collected at the workshops included the identification and potential usage levels of vegetation types utilised for building bees. The build types recorded included; honey production, crop pollination, queen bee breeding and packaged bees.

An economic survey was sent to 10 apiarists and used to compare Queensland apiary costs and average production levels with a New South Wales study. Due to time constraints and the decision to use of this survey as a comparison meant that this survey was limited in its coverage of SEQ beekeepers. The production levels used in the economic calculations in this report were calculated on a commercial apiary basis. This distinction is important as production levels vary greatly between commercial and non-commercial beekeepers. The cost and production data plus prices paid to the apiarists by Capilano Honey Ltd allowed the calculation of revenue and operating profit for honey and beeswax production. The eight grades of honey were grouped into two quality grades, with the median prices used being $1.61 and $1.74 per kilogram (1996/97 prices). The cost per kilogram of honey was estimated to be $1.48. As sites used to build bees for subsequent honey production are of value to the industry, 25 per cent of the value and cost of honey and beeswax production were allocated to honey build sites.

A potential of 5.3 million kilograms of honey was estimated could be produced in the SEQ RFA region on State forests, timber reserves and State reserves. The annual profit of the potential honey production when beeswax is included is $1.3 million with an annual turnover of $7.2 million (1996/97 prices). As 25 per cent of the value of honey production was attributed to build areas these values need to be considered in conjunction with the honey build value. The annual profit of the potential honey build is $0.3 million with an annual turnover of $2.4 million (1996/97 prices)

State forests, timber reserves and State reserves were identified as being an important resource for building bees for honey production, queen bee breeding, crop pollination and package bees. Sixty three, 51 and 39 per cent of the total area of State forests, timber reserves and State reserves were estimated as having potential for honey, queen bee building and crop pollination respectively. The annual profit to beekeepers of potential build sites for honey production, queen bee breeding and crop pollination is $1.3 million in total. In addition, it was estimated that an annual profit of $16 million was attributable to crop owners, resulting from pollination services through the use of potential build areas. State reserves reported in these figures have been filtered to remove reserves of less than 50 hectares

The Net Present Value (NPV) of potential honey and beeswax production calculated over the 20 year period of the RFA for SEQ State forests, timber reserves and State reserves is $14.8 million (State reserves less than 50 ha filtered). The combined potential build sites for honey production, queen bee breeding and crop pollination was calculated to have a potential NPV for the beekeepers of $14.7 million (State reserves less than 50 ha filtered).

1. INTRODUCTION

1.1 BACKGROUND

A large proportion of the Queensland apiary industry resides in the region covered by the SEQ Regional Forest Agreement (RFA). This region contributes approximately 43 per cent of the states honey production. The native forests of the region are a major source of nectar and pollen for the industry and are readily accessible to industry markets.

Currently little consolidated information exists in relation to the apiary industry in Queensland. This project was undertaken as part of the Comprehensive Regional Assessment (CRA) process in the SEQ RFA. This project is concerned with the sector of the apiary industry that utilises forested crown land, namely State forests, timber reserves and State reserves within the SEQ RFA region. These generally are the larger operators, with a great proportion of these operating on a commercial or part time basis. State forests and timber reserves are extremely important to these operators with approximately 40 per cent of honey produced in the SEQ RFA region sourced from hives located on these tenures. In addition the continued clearing of freehold land has resulted in the increased use and value of forested crown land to the apiary industry. Even though this project is primarily concerned with State forests, timber reserves and State reserves, the method adopted for the assessment of forested land is not dependent on tenure.

1.2 OBJECTIVES

The objectives of this project are:

- to describe the nature of the apiary industry in SEQ
- to describe the significance of State forests, timber reserves and State reserves to the industry
- to provide sufficient quantitative data (product volumes and financial) to allow the economic significance of the apiary industry to be described, and impacts of land use changes estimated.

1.3 PROJECT SPECIFICATIONS

For the project specifications, refer to Appendix 1.1.

1.4 DEFINITIONS

Apiary industry
For the purpose of this project, the apiary industry is defined as the beekeepers who utilise State forests, timber reserves and State reserves. The beekeepers who utilise native forests on these tenures are generally the larger operators, with the majority of these operating on a commercial or part time basis.

Apiary site
The site where an apiary is situated in or upon any place.

Build site
A site of particular floral resources used for increasing the strength and numbers of bees for subsequent productive uses e.g. honey production.

Native forest
The National Forest Policy Statement (1992) definition of forests, where the canopy density exceeds 30 per cent, is inappropriate for the purposes of this report. State forest, timber reserves and State reserves in SEQ RFA region contain areas utilised by the apiary industry where the canopy density is less than 30 per cent. These are predominantly dry forest areas that contain open woodland.

Therefore for the purposes of this report, native forest constitutes those areas with a canopy density exceeding five per cent.

Vegetation type
A vegetation type for the purposes of this report is a group or community of species commonly found together which have been allocated a vegetation type code e.g. 4a.

Composite vegetation type
The vegetation maps used in this report have composite vegetation types within a defined area that are made up of one to four vegetation types present in given percentages e.g. 4a/5b, 75/25 per cent.

Variable costs
Costs that change as the level of production varies.

Fixed costs
Costs that within limits do not change as the level of production varies.

Net Present Value
The present value of a cash flow.

Operating profit
Income less variable and fixed costs, taken for the purposes of this report only from forest grazing section of the enterprise.

2. INDUSTRY DESCRIPTION

2.1 HISTORICAL DEVELOPMENT OF THE INDUSTRY

Although Australia has its own stingless native bee (*Trigona carbonaria* and *Austroplebeia australis*), the better honey production and hiving characteristics of the European (black) bee *Apis mellifera mellifera* made it a more useful species for honey production for early settlers. European bees were originally introduced into Australia to provide honey as a sugar source before the introduction of sugar cane.

Successive races of honey bees have been introduced into Australia since early European settlement, although details are not well recorded. The major bee currently used for honey production is the Italian bee *Apis mellifera ligustic.*

Until the 1930s bee hives were located mainly around Brisbane, Ipswich, Warwick and Caboolture. Hives were distributed across the state for personal use and the bee population spread quickly to forest areas from these hives. The black bees became established in the bush soon after their first introduction in the early 1800s and are now spread over most of coastal Queensland. Many early beekeepers started by boxing feral colonies. Today feral bees are often an Italian-black hybrid.

Historically, the apiculture industry expanded outwards from the Brisbane area. The spread to the north was limited as the areas were not as productive as those closer to Brisbane. The spread to the west into the Darling Downs region found good honey sources and the industry spread even further west.

It is unclear when State forests and timber reserves were first used for honey production and when forests became important to the industry, but it is believed that once roads were constructed into forest areas, the apiary industry was swift to utilise the available resource. The ever increasing clearing of land for agriculture by ringbarking and earth moving machinery saw more beekeepers utilise crown forests in the 1960s. The forests around Jimna became popular at this time and were used in spring and summer in combination with wintering on the coastal tea tree.

The development of the apiary industry throughout the state is closely related to the development of the road network and availability of transportation. As technology improved the means of transport, roads and equipment, beekeepers were able to move their hives greater distances from home. Individual beekeepers now frequently manage up to 700 hives and travel up to 800 km from their home base (Warhurst and Goebel 1995).

The improving road system in the early 1970s in far south-west Queensland between Warrego, Paroo and Bulloo Rivers resulted in this area gaining importance to the industry with these areas used commonly as a resource in the winter months (Warhurst and Goebel 1995). These areas are currently favoured as a honey and pollen producing area by numerous beekeepers, including those residing in SEQ.

2.2 CURRENT AREAS OF OPERATION

South East Queensland is the northern end of the major honey producing belt of Eastern Australia. This belt extends as far south as Victoria. Movement north into Queensland sees a decline in productivity attributed to a higher rainfall and abundant native grasses. Most forest areas from the NSW border to approximately Maryborough have been utilised by the apiary industry at some time, with forests north of Maryborough containing unknown potential to the industry (Rhodes, J. 1997, pers. Comm.[1]). Although there has only been limited use of these forests, some apiarists report that these areas are seasonal and unreliable (Keith, D. 1997, pers. Comm.[2]). However the industry is further exploring these resources as other SEQ forests become heavily utilised.

While there are no regions or logical subdivisions of the apiary industry in Queensland, there are areas that are favoured. The industry subsequently is based primarily in the South-East Queensland RFA Region and the Darling Downs. While many of the beekeepers outside SEQ have relatively small scale operations there are some larger operators.

The extent of beekeeping is limited by two important considerations:

- the reliability and yield of the local honey and pollen flora
- marketing facilities

(Warhurst and Goebel 1995)

Analysis of the data collected for this report indicates that the greatest density of apiary sites occurs centrally in the SEQ RFA region. This area is also shown to contain the most productive floral species and is central and convenient to the honey packers and the majority of apiarists.

In July 1998, there were over 3300 beekeepers registered in Queensland, including 54 beekeepers (with over 500 hives) who obtain most of their income solely from beekeeping. Approximately 2200 apiary sites used on average in State forests and timber reserves, see table 6.4.

[1] John Rhodes, Primary Industries Intensive Livestock Services
[2] Don Keith, Chairman, Resource Committee, Qld Beekeepers Association.

3. MANAGEMENT PRACTICES AND ENVIRONMENTAL CONSIDERATIONS

3.1 FOREST MANAGEMENT AND BEEKEEPING

3.1.1 Tenure

The SEQ RFA region is divided into the land tenure classes summarised in Table 3.1. State forests, timber reserves and State reserves together comprise approximately 16 per cent (990 000 ha) of the total area of SEQ. This reduces to 832 000 hectares, when plantations are excluded (CRA 1998, Table 3.3).

Table 3.1: Tenure by Area in SEQ RFA Region

TENURE	AREA (ha)	% of SEQ
Freehold	4 253 583	69.78
State forest	887 837	14.56
State reserve	78 597	1.29
Timber reserve	23 992	0.39
National park	322 672	5.29
National park (proposed)	86 067	1.41
Other Crown land	414 978	6.81
Unclassified	28 150	0.46
TOTAL SEQ	6 095 875	100.00

Source: Digital Cadastral Database (DCDB 1997)
Note: Dedicated roads have been dissolved into the surrounding tenure classes, hence slight over estimates may occur.

3.1.2 Legislation

The major pieces of legislation relating to the apiary industry on State forests and timber reserves are the *Apiaries Act 1982* and the *Forestry Act 1959*. The *Land Act 1994* legislates for apiary sites on reserves, including State reserves, unallocated state land and roads. Permits are issued under the *Land Act 1994* by DNR in consultation with DPI apiary officers. An apiary site permit is required for each apiary site occupied (DPI 1993). Other legal requirements are necessary when a beekeeper is employing extra labour, for example Occupational Health and Safety, Public liability etc. (Warhurst and Goebel 1995).

The *Forestry Act 1959* requires an authority for beehives to be placed on State forests or timber reserves. An Apiary Site Permit, issued by Department of Primary Industries (DPI) native forests section, gives this authority (DPI 1993). Beekeeping occurs on some lands managed by the Department of Environment and Heritage under permit, but generally not on national parks. Conservation reserves, as defined by the *Nature Conservation Act 1992*, are generally not available for beekeeping.

The *Apiaries Act 1982* defines a number of requirements pertaining to beekeeping including:

1. All beekeepers in Queensland should be registered with the DPI. There is $10 fee charged for registration.
2. Apiaries must be marked to identify the beekeeper.
3. Distances between apiary sites, e.g. apiaries of apiary class B (≥ 40 hives) must be placed a minimum of 0.8 km apart from apiary sites of established apiary class B.
4. Guidelines for managing the outbreak of disease. (American Brood Disease is notifiable).

3.1.3 Apiary Permit Price Determination

Apiary Site Permit fees on State forests and timber reserves and lands managed by the Department of Environment and Heritage are reviewed annually. Fees are calculated using the preceding three year rolling average of the annual percentage change in the index of honey prices received by Queensland farmers as published by the Australian Bureau of Agricultural and Resources Economics (ABARE) (DPI, 1993). The price of an annual Apiary Site Permit in 1998 is $70.80 (Walls, J. 1998, pers. comm., 30 March[3]).

3.1.4 Selection of New Apiary Sites

In SEQ there are a large number of apiary sites that are used regularly by apiarists. When establishing new apiary sites, a number of aspects need to be considered including floral resource, road access, proximity to water, shelter from strong winds, sunny northerly aspect in winter, shade in summer and dry position. Table 3.2 illustrates the major honey flora species in SEQ biogeographic region.

New apiary sites on State forests or timber reserves are generally identified by the beekeepers and considered by DPI Forestry, taking into account other forest users. Sites on freehold and other Crown land are negotiated between the beekeepers and landowners or lessees (DPI 1993).

[3] Jeff Walls, Senior Sales Officer – Native Forests, Qld DPI–Forestry.

Table 3.2 Major Honey Flora in SEQ Biogeographic Region

Common Name	Scientific name
SEQ biogeographic region	
Grey Ironbark	*Eucalyptus siderophlora*
Narrow Leaved Ironbark	*E. crebra*
Brush Box (Supple jack and Pink Box)	*Lophostemon confertus*
Spotted Gum	*Corymbia.citriodora*
Swamp Mahogany, Swamp box	*Lophostemon suaveolens*
Silver – Leaved Ironbark	*E. melanophloia*
Yellow Box	*E. mellidora*
White Stringy Bark	*E. eugenioides*
Stringy Barks	
Grey Top Box	*E. molucanna*
Bloodwood Species	
River Mangrove	*Aegiceras corniculatum*
Teatree	*Melaleuca quinquenervia*

Source: DPI (1993) and QBA

3.1.5 Renewal of Apiary Permits

Apiary Site Permits on State forests and timber reserves are generally renewed non-competitively, with preference given to the previous permit holder. Apiarists tend to hold onto and pay for sites with a good production history even if they are not used every year. It is only in bad seasons that apiarists will release such sites due to the accumulative costs of fees of non utilised sites. Where a permit is not renewed the site becomes available to interested parties.

Permit holders may make application to transfer permits to other parties in accordance with the provisions of the Forestry Act, which requires the consent of the DPI Corporation or nominee. The permittee may set any value on the permit for transfer and DPI–Forestry does not levy any transfer fees (DPI 1993). If an apiarist is selling up their business, known apiary sites are a major selling point.

3.1.6 Lessee, Permittee and Silvicultural Treatment

Silvicultural treatments undertaken by DPI or permittee/lessee (under the *Land Act 1994*) on State forest or timber reserves, may affect other users of the resource. Prior to treatment, consideration needs to be given to the importance of the flora species identified for treatment or destruction to the apiary industry and how the timing of treatments will affect beekeeper usage.

The premium honey species, yellow box *Eucalyptus melliodora* and caleys ironbark *E. caleyi* are on the protected list in State forests. These species are not to be destroyed in State forests during treatment operations due to their honey producing capacity (DPI 1993).

3.1.7 Chemical Treatment and Prescribed Burning

Concerns have been raised over the use of Tordon TCH and the possible links to bee deaths. A knowledge of flowering periods, advising beekeepers of proposed treatments or delaying treatments will assist in minimising concerns (DPI 1993).

Similarly, prescribed burning in important apiary areas should be conducted in a manner so as to minimise any short term disadvantages to beekeepers – e.g. delay burning when the forest is experiencing a good nectar flow

3.1.8 Diseases and Pests

Australia has relatively few diseases and pests that impact on managed bees due to its isolation. Maintaining this low level is extremely important for local production and export considerations. Care is needed to eliminate the introduction of any more exotic diseases and all efforts should be made to reduce and eradicate the main disease in Australia, American brood disease (ABD).

Other diseases of note in Australia are European brood disease, Sacbrood, Chalkbrood and Nosema. Pests of apiary hives includes beeswax moth, cane toads, various ants, honey fly and bee eating birds (Warhurst and Goebel 1995).

3.2 INTERACTION OF FERAL AND MANAGED HONEY BEES WITH NATIVE BIOTA

Honey bees interact with a wide variety of Australian plants and animals and are now the most frequent floral visitor for many plants, often consuming more than half of a plant's floral resource and as such interact significantly with Australia's biota (Paton 1996).

A few studies have attempted to measure the impacts of honeybees on native flora and fauna, with suggestions that native bee numbers are reduced when honeybees are working the flowers but data presented to support this is doubtful (Paton 1996). Reproductive studies of several Australian native bees have so far failed to demonstrate an obvious and consistent negative effect (Paton 1996). Manning (1997) concluded that most research to date has failed to prove categorically that European honey bees are having a significant impact on Australian wildlife.

The response of honeyeaters to the introduction of honey bees is varied. Studies have shown that where surplus resources are available the number of honeyeaters did not decrease following the introduction of commercial loads of honeybees. In other areas where there are no surplus resources available individual honeyeaters often hold there feeding territories. Territorial honeyeaters respond to a loss of resource by increasing their feeding territories and adjusting the frequency that they visit flowers. Further work is needed to establish if localised reductions threaten the long term viability of these birds. The increase in competition with the honey bees may be partly attributed to habitat destruction and degradation (Paton 1996).

For the potential effects of feral and managed honeybees to be clearly distinguished, the population dynamics of feral and managed honey bees must be understood. Feral honey bees are uncontrolled, self-sustaining and occur over most of coastal Queensland. Managed honey bees, in contrast, are controlled by beekeepers and are moved regularly to harvest surplus honeyflows (Gibbs and Muirhead 1997).

Honey bees also influence the production of seeds by various plants, with their presence reducing seed production and/or pollination rates. Other plants have been found to experience enhanced production when honey bees are present. These appear to be those that are pollinator limited, suggesting that native fauna are no longer providing an adequate service. Honey bees may now be important pollinators of native plants where native pollinators are deficient (Paton 1996).

Feral honey bees use hollows that broadly overlap with those used by a wide variety of birds and mammals. Initial studies suggest that interactions with hollow nesting fauna may not be substantial however adequate assessment of available hollows is necessary and in some locations where hollows are rare significant competition may occur (Paton 1996).

Overall, the debate on the impact of introduced honeybees on the Australian environment has been inconclusive to date (Manning 1997, Schwarz & Hurst 1997, Paton 1997, New 1997). Further details are provided in Volume 114, No. 1, 1997, of the Victorian Naturalist on this aspect of the apiary industry.

4. PRODUCTS AND USES

4.1 PRODUCTS AND USES

The main source of income for apiarists is from the sale of honey and beeswax, with some specialists rearing colonies and queen bees and other apiarists providing bees on a rental basis to farmers and orchardists for pollination. Other products for which demand is increasing are royal jelly, pollen and propolis, which are used in the manufacture of some cosmetics, health foods and pharmaceutical products (Warhurst and Goebel 1995).

4.1.1 Honey

Honey is the main source of income to Australian apiarists and is the major product produced by apiarists on State forests and timber reserves. The floral source determines the final product. If only one species is flowering at one time eg *Lophostemon confertus* (brush box), the honey will be a 'straight line'. If many species are flowering at one time or there is honey from another floral source, the extracted honey is a blend of those types. Due to the differing sources of nectar, there will be variations in honey colours and flavours from site to site and season to season.

Generally beekeepers have little opportunity to select honey flows that will yield a particular colour and it is the packer's job to blend honey to the colour specified by the buyer. Colour is a major marketing factor, with light colours tending to have mild flavours, bringing the highest prices. Density or moisture content, is another important marketing factor as honey of low densities will ferment and render the honey useless. Packers generally pay a premium price for dense honey and may refuse to accept a honey with a moisture content above 18 per cent (Warhurst and Goebel 1995). Bottled honey is the most common product. Other products include creamed and candied honey, comb honey and honey mead.

Annual production from well managed apiaries, in the warmer parts of Australia varies from 90 – 150 kg/hive, although an average of 225 kg is not unknown in some seasons. Overall Australian honey production ranges from 18 000 to 28 000 tonnes annually due to climatic variation (Warhurst and Goebel 1995).

Over the last seven years, the average annual export of Australian honey has been 10,500 tonnes. Competition is increasing for these export markets, with Australia being at a disadvantage due to remoteness from the markets making freight costs high, therefore it is important to produce a high quality product. Most importing countries impose stringent requirements on entry of honey including colour, density and sucrose content (Warhurst and Goebel 1995).

Beekeepers generally contract supply to a honey packer. There are differing prices paid by the honey packers to the beekeepers depending on colour, flavour and density of the honey. Choice

honey produced in Australia is worth approximately $1.85 per kg with the lowest grade paying $1.44 per kg with a sliding scale between the two prices (Capilano Honey Limited 1997).

4.1.2 Beeswax

Beeswax is a by-product of honey extraction, with much of the beeswax produced being returned to the industry as foundation or sold as pure beeswax blocks. Popular uses of beeswax include religious and decorative candles, cosmetics and timber polish (Warhurst and Goebel 1995).

4.1.3 Rearing Queen and Package Bees

The queen bee is the mother of the colony and as such, is the most important bee in the hive. Under natural conditions the queen is replaced regularly as her egg production declines with age, whilst in managed hives to maintain the colonies strength the queen is replaced every 12 – 24 months (Warhurst and Goebel 1995). Care is needed to produce reliable queens hence many beekeepers prefer to purchase them from queen bee rearers.

The breeding of queen bees is a specialist field with skills extending to artificial insemination of queen bees. Due to the time and skill involved in queen breeding, apiarists who participate in this aspect of the industry are confined almost exclusively to this activity.

Package bees are generally produced as part of a honey producers operation as they have large numbers of hives and bees. A package of bees is a gauze-sided box containing between 1–2 kg of bees, a caged queen bee and a supply of sugar syrup that are sold to other apiarists. The majority of package bees are exported as they provide a quick start to other countries at the start of their Spring, when their hives are not at their maximum. Package bees may be sold to other apiarists in emergency circumstance, though this practice is avoided if possible due to the high purchase cost of package bees.

Australia is an exporter of queen bees both in their own right and as part of packages of bees. A queen bee for sale is estimated to cost a purchaser $7 – $8 and the producer receives $20 per kg for package bees. For the export market, most package bees are required in March and April depending on the location of the importing country. There was a strong demand for package bees in 1995 from Korea and the Middle East. Export of both queen and packaged bees fell in 1993/94 as a result of drought and Chalkbrood disease.

4.1.4 Pollination and Pollination Services

Most of Australia's agricultural and horticultural crops are non-indigenous, with many dependent on or benefiting from insect pollination. Crops requiring insect pollination may not be most effectively pollinated by native insects, while honeybees tend to be adapted to them. For some crops feral or wild honey bees are often in sufficient numbers for adequate pollination, but in times of drought or when insecticide use is heavy, feral colonies often become weak and are ineffective pollinators. However, there are crops for which feral or wild honey bees never provide adequate pollination.

The clearing of vegetation around agricultural crops, pesticide use on crops and the effect of the European Brood Disease (Williams 1987) make pollination by native and feral honeybees uncertain.

For these reasons, hives are moved to the crops, usually under contract to ensure that there are adequate pollinating insects to do the job (Warhurst and Goebel 1995).

The type of crop and the demands of the crop producers however can affect the health of the hives. Some crops are a poor nectar source even with normal bee numbers, causing bee losses without nutritional supplementation. Over-stocking of hives in an area is practised when the crop producer wants to guarantee full pollination, but it results in poor bee health and/or deaths. Hives with weak or decimated bees will provide no financial return to the apiarist until rebuilt.

4.1.5 Pollen

Pollen is used by bees as the main source of protein, lipids, vitamins, minerals and some carbohydrates. Pollen can be collected in the hive by a special trap and can be used for human consumption and in bird, animal and insect diets. It can also be fed back to the bees once sterilised. Very few native tree species have sufficient pollen for collection to take place. Spotted gum (*Corymbia citriodora*) is one of the few in SEQ which has sufficient pollen for collection. A strong hive will collect 1 – 2 kg a week depending on availability of pollen yielding plants and the bees needs (Warhurst and Goebel 1995).

4.1.6 Propolis

Propolis is a sticky substance gathered by bees from exudations of certain plants. While bees themselves use propolis to plug up holes in the hive, Europeans use propolis in toothpaste, medicines and other products for human consumption as research has shown that propolis has antimicrobial properties. There is limited interest in collection of propolis in Australia because of the high labour costs needed to collect it, making the return uneconomical (Warhurst and Goebel 1995).

5. ASSESSMENT METHODS

5.1 RESOURCE ASSESSMENT METHODS

5.1.1 Existing Use Patterns in SEQ

Data sources and limitations

The natural resource database for the apiary industry
To date, limited comprehensive information of the apiary industry in Queensland has been collected. In 1995, the Honeybee Research Development Council looked at addressing this problem through the DPI Intensive Livestock Services partly funding a project that established a Natural Resource Database for the apiculture industry (NRDA) in Queensland. The database was compiled in 1997 and was used for analysis of the existing use patterns of the apiary industry outlined below. The NRDA was constructed from data collected from an apiary questionnaire that was mailed to registered beekeepers with greater than 50 hives. The database includes site specific information on each apiary site held by individual beekeepers, including production figures, targeted flora and site history information. This project is part of a larger national project.

The data collected while comprehensive, is limited for use in this report due to:

- limited response and distribution of the questionnaire i.e. NSW beekeepers who work in QLD were not taken into account
- production data for detailed analysis could only be used for State forests and timber reserves as exact location of the private sites were unknown
- uncertainty of tenure on a number of occasions ie the beekeeper may not have known when a site was leased crown land as opposed to freehold
- there is no measure of importance of a site to other uses such as building up bees
- total survey response rate of 59 per cent with a response rate of 66 per cent for beekeepers with greater than 200 hives.

Agriculture census data
Australian Bureau of Statistics (ABS) compiles agriculture census data for extracted honey, including honeycomb. Survey forms are sent to persons undertaking agricultural operations with an estimated value of agricultural operations (EVAO) of a specified amount dependent upon budgetary constraints. For the financial years 93/94 – 95/96, the specified EVAO was $5000. As budget constraints determine the number of persons surveyed, the results are subject to limitations.

As the surveys are sent to persons undertaking any agricultural operations, honey production

information will not only be collected for persons whose sole employment is beekeeping but also persons who may be involved in other agricultural activities other than beekeeping, for example grazing. The survey covers all tenure types and completion is compulsory. These data were sourced for the financial years from 1989/90 to 1995/96.

Methods and analysis

The existing use pattern of the apiary industry was compiled from information contained in the NRDA (section 6.1 details the results). For the beekeepers that responded to the questionnaire, production on State forests and timber reserves was compared to other tenures for the whole of Queensland. For the purposes of this report leasehold and freehold were combined due to the limitations of the data as outlined above. A third tenure category of other Crown includes unallocated state land, roads, stock routes and reserves.

The NRDA was also used to examine honey production for the SEQ region. While exact locations of apiary sites were not recorded in the database, the closest town to the site and its respective postcode was recorded. Postcodes were used to identify those sites in SEQ, with information for sites whose postcode is only contained in part in the SEQ RFA region have been included in the analysis.

The NRDA provides detailed information about site usage in State forests and timber reserves. However, due to the limited response of beekeepers, DPI Intensive Livestock Services also collected data to determine historical apiary site usage of State forests and timber reserves. This data has been included in the analysis to supplement data in the NRDA.

Agriculture census data for extracted honey and honeycomb was sourced for the financial year's 1989/90 to 1995/96. The data extracted was for the whole of Queensland and for the SEQ RFA region. The SEQ RFA region was defined by shires that are contained with in the region. There have been a number of shire amalgamations since 1989/90 and these changes are detailed in Appendix 5.1.

Alternative methods for estimating current honey production

There are a number of alternative sources that may be drawn upon to provide an estimate of the current honey production in Australia and Queensland. Apart from the methods mentioned above, estimates may be calculated from:

- levies paid
- honey receivals, from Capilano Honey Ltd the largest honey packer in Australia, or
- hive numbers and an estimated average annual production.
- (Gibbs and Muirhead 1997)

Levies are paid on honey produced by beekeepers to the Commonwealth Department of Primary Industries and Energy (DPIE). However there is a minimum production level before the levy is payable. It is acknowledged that levies are not payable on all honey produced either through unregistered hives or undeclared honey (Gibbs and Muirhead 1997).

Capilano is the largest honey packer in Australia, accounting for approximately 67 per cent of all sales in Australia (Gibbs and Muirhead 1997). Total honey receivals from Capilano in 1996 provide an estimate to the total Australian production.

Production may be estimated from the number of registered hives and an estimated annual production per hive. Gibbs and Muirhead 1997 estimated an annual production of 70 kg per hive for beekeepers with greater than 200 hives. This estimate may be conservative as it is considered that most commercial beekeepers can achieve an average of 100 kg per hive. Also production from beekeepers with less than 200 hives are excluded in this estimate.

5.1.2 Production Potential in SEQ

Primary data sources and limitations

Tabular
DNR conducted two workshops to obtain data on the potential productivity of SEQ vegetation types for beekeeping using expert knowledge of representatives of the apiary industry. This information is maintained in a database compiled by DNR and is known as the Apiary Potential Productive Database (APPD). The methods for the collection of this data are detailed below. Metadata is provided in Appendix A

Spatial
1. A vegetation coverage prepared by Department of Environment details composite vegetation types that cover SEQ RFA region with a key to the structure and species that make up the vegetation types. The data in the APPD was linked to the vegetation coverage to allow this information to be displayed spatially. The vegetation coverage was combined with the **tenure** coverage and truncated to the RFA region. The coverage is known as **apiary_SEQ.** Metadata is provided in Appendix A.

2. A honey coverage, **honey_SEQ** was produced by DNR containing the derived honey variables calculated from the spatial variables in the apiary_SEQ coverage. These are detailed later in the report. This coverage was derived from the vegetation coverage joined with data from the APPD. Metadata is provided in Appendix A.

3. A build coverage, **bee_bld_SEQ** was produced by DNR containing the derived build variables calculated from the spatial variables in the apiary_SEQ coverage, detailed later in the report. This coverage was initially derived from the vegetation coverage joined with data from the APPD. Metadata is provided in Appendix A.

4. A **tenure** coverage was derived from the Digital Cadastral Database (DCDB) by grouping broad tenure classes. Metadata is provided in Appendix A.

Data limitations
The constructed APPD, apiary_SEQ and subsequent derived coverage are limited for a number of reasons including:

- The vegetation coverage utilised at the workshops was in draft format at the time and had only been edge matched in part. The vegetation coverage is considered to be representative of the final data set.

- The composite vegetation types on the final vegetation coverage were reclassified and grouped to the extent that it was not possible to translate the workshop data to the final vegetation coverage.
- Due to difficulties in mapping *Lophostemon confertus* (Brush Box), its occurrences may have been under estimated in the vegetation coverage and hence vegetation types that contain Brush Box may have under valued with respect to their potential production and usage.
- The workshop data were collected for individual vegetation types, whereas the vegetation coverage consists of composite vegetation types. Assessing vegetation types individually at the workshops instead of the composite vegetation types may have effected the valuation of some composite vegetation types.

Methods and analysis

A) Primary data collection

It was the aim of this project to measure not only the current usage of native forests on State forests, timber reserves and State reserves by the apiculture industry but also to estimate their productive potential. Hence all forests types were assessed for their value to the industry, irrespective of whether they are currently used or not. To do this it was necessary to develop a method to assess the productive potential of all areas of native forest.

Data for the APPD was collected from two workshops, run over three days in the later half of 1997, involving representatives of the Queensland Beekeepers Association (QBA) and DNR. The base data set was a series of 1:100 000 vegetation map sheets covering the SEQ RFA, produced from the vegetation coverage. The vegetation map sheets detailed vegetation types and their percentage occurrence in each composite vegetation type. Potential production information in each vegetation type was recorded using the legend from each map sheet. See Appendix 5.2 and 5.3 for an example of the legends and maps used.

The vegetation spatial coverages used to produce the maps for the workshops were in draft format at the time of map preparation and as such were not fully validated or edge matched. However, at the time it was considered possible to translate the workshop data generated from the draft coverages to the final vegetation coverage. Due to unforseen problems this was not possible. Whilst the validation process for the vegetation mapping may influence the productivity estimates of some sites, the use of individual map sheets allowed for regional differences in the productivity of the same vegetation types to be taken into account.

Workshop participants were selected by the QBA based on their direct experience of beekeeping in the vegetation types in the SEQ RFA region. Nine and 13 beekeepers attended the first and second workshops respectively. They utilised their experience and knowledge of vegetation types in the region to estimate potential production for honey and building over time, for each vegetation type on individual map sheets irrespective of tenure. While beekeepers may not have used every site on the individual map sheets, mainly due to access, they were able to use their knowledge of the vegetation types' performance on the given map sheet and apply their knowledge to all sites of the same vegetation type. Information collected at the workshops included how often the vegetation type produces a honey crop and the average production of that crop when it produces. The form used to collect data at the workshops is shown in Appendix 5.4.

Other valuable information collected at the workshops included the identification and potential usage levels of vegetation types utilised for building bees. The build types recorded were for honey

production, crop pollination, queen breeding and packaged bees. An additional category recorded was maintenance sites that are particularly important to the industry, especially as winter sites.

B) Assumptions

A number of assumptions were used in the estimation of productive potential and these are outlined below:

1. Estimates of productive potential for all vegetation types are based on historical use and expert knowledge. The estimates are long term average potential values, taking into account seasonal fluctuations.
2. Vegetation types were assessed and valued, based on the beekeeper's experience of the vegetation type in question. If a vegetation type occurred a number of times over a map sheet but the beekeeper had not worked all sites of the particular community, their estimations of the known sites was applied to all occurrences of the particular vegetation type for the map sheet.
3. All vegetation types were assessed for their potential, irrespective of their current use by the apiary industry.
4. Any level of use of a vegetation type was assumed to be economically viable.
5. Each apiary site was assumed to have an area of 200 hectares (Keith, D. 1998, pers. comm.).
6. A number of vegetation types were unknown to the beekeepers. They have been entered into the database as not useful to the beekeepers but were flagged as having 'unknown potential' value.
7. Plantations were not valued by the beekeepers in this process as this assessment is only concerned with native forests. For the purpose of the apiary assessment, plantations have been given a production value of zero. However the remnant vegetation within the plantations is utilised by beekeepers, particularly Teatree and Bush Pea.
8. Vegetation types on Fraser Island were not assessed, as the apiary industry does not have access to Fraser Island.
9. Vegetation types on Curtis Island were not assessed as the vegetation mapping work was not available at the time of the workshops and it was considered that this was not a major honey producing area.

C) Calculations in APPD

The workshop data was entered into the APPD and validated. Prior to linking the data to the vegetation spatial coverage, a number of fields were calculated in the database. These are described below.

Honey kg/ha/yr

The fields collected for honey producing vegetation types at the workshop were:

A) How often (years) the vegetation type produces a crop – Q3 on the form, (crop years).
B) Average production per hive when the crop produces – Q4 on the form, (av honey prod/hive).
C) No of hives at the site – Q5 or Q6 on the form, (no of hives).

It was assumed that each apiary site covered an effective area of 200 ha. The average annual honey production per ha for each vegetation type can be calculated by the formulae:

$$\text{Av honey prod/ha/yr} = (C*B)/(A*200)$$

For example if a site within a given vegetation type is used every 2nd year, with an av honey prod/hive of 80 kg and the no of hives at the site is 100 then the average annual production/ha equals 100*80/2*200 = 20 kg/ha/yr. See Appendix 5.4 for details of the workshop forms.

Build weeks per year

The fields collected for vegetation types utilised for building at the workshop were:

D) How often (years) the vegetation type provides adequate build condition – Q8 on the form.
E) Bees built on this vegetation type used for honey production, queen bee breeding, crop pollination, package bees and other – Q9 on the form.
F) When a vegetation type is utilised for building, the average weeks used – Q10 on the form.

The average build weeks per annum for each vegetation type can be calculated by the formulae:

Av build weeks/yr = F/D

Building for honey production, crop pollination, queen breeding and package bees are recognised as the four major build types. They are assumed to have equal weighting ie to build for honey is no more important than building for any of the three other recognised major uses. This assumption enabled build type by weeks to be generated by equally dividing the builds weeks per annum for the vegetation type by the number of build uses i.e. F/D/E. For example if a vegetation type is used on average for building 10 weeks/annum for honey production and crop pollination then each build use is attributed 10/2 =5 weeks/annum.

D) Linking APPD to the GIS coverage

Upon completion of the calculations in the APPD, the complete database was linked to the vegetation coverage. The composite vegetation types eg 4a/3b/2c and the respective percentages of each vegetation type e.g. 50/30/20 were separated into new variables. This enabled linking on a map sheet by map sheet basis. All map sheets covering the SEQ RFA region were then appended together to construct one GIS coverage. The APPD was then joined consecutively to the new variables and checked.

E) Derived GIS items and coverages

Once the database was joined a number of derived items could then be calculated using the composite vegetation polygon areas from the GIS coverage now incorporating the textural data from the APPD. These were divided into honey and build related items and are listed below. Details of their derivation are provided in Appendix 5.5 and the Metadata in Appendix A.

Honey items

- kg/ha/annum for honey total
- kg/ha/annum of honey for grade 1
- kg/ha/annum of honey for grade 2
- ha/ honey grade 1
- ha/honey grade 2
- honey revenue for grade 1
- honey revenue for grade 2
- total honey revenue
- operating profit of honey and wax production for grade 1
- operating profit of honey and wax production for grade 2
- total operating profit of honey and wax production

Build items

- weeks (building)/annum
- no of build uses
- types of build uses
- build weeks/annum for honey production
- build weeks/annum for crop pollination

- build weeks/annum for queens breeding
- build weeks/annum for package bees
- revenue from honey build
- operating profit from honey build
- operating profit from crop pollination build for beekeepers
- operating profit from crop pollination build for crop owners
- operating profit from queen bee breeding build

Note: the weeks/annum for maintenance or another build use type apart from honey, crop pollination, queen bee breeding or package identified in isolation for any vegetation type were not included in the calculation. That is, the derived week/annum for the composite vegetation type did not take the weeks/annum for these other build uses into the calculation.

GIS results and analysis
Upon completion of the derived items, two coverages were constructed. The first, honey_SEQ contains the derived honey items listed above. The second, bee_bld_SEQ contains the derived build items listed above. The tenure coverage was used to reselect data on State forests, timber reserves and State reserves on both coverages.

Total revenue from honey and wax production, number of kg/annum of honey and number of build weeks/ha was calculated for State forests, timber reserves and State reserves. These calculations enabled a further number of variables to be derived and added to the bee_bld_SEQ coverage. They are listed below:

- revenue from honey build
- operating profit from honey build
- operating profit from crop pollination build for beekeepers
- operating profit from crop pollination build for crop owners
- operating profit from queen bee breeding build.

The reselected data on the two generated coverages was used to derive resource and economic information detailed in chapters 6 and 7. Details of their derivations are provided in Appendix 5.5. Honey_SEQ and bee_bld_SEQ will be used to attribute the SEQ planning units and as a contextual layer in the planning support tool for integration and option development.

5.2 ECONOMIC ASSESSMENT METHODS

5.2.1 Honey and Beeswax

An economic survey was mailed to 10 apiarists to acquire data on their average annual honey production levels (kg/hive), number of hives, fixed and variable costs associated with honey production, along with the percentage of their business attributable to honey production. The survey data collected referred to the last two complete financial years, 1995/96 and 1996/97. The survey form is shown in Appendix 5.6. This survey provided a comparison of apiary costs in SEQ with the costs for New South Wales obtained from the Mansfield Report (Anon., 1996). Production levels in the apiary industry vary greatly between commercial and non-commercial beekeepers. For the purposes of economic calculations in this report commercial production levels were used.

The resource data in the APPD provided annual honey production figures by vegetation type. Honey prices were collected from Queenslands largest honey packer, Capilano. These were used in conjunction with the costs collected in the economic survey, to calculate operating profit for honey and beeswax for each vegetation type.

FORUM, an economic model developed by the Australian Bureau of Agricultural and Resource Economics (ABARE), will be used during option development to optimise the structure of the timber industry. In addition to the capacity to model the timber industry, the model has the capability of providing summary data on other industries when appropriate data is input into the model. Economic data from this report will form the input into FORUM allowing calculation of summary data on yearly values, and a net present value (NPV) over the period of the SEQ RFA for the apiary industry. These outputs will be used in the options development process of the SEQ RFA. To provide data for this report on the potential economic value of the apiary industry over the next 20 years, a NPV was calculated for State forests, timber reserves and State reserves within the SEQ RFA region.

Production potential

For the purposes of economic valuation in this report, production data was only calculated over land that falls into the tenure types of State forests, timber reserves and State reserves. This value represents a potential production figure for the apiary industry, as not all sites assessed to be of value to the beekeepers will currently be in use. Production of beeswax was assessed at a rate of one sixtieth of honey production as in the Mansfield Report (Anon., 1996).

Revenue

As honey is sold in several different quality grades, the production data was separated to account for this prior to its use in attributing revenue to the spatial vegetation coverages. A list of the floral species which produce high quality honey was collated by Keith (1998, pers. comm., 27 Jan[4]) and these species are presented in Table 5.1. A grade 1 category was assigned when one or more of the species found in Table 5.1, were a dominant species in a vegetation type (dominant species were highlighted in each vegetation description). All other vegetation types were assigned a grade 2 category.

Table 5.1 Floral Species That Produce Premium Grade Honey

Common name	Scientific name
Grey Ironbark	*Eucalyptus drepanophylla* or *E. siderophloia*
Brush Box	*Lophostemon confertus*
Narrow Leaved Ironbark	*E. crebra*
Silverleaf Ironbark	*E. melanophloia*
Gumtopped Ironbark	*E. decorticans*
Broad Leaved Ironbark	*E. fibrosa* or *E. siderophloia*
Swamp Mahogany	*Lophostemon suaveolens*
River Mangrove	*Aegiceras corniculatum*
Gumtopped Box	*E. moluccana*

Source: Keith 1998, pers. comm

4 Don Keith, Chairman, Resource Committee, Qld Beekeepers Association.

In consultation with Keith (1998, pers. comm., 27 Jan[4]) the honey prices were separated into two quality categories using the median price for the top three grades and the lower five grades respectively. The prices used were taken from the Capilano Pricing Schedule for December 1996 and July, October 1997, including loyalty bonuses where appropriate. Further calculations were associated with the spatial coverage and were undertaken using a Geographical Information System (GIS). Honey production data (kg/annum) by vegetation type was used to estimate the production of beeswax as honey equivalent. Beeswax is produced at one sixtieth the rate of honey, but is valued at 3.75 times the value of honey (Anon., 1996). The honey and beeswax (as honey equivalent) were summed to provide the production levels for each vegetation type.

The return to honey and wax production was reduced to allow a proportion of the revenue to be allocated to vegetation sites where bees are built prior to honey production. The reasoning behind this is explained in section 5.2.2. As 25 per cent of the revenue from honey and beeswax production was allocated to honey build areas, the production data was multiplied by 75 per cent of the appropriate median honey price depending on the quality grade. This provided an estimate of the revenue available from the production of honey and beeswax (as honey equivalent) over each vegetation type in the SEQ RFA region. Finally, revenue for all the vegetation types in the composite vegetation type were summed by honey grade and in total, to give three revenue figures for the composite vegetation type.

Costs

Two years worth of costs associated with beekeeping were obtained from the economic survey. These costs were separated into variable and fixed costs. Variable costs change with differing output levels, e.g. hive maintenance and replacement. Fixed costs are costs associated with running a business and will not vary until there are large changes in production levels, e.g. administration costs. An operators allowance and depreciation costs were included in the fixed costs. The 1995/96 costs were divided by the Consumer Price Index (CPI) (base year 1996/97) to bring them in line with the1996/97 costs. The costs in each survey were adjusted using the percentage each apiarist attributed to honey and beeswax production.

The costs for each enterprise were calculated on a per kilogram of honey basis, then an average cost per kilogram of honey across all surveys was calculated. In attributing costs in the GIS coverages, only 75 per cent of the cost per kilogram of honey were used, so as to account for build costs. As in the revenue calculations, the remaining 25 per cent of costs are attributed to the vegetation types that are used to build bees for honey production. Costs were calculated by honey grade within each composite vegetation type.

Operating profit

The operating profit for each honey grade was calculated by subtracting the costs from the revenue. For each composite vegetation type, three operating profit values were attributed to the GIS coverages, one for each honey quality grade and a total.

Limitations of survey data

The economic surveys were targeted at specific apiarists using the convenience sampling method, a non-probability sampling method ie. surveys are sent to specific targets in the population, usually chosen for their interest or appropriateness to reply to the survey topic and a willingness to reply. The number of surveys distributed to and returned from apiarists was not of sufficient size under scientific principles for the results to be extrapolated to the population being studied with a high level of confidence.

The costs calculated from the survey replies correlated well with the Mansfield Report (Anon., 1996) when applied on a cost per hive basis. However there was a large difference in the production data, with the average production per hive considerably higher in the Queensland surveys. As the Queensland beekeepers access different floral resources this may explain the higher production figures. However, the reader should interpret the results in light of the higher production levels.

5.2.2 Building Bees for Honey and Beeswax Production

The time bees are located on build sites to build up their numbers and strength in between time spent at honey producing sites is generally considered to be part of the cost of honey production. However, build sites have an inherent value to the industry, as without access to these sites honey production would be limited. Vegetation types useful for honey production and building are frequently different. Therefore, a proportion of the value of honey production has been allocated to the build sites according to their potential use.

Several SEQ beekeepers (Hacker, C., Johnson, R., Knight, T, McMartin, D. and, Palmer, R., 1998, pers. comm., 30 March[5]) estimated that on average hives are being built up and not producing honey for approximately 3 months each year. To account for this, 25 per cent of the costs and revenue from honey production within the SEQ RFA region were attributed to honey build areas. Inherent in this method was an assumption that all bees that are used to produce honey in the SEQ RFA region are also built in this region and visa versa. This assumption was checked with several SEQ beekeepers (Hacker et al. 1998, pers. comm., 30 March[5]) who agreed on balance that this assumption was reasonably accurate. This method enabled a correlation between the value of honey build sites and subsequent honey production.

There are costs associated with having bees in build areas e.g. transport costs to site, partial contribution to maintenance of equipment etc. However, the exact proportion of total costs would be hard to determine. Twenty five per cent of honey costs were used as costs associated with build sites were considered likely, on average, to be similar to honey sites.

Following the attribution of revenue and costs for honey production to all the vegetation communities over the SEQ RFA region, a tenure layer of State forests, timber reserves and State reserves was used to calculate the total revenue and costs for these tenure types. From this information, 25 per cent of the revenue and costs were extracted and attributed to build sites.

The resource workshops provided data on the use of different vegetation types as honey build sites. From this information the total number of weeks per annum weighted by hectares that can be used to build bees for honey production in the SEQ RFA region over State forests, timber reserves and

[5] Charles Hacker, Bob Johnson, Tony Knight, Duncan McMartin, and, Rod Palmer, SEQ Beekeepers.

State reserves was determined using GIS coverages. The number of honey build weeks per annum weighted by hectares in each composite vegetation type was divided by the total number of weeks per annum weighted by hectares available for building bees for honey production in State forests, timber reserves and State reserves. This provided the percentage of honey build value for each composite vegetation type. This percentage was then multiplied by 25 percent of the total revenue and costs from honey and beeswax production, to determine the revenue and costs attributable to each composite vegetation type. This allowed the determination of the operating profit attributable to each composite vegetation type from honey build. Details of this process are available in Appendix 5.5.

5.2.3 Building Bees for Crop Pollination and Queen Bee Breeding

The objective of this section is to provide estimates of the actual and implied economic values of forest build areas from queen bee breeding and crop pollination. Paucity of statistically reliable data prevents conclusive analysis of the value of build areas. In this study, data from diverse sources had to be used, so their consistency and compatibility cannot be guaranteed. Moreover, subjective expert opinion was called for to fill gaps in data. Hence, the results of the study are indicative rather than exact.

The method is to identify the marginal net benefit of queen breeding and pollination, to all involved in the activities. In queen breeding, a conventional operating profit calculation is sufficient, by deducting all relevant business costs from total revenue. The valuation of pollination is more complex, as it requires the estimation of the opportunity cost to the crop owner of assisted pollination versus the natural alternative. As cropping businesses usually contain a number of individual enterprises (crops), the measure used is the relevant gross margin that does not include the business overheads. (This is different from, e.g. apiary where there is just one dominant enterprise, thus business overheads are also deducted and operating profit is the applicable measure.) The simplified formula for calculating gross margin is as follows:

$$GM = GR - VC(PrH) - VC(H) - VC(PoH)$$

Where: GM = gross margin
GR = gross revenue
VC(PrH) = variable costs incurred pre harvest
VC(H) = variable costs of harvesting
VC(PoH) = variable costs incurred post harvest

Crop owners planning their enterprise in expectation of the benefits of assisted pollination would suffer two types of losses if their crop fails completely before harvest: (1) the actual expense of pre-harvest operations already carried out, and (2) the perceived loss of the gross margin expected from the crop that will not now be collected. (Note that harvesting and post-harvest costs would not be incurred on a crop that failed, hence, these were not counted among the losses.)

However, even if assisted pollination does not eventuate crops may not fail completely. Rather, there would be some, albeit reduced, yield due to the work of naturally occurring pollinators in the crop. In this case, the crop owner's losses are calculated as the difference of the expected gross margin and the actual gross margin gained from the crop:

$$GM(lost) = GM(expected) - GM(actual)$$

While this is a gross margin figure related to a specific crop, any losses in a crop such measured would be equivalent to lost operating profits at the whole-farm level. As such, the figures shown in the result section 7.3.1 as gross margins are equivalent to apiary operating profits in other parts of this report.

5.2.4 Building Bees for Packaged Bee Production

No economic values were attributed to the packaged bee build areas, as there is limited use of Crown native forests in SEQ by packaged bee operators. This was highlighted in the results of the NRDA where no packaged bee production is shown for State forests or timber reserves in SEQ. Forest use mainly occurs through operators from New South Wales (Charles Hacker 1998, pers. comm. May)[6]. The level of use depends largely on the seasonal conditions in the New South Wales forests in the areas normally frequented by these operators.

5.2.5 Net Present Value of Honey and Beeswax Production Including Building Values

A net present value (NPV) for honey and beeswax production and build areas in the SEQ RFA region, over State forests, timber reserves and State reserves was calculated for the purpose of this report. The NPV shows the potential value of the native forest floral resource to apiarists over the 20 year period of the SEQ RFA.

When calculating a net present value, a discount rate and time horizon must be set. The application of a discount rate occurs due to the opportunity cost of capital, ie a dollar is worth more today than in a years time as a person could invest it for the year. Therefore, dollars received further into the future have a lower present value than those received today. As this calculation forms part of an economic assessment at the level of the whole of society, the discount rate used was a social discount rate. This differs from the rate a private investor would use, in that it is lower, due to society usually considered to have a longer time horizon and lower risk allowance than an individual (Gittinger 1982). The average of the 1995/96 and 1996/97 10 year bond rate was 8.2 per cent (Reserve Bank of Australia Bulletin 1997) and the average underlying treasury rate of consumer price inflation (ABS 1997) over the same period was 2.6 per cent. This resulted in a real rate of interest of 5.6 per cent. The social discount rate used in this project was 6 per cent real, which compares with the rate of six per cent real recommended by Queensland Treasury (Queensland Treasury 1997).

The second parameter that must be set is the time horizon. Choosing an appropriate time horizon involves several issues, one being the confidence with which future product prices, substitutes, and technical advances etc can be predicted. Honey prices tend to be relatively volatile hence no firm conclusions can be set on future values. The second issue is that at the most commonly used discount rates, extending the time horizon of the analysis much past twenty five years, results in the present value of each ensuing year to be so small a value as to contribute little to the net present value, rendering it pointless (Gittinger 1982). For this report the NPV was calculated over 20 years, to fit with the period covered by the SEQ RFA. This meant the time horizon used fell within the generally accepted boundary of the number of years, given a six per cent discount rate.

As NPV calculations are carried out in real (no inflation) terms, costs were assumed to remain

[6] Charles Hacker, SEQ Beekeeper

constant over the 20 year term of the SEQ RFA. Due to no long term forecasts being available on world honey prices (Australian honey prices are closely linked to world honey market prices) the honey price was also assumed to remain constant.

The NPV was calculated on 100 per cent of the costs and revenue from honey production within the SEQ RFA region over the three tenures, thereby including the value of honey build sites. Added to these values were the operating profits for queen bee breeding and crop pollination to the beekeepers. A separate NPV was calculated for the value of crop pollination to the owners of the crops. For the options development phase of the SEQ RFA, the net present values will be provided from FORUM.

6. RESOURCE RESULTS AND DISCUSSION

6.1 CURRENT PRODUCTION

6.1.1 Existing Use Pattern

As detailed in section 5.1.1, a Natural Resource Database for the apiculture industry (NRDA) was compiled by DPI – Intensive Livestock Industry Services in 1997 from responses of a questionnaire sent to all apiarists registered in Queensland who own fifty or more hives. Response rates to the questionnaire are shown below in Table 6.1.

Table 6.1 Response Rates to the Apiary Questionnaire

	51–200 hives in 1995/96	> 201 hives in 1995/96	Total
No of beekeepers	280	139	419
No of beekeepers responding	156	92	248
Per cent responses	55.7	66.2	59.2

Source: NRDA, DPI Intensive Livestock Industry Services 1997

It must be noted that while the average response rate was 59 per cent, the response rate for beekeepers with more than 200 hives was higher at 66 per cent. These apiarists are the major producers, with greater reliance on State forests and timber reserves.

Production information of the responding beekeepers extracted from the NRDA for Queensland and SEQ is shown in Tables 6.2 and 6.3 respectively.

Table 6.2 Average Annual Production Volumes and Percentage Contribution by Tenure in QLD

Product	SF/TR		Other Crown		Freehold/leasehold		Total
	Volume	%	Volume	%	Volume	%	Volume
Honey (tonnes)	2 512	26.5	99	1.1	6 857	72.4	9 468
Pollen (kg)	0	0	0	0	2 315	100	2 315
Queen bees (Nos)	19 300	19	0	0	84 127	81	103 427
Package bees (Nos)	0	0	0	0	6 770	100	6 770

Source: NRDA DPI Intensive Livestock Industry Services 1997.
NOTE: number of package bees refers to the number of 1.5 kg packages of bees

Table 6.3 Average Annual Production Volumes and Percentage Contribution by Tenure in SEQ

Product	SF/TR		Other Crown		Freehold/leasehold		Total
	Volume	%	Volume	%	Volume	%	Volume
Honey (tonnes)	1 716	41.9	23	0.7	2 348	57.4	4 087
Pollen (kg)	0	0	0	0	758	100	785
Queen bees (Nos)	15 700	17.1	0	0	76 331	82.9	92 031
Package bees (Nos)	0	0	0	0	2 264	100	2 264

Source: NRDA DPI Intensive Livestock Industry Services 1997.
Note: number of package bees refers to the number of 1.5 kg packages of bees

Analysis of the production information extracted from the NRDA for Queensland show that the apiary industry is reliant on State forests and timber reserves for approximately 27 and 42 per cent of honey production in Queensland and SEQ respectively. State forests and timber reserves are also significant for queen bee production with 19 and 17 per cent of queen bees produced in Queensland and SEQ respectively. Refining the results to SEQ highlights the importance of State forests and timber reserves in SEQ to the apiary industry for honey and queen bee production. It indicates that SEQ is a major honey producing region in Queensland and that within that region almost half (42 per cent) of the honey produced is from State forests and timber reserves. Also shown by these tables is that the SEQ region represents 43 per cent of Queenslands honey production.

Historical site usage data was collected to complement the NRDA and is summarised in Table 6.4. The table describes the number of forests in each district, of those forests the number used by apiarists and the total number of sites across these forests and their usage rates in any one year. The forest district boundaries have subsequently been updated since collection of this data. Brisbane now forms part of Beerburrum and Gympie is now contained in Maryborough forest district.

Table 6.4 Historical Site Usage in State Forests (SF) & Timber Reserves (TR) by Forest Districts in QLD

District	No of forests in district		No of forests used by beekeepers		No of apiary sites	Average no of apiary sites Booked/yr	% of available sites booked in one year	No of years data collected	
	SF	TR	SF	TR	SF & TR			No	Yrs
Atherton	29	11	12	0	36*	3.3	9.17	26	1971–96
Beerburrum	23	0	17	0	289	170.0	58.82	9	1988–96
Brisbane	30	3	26	0	269	201.3	74.83	6	1990–95
Dalby	68	0	36	0	1556	451.5	29.02	2	1990–95
Gympie	21	0	18	0	218	74.8	34.31	8	1989–96
Imbil	28	3	17	0	987*	691.0	70.01	4.5 av.	1989–95
Ingham	44	7	4	0	5*	3.0	60.00	1	1995
Maryborough	36	6	19	0	638	239.5	37.54	6	1991–96
Monto	50	7	20	0	413	166.0	40.19	6	1991–96
Rockhampton	78	14	18	2	135*	10.2	7.56	25	1970–95
Roma	35	1	6	0	7*	0.7	10.00	12	1984–95
Yarraman	37	2	29	0	469	196.0	41.79	1	1995
TOTALS	479	54	222	2	5022	2207.3	43.95		

Source: Rhodes (1996)
NOTE: * Based on the maximum number of permits issued in one year

Analysis of historical site usage for Queensland (Table 6.4) illustrates Brisbane, Beerburrum, Imbil and Ingham forest districts importance to the apiary industry in having greater than 50 per cent of their available sites booked on an annual basis. Actual percentage figures of sites booked within these districts, range from 58 to 75 per cent. Brisbane, Beerburrum and Imbil districts are contained in the SEQ RFA region. Imbil district has the greatest average number of sites booked and percentage of available sites booked in any one year, indicating Imbil district is the most important forest district to the apiary industry. The importance of Imbil district is also reflected on the attached maps (Maps 1 & 2).

The highest potential honey producing area is shown on Map 1 as being south west of Gympie. This area is contained mostly in Imbil forest district. The high productivity of this area is reflected by the high average site usage. Similarly, the highest predicted duration of building, shown in build weeks per annum (Map 2) is also mostly contained in the Imbil forest district.

6.1.2 Agriculture Census Data

As detailed in section 5.1.1, agriculture census data was acquired for the extracted honey and honeycomb for the financial years from 1989/90 to 1995/96 for the whole of Queensland and for the

SEQ RFA region. The census data is shown below in Table 6.5. There are some inaccuracies associated with these SEQ RFA region figures due to shire amalgamations and changes, see methods in section 5.1.1.

Table 6.5 Honey Production in QLD and SEQ

	Honey extracted including honey comb (tonnes)		
Year	**All shires in QLD**	**SEQ RFA region**	**EVAO $**
88/89	4 948	2 661*	20 000
89/90	4 159	2 290*	20 000
90/91	3 469	1 789*	20 000
91/92	2 344	1 178*	22 500
92/93	3 952	2 330*	22 500
93/94	2 919	1 606	5 000
94/95	2 743	1 253	5 000
95/96	3 212	2 214	5 000

SOURCE: Agricultural Census data 1998/89 – 1995/96.
Note: *Figures to be verified.

For the financial year 1995/96, 3200 and 2200 tonnes kilograms of honey and honeycomb were extracted for Queensland and the SEQ RFA region respectively. For the financial years of 1993/94 to 1995/96, the average annual production over the three years is 3000 and 1700 tonnes of honey and honeycomb extracted from Queensland and the SEQ RFA region respectively.

It is interesting to note that even with the decreasing EVAO in 1993/94 and onwards, the annual production of honey has not increased compared to prior years. The trend of decreasing honey and honey comb production from 1989/90 onwards is attributed to consecutive dry seasons.

6.1.3 Alternative Methods for Estimating Current Honey Production

As detailed in section 5.1.1, there are a number of alternatives for estimating the Australian honey production. These are detailed in Table 6.6.

Table 6.6 Alternative Estimates Of Current Honey Production in Australia

Source	Australian honey estimates (tonnes)
Levies	29 000 – 30 000
Honey receivals	31 000
Hive numbers	32 675* (5 520 QLD)

Source: Gibbs and Muirhead 1997
* Based on average production of 70 kg/hive of the number of commercial hives (operated by beekeepers with >200 hives).

In 1995/96, levies were paid on 26,000 tonnes of honey. Gibbs and Muirhead (1997) assumed that 12 –15 per cent more honey is produced than is subject to the levy to estimate the figure of 29 000 to 30 000.

Total honey receivals by Capilano in 1996 were just under 20 000 tonnes. Capilano account for approximately 67 per cent of all Australian production, suggesting that the Australian production could be the order of 31 000 tonnes (Gibbs and Muirhead 1997).

An estimate of 33 000 tonnes of honey for Australia resulted from using hive numbers (466 684 hives) and production levels of 70 kg/hive for commercial beekeepers (>200 hives). This estimate could be raised to 47 000 tonnes per annum if an average of 70 kilograms per hive for all registered

hives (< and > 200 hives) (672 557 hives) is used (Gibbs and Muirhead 1997). Alternatively the total production may be in the order of 53 000 tonnes if all commercial operators are assumed to have a production of 100 kg/hive, with all other hives producing 30 kg/hive (Gibbs and Muirhead 1997).

Assuming the annual production of 70 kg/hive to hives registered to beekeepers with greater than 200 hives (78 857 hives), Queenslands annual honey production is estimated to be 5 520 tonnes per annum (Gibbs and Muirhead 1997). If adopting 70 kg to all hives in Queensland (130 723 hives) (Gibbs and Muirhead 1997)), then this figure will increase to 9151 tonnes per annum. If assuming all commercial operators have a production of 100 kg/hive, with all other hives producing 30 kg/hive then the Queensland estimate could be 9442 tonnes per annum.

6.2 POTENTIAL PRODUCTION

6.2.1 Average Annual Production Potential of Honey and Beeswax

As indicated in section 5.1.2, the honey_SEQ coverage was produced by DNR and is derived from the vegetation coverage joined with data from the APPD and includes GIS derived honey items. The honey_SEQ coverage was overlayed with the tenure coverage to reselect potential production data on State forests, timber reserves and State reserves (see methods in section 5.2.1). Potential honey production information is summarised by tenure and shown below in Table 6.7.

Table 6.7 Potential Honey and Beeswax Production by Tenure in SEQ RFA Region

Tenure	Prod data	Honey grade 1	Honey grade 2	Total
SF	Area (ha)	326 291	378 944	705 235
	Honey (kg/ha/yr)	11.09	3.79	7.17
	Honey (tonnes/yr)	3 618	1 437	5 055
	Honey & Wax (tonnes/yr)	3 844	1 527	5 371
TR	Area (ha)	4 074	19 604	23 678
	Honey (kg/ha/yr)	4.94	1.89	2.42
	Honey (tonnes/yr)	20	37	57
	Honey & wax (tonnes/yr)	21	39	61
SR	Area (ha)	14 247	20 956	35 203
	Honey (kg/ha/yr)	6.83	5.91	6.29
	Honey (tonnes/yr)	97	124	221
	Honey & wax (tonnes/yr)	103	132	235
Total	**Honey (tonnes/yr)**	**3 735**	**1 598**	**5 333**
	Honey & wax (tonnes/yr)	**3 969**	**1 698**	**5 666**

SOURCE: Derived DNR Honey_SEQ coverage combined with tenure coverage 1998.

Analysis of Table 6.7 shows that the total estimation of potential honey production and honey and beeswax production per year on State forests, timber reserves and State reserves combined in the SEQ RFA region is 5333 and 5666 tonnes respectively. State forests contribute 95 per cent of the total estimated potential production of honey and beeswax on forested crown land.

6.2.2 Annual Production Potential of Build Weeks

As indicated in section 5.1.2, the bee_build_SEQ coverage was produced by DNR and is derived from the vegetation coverage joined with data from the APPD and includes GIS derived build items. The bee_bld_SEQ coverage was overlayed with the tenure coverage to reselect potential build data on State forests, timber reserves and State reserves (see methods in section 5.2.1). Potential build information contained in the coverage is summarised by tenure and shown below in Tables 6.8 – 6.11.

Table 6.8 Area of State Forests by Build weeks/yr in SEQ RFA Region

	Area (ha) by weeks/year							
Build use	**0**	**>0 ≤ 2**	**>2 ≤ 4**	**>4 ≤ 6**	**>6 ≤ 8**	**>8 ≤ 10**	**> 10**	**Total build area (ha)**
Honey	318 372	366 701	170 868	32 939	1 236	13 779	0	585 523
Queen	425 169	371 083	104 028	3 137	478	0	0	478 726
Crop	537 244	325 295	39 085	2 272	0	0	0	366 652
Package	645 572	229 083	29 219	22	0	0	0	258 324

SOURCE: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.

Table 6.9 Area of Timber Reserves by Build weeks/yr in SEQ RFA Region

	Area (ha) by weeks/year							
Build Use	**0**	**>0 ≤ 2**	**>2 ≤ 4**	**>4 ≤ 6**	**>6 ≤ 8**	**>8 ≤ 10**	**> 10**	**Total build area (ha)**
Honey	3 646	12 625	6,612	1,108	0	0	0	20 345
Queen	13 030	10 961	0	0	0	0	0	10 961
Crop	13 030	10 961	0	0	0	0	0	10 961
Package	14 863	9 129	0	0	0	0	0	9 129

SOURCE: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.

Table 6.10 Area of State Reserves by Build weeks/yr in SEQ RFA Region

	Area (ha) by weeks/year							
Build Use	**0**	**>0 ≤ 2**	**>2 ≤ 4**	**>4 ≤ 6**	**>6 ≤ 8**	**>8 ≤ 10**	**> 10**	**Total build area (ha)**
Honey	47 571	17 546	8 780	3 187	223	88	11	29 835
Queen	55 830	15 209	5 341	745	281	0	0	21 576
Crop	62 490	11 007	3 363	517	30	0	0	14 917
Package	67 869	7 599	1 908	0	30	0	0	9 537

SOURCE: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.

Table 6.11 Percentage Area by Build Type and Tenure in SEQ RFA Region

Build use	SF %	TR %	SR %	TOTAL %
Honey	65	85	39	63
Queen	53	46	28	51
Crop	41	46	19	39
Package	29	38	12	28

SOURCE: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.
Note: Figures do not add to 100 per cent as any vegetation type may have been identified for a number of build uses and areas within any tenure may be contained in more than one build type.

Analysis of Tables 6.8 – 6.11 illustrate that by area irrespective of tenure, building for honey production is the most important build type, with 63 per cent of State forests, timber reserves and State reserves potentially utilised for building for honey production. Building for queen bee production, crop pollination and package bees follow in importance for State forests and State

reserves. For timber reserves, building for queen bee production and crop pollination were equally important.

Analysis of Tables 6.8 – 6.10 illustrates that by area, the majority of building irrespective of purpose commonly occurs for the duration of 0 ≤ 2 weeks per year.

6.3 DISCUSSION

Estimated current honey production data from the NRDA and agriculture census data contained in Tables 6.3 and 6.5 are summarised in Table 6.12.

Table 6.12 Estimated Annual Current Honey Production in SEQ and SF & TR Within SEQ

Tenure	Ag census data – honey and honey comb (tonnes)	NRDA – honey (tonnes)
SEQ total	1 700	4 100
State forest & timber reserves in SEQ	710*	1 700

SOURCE: NRDA and Agriculture census data.
Note: * this figure is calculated at 42% of the estimated SEQ production from Agriculture census data (1,700 tonnes).

The use of 42 per cent in Table 6.12, is based on the figure provided as the breakdown between State forest & timber reserves and other forested land from the NRDA. Analysis of Table 6.12 indicates that the current honey production within State forests and timber reserves in SEQ may be in the range of 710 to 1700 tonnes per annum.

As discussed in section 6.1.3, there are a number of alternatives to estimating the Australian honey production and subsequently the Queensland production. Using the estimation of hive production to be 70 kg/hive for commercial beekeepers in Queensland, then the annual production could be 5520 tonnes. Using a reduction of 43 per cent based on figures from NRDA, the production in the SEQ RFA region could be in the order of 2370 tonnes. Adopting the further reduction of 42 per cent (based on the NRDA) the contribution of State forests and timber reserves in SEQ would be approximately 997 tonnes. Alternatively adopting the average production of 70 kg/hive to all registered hives, then breaking the figure down using NRDA percentages, the contribution of State forests and timber reserves could be in the order of 1650 tonnes of honey per annum.

Given the limitations of the derivation of figures from all sources, see sections 5.1 and 6.1 it is unclear as to the confidence that can be applied to each set of figures or as to the actual current production of honey in the SEQ RFA region, or even further refined to State forests and timber reserves in SEQ RFA region.

Analysis of Table 6.7, indicates that the potential annual production of honey on State forests and timber reserves in SEQ RFA region is 5112 tonnes. It must be noted that this figure as described in section 5.1.2, is based on the assumptions that all the resource is theoretically available and has not been refined. The figure does not take into account such parameters as accessibility, practicality, economics, markets or changes in forest management practices. Hence, it should not be compared to the estimated actual production figures.

The potential impact of reserving significant areas of State forests, timber reserves and State reserves in SEQ will be determined by a number of factors. Segments of the apiary industry rely on these Crown forests in SEQ for different reasons. Small producers in SEQ use Crown forests for

reasons of convenience, i.e. these are close to their home base. Commercial producers are heavily reliant on Crown forests due to increases in clearing of freehold and leasehold land for agriculture that have eventuated over time. Crown forests are more readily available than freehold and leasehold land, where the beekeeper has to negotiate access to freehold or leasehold land with the owner/lessee and the security of access is more tenuous than under the formal lease arrangements on Crown land.

While around 40 per cent of honey produced by commercial producers is produced on State forests and timber reserves, the apiary industry is heavily reliant on these forests for building hives for subsequent production. To reserve areas of these forests will not on directly impact on the production of honey on these areas but will result in lost production of honey, queen, package and crop yields on these tenures and others through the lost or reduction of areas available for building.

7. ECONOMIC RESULTS AND DISCUSSION

7.1 HONEY AND BEESWAX

7.1.1 Average Production, Costs and Revenue

Of the 10 economic surveys (section 5.2.1) seven economic surveys were returned, one of these was an apiarist who is mainly a queen bee breeder, so this survey was not used. In addition one survey had insufficient information, so not used. One survey had information only for the 1996/97 financial year, which was used. The survey results showed an average annual honey production of 118 kg/hive. Minor adjustments were made to the costs in two surveys as not quite 100 per cent of the business was attributable to honey and beeswax production. The surveys provided information on variable and fixed costs, number of hives and average annual honey production. The variable costs were $0.59 and the fixed costs $0.89 per kilogram of honey for an enterprise used exclusively for the production of honey and beeswax. The costs of building the bees for honey production are included in these variable and fixed costs.

Costs per hive in this report were found to be similar to the ones in the NSW Mansfield Report. The main difference between the reports was the average honey production levels. The Mansfield Report showed average honey production to be 82 kg/hive, while this report which only surveyed commercial beekeepers with more than 450 hives, had a production level of 118 kg/hive.

The median honey prices per kilogram for grade 1 and 2 honey, were $1.74 and $1.61 as taken from the Capilano Pricing Schedule for December 1996 and July, October 1997, including loyalty bonuses where appropriate. As 25 per cent of the honey and beeswax value is attributed to honey build areas, 75 per cent of the honey price, i.e. $1.31 and $1.21 per kilogram of honey and beeswax as honey equivalent, were applied to honey and beeswax production.

7.1.2 Potential Value of Honey and Beeswax Production in State Forests, Timber Reserves and State Reserves in the SEQ RFA Region

Table 7.1 below shows the revenue and operating profit for honey and beeswax excluding the build areas, by tenure type. Many State reserves only cover several hectares, so the value of these could be limited by the presence of suitable surrounding vegetation to contribute to the usefulness of the site. If all State reserves with an area less than 50 hectares are filtered out, the operating profit falls by approximately $21 000 or 1.6 per cent of total operating profit. Operating profit with the State reserves filtered was $1.3 million (1996/97 prices).

Table 7.1 Estimated Potential Annual Value of Honey and Beeswax Production in State Forests, Timber Reserves and State Reserves in the SEQ RFA Region (1996/97)

	State forests		Timber reserves		State reserves		Total	
	Revenue $'000	Operating profit $'000	Revenue $'000	Operating profit $'000	Revenue $'000	Operating profit $'000	Revenue $'000	Operating profit $'000
Honey grade 1	5 016	1 001	28	6	135	27	5 179	1 034
Honey grade 2	1 843	249	48	6	159	21	2 050	276
Total	6 859	1 250	76	12	294	48	7 229	1 310

SOURCE: Derived DNR Honey_SEQ coverage combined with tenure coverage 1998.

Grade 1 honey has 79 per cent of operating profit from honey and beeswax production. However, the large difference between operating profit for the two grades is mainly due to the higher average production levels for grade 1 rather than the higher price paid for grade 1. The higher average production levels particularly occur in State forests, where the majority of honey from the three tenure types is produced (see Table 6.7).

7.2 HONEY BUILD

7.2.1 Revenue and Operating Profit from Sites used for Building for Honey Production

Table 7.2 shows the revenue and operating profit attributable to native forest floral resources in the SEQ RFA region with potential as build sites for honey production. This table has been split into the three tenure types examined in this report.

Table 7.2 Estimated Potential Annual Value of Build Sites used for Honey production in State Forests, Timber Reserves and State Reserves in the SEQ RFA region (1996/97)

	State forests		Timber reserves		State reserves		Total	
	Revenue $'000	Operating Profit $'000	Revenue $'000	Operating Profit $'000	Revenue $'000	Operating Profit $'000	Revenue $'000	Operating Profit $'000
Total	2 212	401	67	12	126	23	2 405	436

SOURCE: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.

When State reserves are filtered to remove ones less than 50 hectares, the total operating profit falls to $428 000. State forests account for 94 per cent of the potential operating profit for the three tenure types in the SEQ RFA region, when the State reserves are filtered.

7.3 CROP POLLINATION & QUEEN BEE BREEDING BUILD

7.3.1 Crop Pollination

Beekeepers provide hives for a number of orchard, horticultural and broad acre crops to assist pollination. Tables 7.3 and 7.4 show examples of the movements of apiarists involved in assisted pollination.

Table 7.3 Use of Build Areas in Pollination – Conondales

Location	Time (starting late May)	No. of hives
Build areas	8 wks	
Pollination of plums	6–8 wks	4 hives/100 trees
Build areas	4–6 wks	
Pollination of avocados	4–5 wks	3 hives/100 trees
Build areas	1–2 wks	
Pollination of kiwi fruit	3 wks	4 hives/acre
Build areas	6 wks	
Honey production	until May	

Source: Charles Hacker (pers. comm. 1998)

Table 7.4 Use of Build Areas in Pollination – Gatton

Location	Time (starting July)	No. of hives
Build areas	12 wks	
Pollination of melons	16 wks	2 hives/ha
Honey production	until March	

Source: John Swift (pers. comm. 1998)

From a number of sources (John Swift[7], Craig Pressler[8] and Don Keith 1997 and 1998, pers. comm.), the typical rate of charge for pollination services is around $10/hive*week. This charge may be proportionately reduced where there is honey production from the crop, as such areas can be used for building purposes as well if they produce adequate nectar as well as pollen. However, the economic benefits of pollination services go well beyond the beekeeper and the picture is not complete without accounting for these.

Overall economic benefits of crop pollination have been put at hundreds of millions of dollars Australia-wide, well ahead of the value of honey production (New 1997). Here it is not attempted to put an overall value on pollination services in the SEQ region. Rather, a valuation of the build areas is sought, by the way of attributing identified examples of pollination benefits in crop production to units of build areas.

In some areas of Queensland, where there are no feral honey bees and the number of native bees is too small, orchardists would not be able to stay in business without managed pollination (Craig Pressler 1998, pers. comm.). Even with natural pollinators around, modern horticultural techniques steadily diminish the effectiveness of unmanaged pollination. For example, netting of orchards reduces access to insects, particularly given the large size of netted parcels. In addition, the dark interior hinders the orientation of those insects that are inside. In such conditions, not using managed pollination may result in a fruit set approaching zero for some species, e.g. kiwi fruit and low-chill plums (Winston Lamb[9] 1998, pers. comm.).

John Swift (1998, pers. comm.) suggested that, as a rule of thumb, one may expect a yield increase

[7] Beekeeper and lecturer, University of Queensland Gatton College
[8] Proprietor and manager, 2PH Farms
[9] Beekeeper

of one-third across all insect-pollinated agricultural and horticultural crops if managed pollination is used. There are other benefits to the crop owner, such as:

- better-formed fruit that may not taste better but is more attractive, hence, more marketable
- the convenience and cost saving of fruit being ready for harvest at the same time.

In addition, the bees collect honey of varying amount and quality from agricultural crops. Hence, although not all pollination services are paid for, depending on the crop it may be worth the beekeepers' while to provide such service at less than its actual value to the crop owner.

Experimental data are available on the effect of managed pollination of some crops. Williams (1987) found that managed pollination of rockmelons increased average fruit weight by 40 per cent and the number of melons by 25 per cent (all up a 75 per cent yield increase), compared to the control that excluded bees. DPI (1997a) gave 1800 trays/ha as the average expected yield. At that level, the gain due to more effective pollination may amount to 770 trays/ha, worth a total gross margin of $1632/ha. At a rate of two hives per hectare, over the period of 16 weeks, one hive produces a gross margin of $51/ha for each week of its use in the crop.

Jones (1988) reported on a two-year trial including 25 sunflower cultivars, comparing managed pollination with the exclusion of large insects by putting a net bag over the flowers. Yield increase in the pollinated samples over the bagged controls varied from -4.89 per cent to 167 per cent, with all but two cultivars showing a significant increase. Overall means of the yield increase were 78.8 per cent and 15.71 per cent for the two years, respectively. Stace (1986) did not hinder naturally occurring pollinators in the control and found a yield increase of 14.57 per cent in sunflowers under managed pollination compared to natural pollination. A 15 per cent increase of yield amounts to 0.45 t/ha (dryland) to 1.2 t/ha (irrigated), worth $68 to $180 after the variable cost of harvesting (DPI 1997b). Assuming the use of three hives per hectare, the gross margin attributable to each hive is $23–60/ha for each week of its use.

Strawberries benefit from assisted pollination applied at flowering peaks through the reduction of deformed fruit that would normally be left behind in the field. Such losses run at 5–10 per cent of the total crop, half of which may be avoidable through assisted pollination (Neil Greer[10] 1998, pers. comm.). Assuming a yield of 90,000 punnets/ha (DPI 1998), the gain attributable to better pollination amounts to 2250–4500 punnets/ha, giving a gross margin of $540–1080/ha. Given an average number of 15 hives/ha (Swift 1986) over two weeks, the benefit of one hive is around $18−36/ha of additional gross margin for each week of its use.

Citrus orchards also use pollination services. Although some citrus cultivars are self-pollinating, assisted pollination is said to increase fruit size even for those. With limited numbers of pollinating insects available, a 'picture-frame' effect is said be observable in citrus blocks. That is, fruit size and yield are best at the edges and decline towards the middle of the block (Graham McCrosker[11] 1998, pers. comm.). Frank Robinson[12] (1998, pers. comm.) was of the opinion that without hives in the blocks of Ellendale mandarins the yield may be down by a half to two-thirds. In the case of Imperial and Murcott mandarins the yield-increasing effect is much less pronounced, as these cultivars tend to overcrop anyway, but the fruits left are bigger. Depending on orchard size, Hardman (1994) estimated the total gross margin in Ellendale mandarins as $8400–9300/ha. Given

[10] Extension horticulturist, DPI
[11] Manager, Gaypak
[12] Citrus grower

a hive rate of one per hectare and a period of three weeks, the contribution of managed pollination in Ellendale growing would be around $920–1500/ha*week*hive.

Experimental data reported by Goodman (1988) used insect-excluded controls versus managed pollination in Victoria. While it is not directly useable in this study of SEQ, the general findings support the size of margins in the studies quoted above (see Table 7.5).

Table 7.5 Fruit Yields Corresponding to Managed Pollination vs No Bee Pollination in Victoria

Fruit (cultivar)	Mean yield with bees excluded	Mean yield with managed pollination	Yield increase %
Apricot (Trevatt)	67 kg/tree	99 kg/tree	48
Cherry (Moss Early)	2 kg/tree	35 kg/tree	1650
Peach (Golden Queen)	155 kg/tree (not significant)	216 kg/tree	39
Peach (Crawford)	18 kg/tree	47 kg/tree	161
Plum (Satsuma)	15 kg/tree	38 kg/tree	153
Apples (Yates)	9 kg/tree	125 kg/tree	1289
Pears (Winter Nelis)	12 kg/tree	88 kg/tree	633
Pears (Packham's Triumph)	118 kg/tree (not significant)	176 kg/tree	49
Blueberries	0.19 kg/plant	1.6 kg/plant	742
Loganberries	179 g marketable/plant	452 g marketable/plant	153
Strawberries	46 g marketable/pick off 12 plants	248 g marketable/pick off 12 plants	439

Source: Goodman (1988)

Table 7.6 Indicative Contributions of Managed Pollination to Crop Gross Margins

Crop	Gross margin increase attributable to managed pollination
	$/ha*hive*week of pollination
Sunflowers	23 (dryland) 60 (irrigated)
Rockmelons	51
Strawberries	18–36
Citrus	0–slight (self pollinating cultivars) 920–1500 (Ellendale mandarins)

With over-wintering added in, a week of pollination would need around another week of building on a yearly average. The pollination benefits attributable to build areas, at a rate of 200 hectares for 100 hives, are thus around $10–700/ha*week in the crops for which data could be obtained.

It was not possible to exactly apportion beekeepers' costs between the closely intertwined honey production and pollination components of the same enterprise. Applying the average ratio of operating profit to gross revenue for the industry, the beekeeper's operating profit from pollination is assumed to be $2.6/week*hive. Distributed to the build areas as above, this amounts $1.3/ha*week. It is suggested to use an indicative figure of $50/ha*week for the total net economic benefits of build areas used for pollination.

Table 7.7 shows the operating-profit figures assessed for various tenure types from pollination, allocated to build areas in proportion of their use for pollination build.

Table 7.7 Estimated Potential Annual Value of Build sites used for Pollination in State Forests, Timber Reserves and State Reserves in the SEQ RFA Region (1996/97)

	State forests	Timber reserves	State reserves		Total	
	Operating profit $'000	Operating profit $'000	Operating profit $'000		Operating profit $'000	
			All SRs	> 50 ha	All SRs	> 50 ha
To beekeepers	383	9	28	18	**420**	**410**
To crop owners	14 720	328	1 072	684	**16 120**	**15 732**

Source: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.

7.3.2 Queen Bee Breeding

Queen bee breeding requires over-wintering as any other apiary enterprise. For the rest of the year, the hives are placed either in forests or in certain agricultural crops that provide sufficient nutrition for the bees (e.g. clover, sorghum).

The primary product of the enterprise is queen bees. The by-product is pollination provided to agricultural crops that is not counted among the financial benefits of this enterprise. On the basis of cost and revenue figures provided by a queen bee producer, the necessary build areas to be used in queen breeding yield a net benefit of some $40/ha*year, or around $0.8/ha*week.

Table 7.7 shows the operating profit figures assessed for various tenure types from queen bee breeding allocated to build areas in proportion of their use for queen breeding.

Table 7.8 Estimated Potential Annual Value of Build Sites used for Queen Bee Breeding in State Forests, Timber Reserves and State Reserves in the SEQ Biogeographic Region (1996/97)

	State forests	Timber reserves	State reserves		Total	
	Operating profit $'000	Operating profit $'000	Operating profit $'000		Operating profit $'000	
			All SRs	> 50 ha	All SRs	> 50 ha
Total	420	5	29	19	**454**	**444**

Source: Derived DNR bee_bld_SEQ coverage combined with tenure coverage 1998.

7.3.3 Trends in the Values of Build Areas

The values for build areas arrived at using various methods and case studies exhibit a broad range of variation.

Trends observed in the past and those expected in the future also need to be considered for completeness. The build value of agricultural and horticultural crops rose steeply with the introduction of the Superphosphate Bounty and the extension of irrigation. In addition to the increased productivity of the main crop itself, beekeepers made use of the nectar from weeds that also thrived in such an abundant environment. Once the Superphosphate Bounty was abolished, and fertilizer use plummeted, beekeepers experienced a significant drop in the amount of nectar collected by bees, corresponding to a reduced number of flowering plants.

Beekeepers expect similar reductions in the future, due to:

- Increasing adoption of drip irrigation, further reducing weeds in orchards

- Reduced demand for lucerne seed, an important pollinated crop, due to dairy farms' increasing reliance on mixed feed.

These effects together will reduce the usefulness of agricultural and horticultural crops as build areas. Hence, build areas in forest will become relatively even more valuable for the industry.

7.3.4 Comparison of the Value of Potential and Actual Honey Production

In the resources assessment it was estimated from two data sources that the production levels of honey in SEQ State forests and timber reserves ranged from 710 – 1700 tonnes (table 6.12). The median price paid by Capilano in 1996/97 was $1.66 per kilogram of honey, this gives an annual turnover range between $1.2 million and $2.8 million.

Gibbs and Muirhead (1997) reported the actual turnover attributable for honey production in Queensland to be worth $8.4 million per annum. The NRDA study found that 43 per cent of Queensland honey came out of SEQ and 42 per cent of SEQ honey was from State forests and timber reserves. Using the percentage breakdowns from the NRDA $8.4 million for Queensland is reduced to $1.5 million for SEQ State forests and timber reserves, which lies between the above estimates. These figures can be compared with the potential turnover value of honey and beeswax production and honey build value in State forests and timber reserves in the SEQ RFA region of $9.2 million (Tables 7.1 and 7.2).

7.4 NET PRESENT VALUE OF POTENTIAL APIARY VALUES IN SEQ RFA REGION

The net present value of all potential apiary sites including build sites in the SEQ RFA region over the tenure types of State forest, timber reserves and State reserves is shown in Table 7.9. The second column under State reserves in Table 7.9 shows the change in NPVs when State reserves are filtered to remove ones with less than 50 hectares. The resultant changes in total NPVs are shown in the total column.

Table 7.9 Estimated Potential Net Present Value of The Apiary Industry in State Forests, Timber Reserves and State Reserves in the SEQ RFA Region (1996/97)

	State forests	Timber reserves	State reserves		Total	
	$'000	$'000	$'000		$'000	
			All SRs	>50 ha	All SRs	> 50 ha
Honey and beeswax	14 327	138	555	316	**15 020**	**14 781**
Honey production build	4 596	140	262	170	**4 998**	**4 906**
Queen bee breeding build	4 821	60	332	212	**5 213**	**5 093**
Crop pollination build (beekeepers)	4 390	98	320	204	**4 808**	**4 692**
TOTAL (beekeepers)	**28 133**	**435**	**1 469**	**902**	**30 037**	**29 470**
Crop pollination build (crop owners)	168 840	3 764	12 299	7 843	**184 903**	**180 447**

Source: Derived DNR bee_bld_SEQ and honey_SEQ coverages combined with tenure coverage 1998. (Over 20 years @ discount rate of 6%)

State forests represent 88 per cent of the total area covered by the three tenure types within the SEQ RFA region. However, State forests account for 96 per cent of the total net present value to beekeepers (with State reserves filtered).

8. RECOMMENDATIONS FOR FUTURE WORK

A few studies have attempted to measure the impacts of feral and managed honey bees with native flora and fauna. Most research to date has failed to prove categorically that European honey bees are having a significant impact on Australian wildlife. Further research is required to conclusively prove whether or not honey bees have a detrimental affect on native flora and fauna. Ecological Sustainable Forest Management principles with respect to apiculture ultimately need to be determined on all tenures.

Currently there is little consolidated information in relation to the apiary industry in Queensland. There is a void of information on the locations of apiary sites and detailed production information and usage of these sites. The NRDA constructed by DPI Intensive Livestock Services, attempts to fill this void. The NRDA provides production information at a broad level but lacks locational details that would have enabled production information to be attributed to a finer scale.

The construction of a spatial layer of apiary sites would be useful as a management tool. A linked database to the apiary sites could provide details to the frequency of sites being booked on an annual basis. Further information that would be useful would be the usage of the sites, how often and what for, and the production at the sites.

The potential honey production data at present lacks any refinement of figures in terms of accessibility, practicality, economics or markets. Further refinement of these figures would provide a more realistic potential honey production figure based on current usage patterns and market forecasts.

9. CONCLUSIONS

A large proportion of the Queensland apiary industry resides in the region covered by the SEQ Regional Forest Agreement (RFA). This region contributes approximately 43 per cent of the states honey production. The native forests of the region are a major source of nectar and pollen for the industry and are readily accessible to industry markets.

The continued clearing of freehold land has resulted in the increased use and value of forested crown land to the apiary industry. State forests and timber reserves account for greater than 40 and 17 per cent of honey and queen bee production respectively, in the SEQ RFA region.

Honey is the main source of income for Australian apiarists and is the major product produced by apiarists on State forests and timber reserves. State forests and timber reserves are also utilised for build sites where bee numbers and strength are increased. Build sites have an inherent value to the industry as without access to these sites, honey production and other hive uses would be limited.

A few studies have attempted to measure the impacts of feral and managed honey bees with native flora and fauna. Most research to date has failed to prove categorically that European honey bees are having a significant impact on Australian wildlife.

The productive potential of native forests throughout the SEQ RFA region were estimated with respect to the apiary industry using the vegetation coverage, expert knowledge and experience. This method allowed for the productive potential of honey and building to be estimated irrespective of tenure. A potential production of 5.3 million kilograms per year of honey was estimated for the SEQ RFA region on State forests, timber reserves and State reserves. The annual profit of potential honey production when beeswax is included is $1.3 million with an annual turnover of $7.2 million (1996/97 prices). Production levels within the apiary industry vary greatly between commercial and non-commercial beekeepers, the economics in this report on honey production are calculated on a commercial basis.

State forests, timber reserves and State reserves were identified as being an important resource for building bees for honey production, queen bee breeding, crop pollination and package bees. Sixty three, 51 and 39 per cent of the total area of State forests, timber reserves and State reserves were estimated as potentially available for honey, queen bee and crop pollination building, respectively. The annual profit to beekeepers of potential build sites for honey production, queen bee breeding and crop pollination is $1.3 million in total (State reserves less than 50 ha filtered).

The value of build areas in crop pollination was derived by using the limited data on the effect of bee pollination on crop production, and then attributing the margin to build areas proportionately with the time hives spend in either. The benefit of pollination accruing to the agricultural sector is at least one magnitude larger than that captured by beekeepers. Due to the inherent uncertainties, the

overall value of pollination has not been estimated in this limited report. A value of $50/ha of SEQ build areas from crop pollination is well supported by the available evidence.

The Net Present Value (NPV) of potential honey and beeswax production calculated over the 20 year period of the RFA for SEQ State forests, timber reserves and State reserves is $14.8 million (State reserves less than 50 ha filtered). The combined build sites for honey production, queen bee breeding and crop pollination was calculated to have a potential NPV for the beekeepers of $14.7 million (State reserves less than 50 ha filtered).

APPENDICES

Appendix 1.1

CRA/RFA PROJECT SPECIFICATIONS

PROJECT NAME:	**Forest grazing, apiculture, and other products description and assessments**
PROJECT IDENTIFIER:	**SE 4.2**
LOCATION/EXTENT:	**SEQ**
ORGANISATION/S:	**CRA Unit, DNR** **DPI–Forestry** **BRS**
CONTACT OFFICERS:	**George Antony: Resource Economist** **& Pauline Stewart: Forest Resources Officer** **Malcolm Taylor: Senior Planning Officer** **Dan Sun: Senior Research Scientist**
POSTAL ADDRESS:	**GA/PH: CRA Unit, 80 Meiers Rd, Indooroopilly, Qld 4068** **PS: CRA Unit, 80 Meiers Rd, Indooroopilly, Qld 4068** **MT: Forestry House, 160 Mary St, Brisbane, Qld 4000** **DS: John Curtain House, PO Box E11 Queen Victoria Terrace, Parkes ACT 2600**
TELEPHONE:	**GA: (07) 3896 9448 FAX: (07) 3896 9858** **PS: (07) 3896 9841 (07) 3896 9858** **MT: (07) 3234 0136 (07) 3234 1200** **DS: (02) 6272 5694 (06) 272 3882**
E-MAIL ADDRESS:	**GA/PH: antonyg@dnr.qld.gov.au** **PS: stewartp@dpi.qld.gov.au** **MT: taylorm@dpi.qld.gov.au** **DS: dsun@mailpc.brs.gov.au**
LINKAGES/DEPENDENCIES:	SE 4.4 Incorporation of Other Industries into FORUM development (highly dependent on SE 4.2 for base data sets) PI 5.3 Broad Economic Assessments (linkages from SE 4.4) SE 5.2 Regional Social Profile Analysis (limited linkages) SE 5.3 Social Case Study Area (limited linkages)
TYPE OF STUDY:	**Resource/Economic**

1. OBJECTIVES OF THE PROJECT

To describe the features of the forest grazing, apiculture and other minor forest product industries relevant to CRA, and to provide sufficient quantitative data (product volumes and financial) to allow the economic significance of the industries and to be described and impacts of land use changes estimated.

2. BACKGROUND

Native forests in South East Queensland (SEQ) are a major source of nectar and pollen for the apiculture industry in Queensland. Department of Primary Industries (DPI) maintain records of paid apiary sites and are currently compiling an extensive database of the industry in Queensland. These will form the basis of the apiculture assessment.

Forest grazing has historically been an important sector of the grazing industry in Queensland, with most available forest areas grazed. Databases derived from DPI stock grazing permit and DNR grazing lease information have been compiled and these will form the basis of the forest grazing assessment.

The public forest resource in SEQ is a major source of other wood products for the wood and wood products industry in the region. DPI maintain the sales database of all products sold by DPI on state forests and plantations and this in consultation with DPI–Forestry personnel will form the basis of the assessment of other wood products.

A detailed assessment of the resource with respect to the aforementioned industries will provide base data for the economic analysis and the option development process.

Estimated land use capacity will to the greatest extent possible be based on the principles of ecologically sustainable forest management.

3. SCOPE OF THE PROJECT

Project will detail the nature of the industries, the current situation and any trends in the industries as well as providing data required for analytical purposes.

4. METHODS

- available data sources on the relevant industries to be evaluated and collated.
- compile databases of Stock Grazing Permits and forested Term Leases.
- for forest grazing, available data on stock carrying capacities to be modelled to generate complete coverage of forest grazing potential.
- compile database and Arcview coverage of paid apiary permits.
- compilation of other wood products sales data and derivation of rule of thumb for these products.
- discussion with industry and government experts to identify key features of the industries.
- economic value of industries to be identified on the basis of secondary data from various sources and expert groups.
- analysis of forest types and structure in relation to its significance to the apiary industry.

Inputs include:

- Stock Grazing Permit, Term Lease and Apiary Site data from DPI and DNR
- survey of apiary industry conducted by DPI.
- industry description, production features (including current levels, potential and limits) and economic information from peak industry bodies, industry experts and government specialists.
- financial data for industries from range of sources; such as literature, industry bodies, ABS, DPI etc.

5. CRITICAL PATH

Outcomes/Outputs

- spatially related databases suitable for input into FORUM and decision-support system for the forest grazing and apiculture industries, detailing:
  - existing use patterns
  - production potential across the forest estate
- report on forest components of the industries detailing:
  - brief description of industries
  - estimate of current and potential use of forested areas for those industries
  - regional dependence on the forest estate
  - contribution of various land tenures
  - where possible, value of broad forest types to each industry
  - cost of production and gross margin data for major producers
  - the economic contribution of these industries to SEQ
  - limitations of methodology

Reporting

Draft project report (grazing & apiculture) to be prepared by end of September 1997.

Progress reports to be prepared monthly.

Milestones and Timetable

Task description	Duration (w,d)	Earliest/ actual start	Actual finish	Task dependencies diagram	Who	Link to payment yes/no amount
Databases of SGP and forested term leases compiled			11–1996		Pauline Stewart	
Cattle numbers on OCL estimated			11–1996		Pauline Stewart	
Compiled database and Arcview coverage of paid apiary permits			11–1996		Pauline Stewart	
Analysis of partly completed apiary database compiled by DPI			11–1996		Pauline Stewart	
First draft of apiculture and grazing current status reports			2–1997		Pauline Stewart	
Compilation of other wood products and derivation of rule of thumb for these products	2,0	3–1997			Pauline Stewart	
Draft report on other products	1,0	4–1997			Pauline Stewart	
Draft reports refined based on consultation with industry groups	8,0	3–1997			Pauline Stewart	

6. BUDGET DETAILS

Commonwealth cash	
Commonwealth (in kind)	$5 000
Queensland cash	
Queensland (in kind)	$60 000
TOTAL BUDGET	**$65 000**

8. PERFORMANCE INDICATORS

- the project outcomes are useable
- improvement in the extent and quality of existing information
- the industries are satisfied with their representation in the assessment reports
- completion of the project in a timely manner
- funds are properly acquitted
- information able to be easily incorporated into the economic analysis

9. QUALITY CONTROL

- Regular project reporting to Project Manager, CRA Queensland
- Submit draft reports to industry for comment
- Regular review of data and methodologies by SE Technical Committee

Appendix 5.1

Current Local Govt Name	Formerly	Gazette
Ipswich City	Ipswich City Moreton Shire	Sub.Leg.1994No.479
Gold Coast City	Gold Coast City Albert Shire	Sub.Leg.1994No.478
Warwick Shire	Allora Shire Glengallan Shire Rosenthal Shire Warwick City	Sub.Leg.1994No.163
Burnett Shire	Gooburrum Shire Woongarra Shire	Sub.Leg.1993No.494
Cooloola Shire	Gympie City Widgee Shire	Sub.Leg.1993No.373
Caloundra City	Landsborough Shire	GG 19 Dec 1987

Appendix 5.2

HELIDON MAP SHEET VEGETATION TYPE LEGEND

P.Grimshaw 24/9/97 heli_leg.doc

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
1a	Very tall open forest or very tall woodland or tall open woodland of ***Eucalyptus tereticornis (blue gum, forest red gum) ( ) * +*** *Corymbia tessellaris (carbeen, Moreton Bay ash) , Angophora subvelutina (creek apple, broadleaf apple) / Angophora floribunda (roughbark apple, rough-barked apple) *, Casuarina cunninghamiana (river sheoak) , Melaleuca bracteata (black ti-tree, river ti-tree, black tea-tree) , Castanospermum australe (Moreton Bay chestnut, black bean) , Lophostemon suaveolens (swamp box, swamp mahogany) *, Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark) *, Corymbia intermedia (pink bloodwood, red bloodwood) *, Eucalyptus moluccana (gum-topped box, grey box) *, Callistemon viminalis (red bottlebrush, river bottlebrush, weeping bottlebrush, drooping bottlebrush) , Acacia salicina (sally wattle, cooba) , Melaleuca tamariscina Subsp. irbyana (bush house paperbark) *, Grevillea robusta (silky oak, southern silky oak) , Casuarina cristata (belah) *, Acacia harpophylla (brigalow) .* [Those species indicated with asterisks* also occur on creek and alluvial flats away from watercourse fringes and drainage lines, with grassy understorey, and possibly represent an additional vegetation mapping unit. These linear units are too narrow, intermixed and difficult to delineate separately at this mapping scale.] (dense understorey to open grassy groundlayer)
1b	Very tall woodland or very tall open woodland of ***Eucalyptus tereticornis (blue gum, forest red gum) ( ) , +*** *Eucalyptus nobilis (manna gum) , Angophora floribunda (roughbark apple, rough-barked apple) , Casuarina cunninghamiana (river sheoak) , Eucalyptus melliodora (yellow box) , Eucalyptus conica (fuzzy box), Eucalyptus moluccana (gum-topped box, grey box) , Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark) , Casuarina cristata (belah) , Themeda triandra (kangaroo grass) ( ) , Dichanthium sericeum (Queensland bluegrass) , Chrysopogon fallax (golden beardgrass), Sorghum leiocladum (wild sorghum) .* (grassy groundlayer to shrubby lower stratum)
2a	Very tall open woodland or tall woodland or mid-high woodland of ***Eucalyptus albens (white box) +*** *Eucalyptus melliodora (yellow box) , Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus orgadophila (mountain coolibah) , Eucalyptus moluccana (gum-topped box, grey box) , Exocarpos cupressiformis (cherry ballart, native cherry) , Dichanthium sericeum (Queensland bluegrass) , Aristida personata ( ) , Themeda triandra (kangaroo grass) ( ) .* (predominantly grassy groundlayer)
2b	Very tall open forest or tall open forest or very tall woodland or tall woodland or mid-high woodland of ***Eucalyptus biturbinata (grey gum) +*** *Eucalyptus melliodora (yellow box) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Lophostemon confertus (brush box, pink box) , Angophora floribunda (roughbark apple, rough-barked apple) , Acacia irrorata (green wattle) , Sorghum leiocladum (wild sorghum) , Themeda triandra (kangaroo grass) ( ) , Cymbopogon refractus (barbed-wire grass) , Asperula conferta (common woodruff) , Doodia aspera (prickly rasp fern, rasp fern) .* (predominantly grassy to forby and sometimes ferny groundlayer)

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
2c	Very tall open forest or tall open forest or very tall woodland or tall woodland or mid-high woodland of ***Eucalyptus eugenioides (thin-leaved stringybark, white stringybark)*** ***±*** *Eucalyptus melliodora (yellow box) , Eucalyptus biturbinata (grey gum) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus quadrangulata (white-topped box) , Angophora floribunda (roughbark apple, rough-barked apple) , Lophostemon confertus (brush box, pink box) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Xanthorrhoea glauca (grasstree, blackboy) , Acacia irrorata (green wattle) , Poa sieberiana (snowgrass, fine-leaved tussock grass) , Themeda triandra (kangaroo grass) ( ) , Sorghum leiocladum (wild sorghum) , Imperata cylindrica (blady grass) .* (mid-dense mid-stratum and grassy to forby groundlayer)
2d	Very tall open forest or tall open forest or very tall woodland or tall woodland or mid-high woodland of ***Eucalyptus melliodora (yellow box) , + Eucalyptus tereticornis (blue gum, forest red gum) ( )*** ***±*** *Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Eucalyptus biturbinata (grey gum) , Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark) , Eucalyptus albens (white box) , Lophostemon confertus (brush box, pink box) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Brachychiton populneus ( ) , Xanthorrhoea glauca (grasstree, blackboy) , Themeda triandra (kangaroo grass) ( ) , Sorghum leiocladum (wild sorghum) , Poa sieberiana (snowgrass, fine-leaved tussock grass).* (sparse mid-stratum and grassy to forby groundlayer)
2e	Very tall open forest or very tall woodland or tall woodland or mid-high woodland or mid-high open woodland of ***Eucalyptus crebra (narrow-leaved ironbark) ( ) , + Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark)*** ***±*** *Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Corymbia tessellaris (carbeen, Moreton Bay ash) , Eucalyptus melliodora (yellow box) , Corymbia clarksoniana (southern long-fruited bloodwood) , Corymbia intermedia (pink bloodwood, red bloodwood) , Angophora floribunda (roughbark apple, rough-barked apple) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Brachychiton populneus ( ) , Callitris glaucophylla (white cypress pine) ,* (*Callitris baileyi (Baileyís cypress)* occasionally in sheltered valleys), *Choretrum candollei (white broom, sour bush, white sour bush) , Dodonaea viscosa (sticky hopbush) , Acacia fimbriata (fringed wattle, Brisbane wattle) , Bothriochloa decipiens (pitted bluegrass) , Cymbopogon refractus (barbed-wire grass) , Themeda triandra (kangaroo grass) ( ) .* (mostly sparse mid-stratum to low shrubby and grassy groundlayer)
2f	Very tall woodland of ***Eucalyptus nobilis (manna gum)*** ***±*** *Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Angophora floribunda (roughbark apple, rough-barked apple) , Eucalyptus melliodora (yellow box) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Eucalyptus saligna ( ) , Acacia irrorata (green wattle) , Exocarpos cupressiformis (cherry ballart, native cherry) , Adiantum* spp., *Desmodium varians (slender tick trefoil) , Poa labillardieri ( ) .* (Sparse to mid-dense mid-stratum and grassy groundlayer)

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
2g	Extremely tall open forest or very tall open forest or tall open forest of ***Lophostemon confertus (brush box, pink box)*** ***±*** *Eucalyptus biturbinata (grey gum) , Eucalyptus saligna ( ) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Adiantum aethiopicum (common maidenhair-fern) , Doodia aspera (prickly rasp fern, rasp fern) ,* [usually with rainforest elements in understorey and occasionally in canopy or as emergents]. (mid-dense to dense mid stratum and lower stratum and sometimes ferny groundlayer)
2h	Very tall woodland or tall woodland or very tall open woodland or tall open woodland of ***Eucalyptus orgadophila (mountain coolibah)*** ***±*** *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus albens (white box) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus melliodora (yellow box) , Angophora floribunda (roughbark apple, rough-barked apple) , Dichanthium sericeum (Queensland bluegrass) , Aristida personata ( ) .* (sparse mid-stratum and grassy groundlayer)
2i	Extremely tall open forest or very tall open forest or tall open forest of ***Eucalyptus andrewsii*** subsp. ***Campanulata ( ), + Eucalyptus saligna ( ) ,*** *Eucalyptus biturbinata (grey gum) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Lophostemon confertus (brush box, pink box) , Eucalyptus quadrangulata (white-topped box) , (Eucalyptus banksii (tenterfield woollybutt)* only on Mt.Castle), (*Eucalyptus obliqua (messmate stringybark)* only near Sylvesterís Lookout), *Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Acacia irrorata (green wattle) , Acacia melanoxylon (blackwood) , Poa sieberiana (snowgrass, fine-leaved tussock grass) , Doodia aspera (prickly rasp fern, rasp fern) .* (mid-dense mid-stratum and grassy to forby sometimes ferny groundlayer)
2j	Very tall open forest or very tall woodland of ***Eucalyptus moluccana (gum-topped box, grey box) ,*** ***±*** *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus biturbinata (grey gum) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark) , Eucalyptus albens (white box) , Cymbopogon refractus (barbed-wire grass) , Themeda triandra (kangaroo grass) ( ) , Bothriochloa decipiens (pitted bluegrass) .* (sparse mid-stratum dense grassy groundlayer)
2k	Tall open woodland or mid-high open woodland (associated with areas of bare rock) of a heterogeneous mix of trees, shrubs, forbs and grasses etc including species such as *Angophora floribunda (roughbark apple, rough-barked apple) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus andrewsii* subsp *campanulata ( ), Eucalyptus melliodora (yellow box) , Eucalyptus biturbinata (grey gum) , Banksia integrifolia (coast banksia, honeysuckle oak) , Acacia obtusifolia ( ) , Acacia melanoxylon (blackwood) , Doryanthes palmeri (giant spear lily) , Xanthorrhoea glauca (grasstree, blackboy) , Lissanthe strigosa (peach heath) , Leucopogon juniperinus (prickly heath) , Poa* spp. *Themeda triandra (kangaroo grass) ( ) , Danthonia induta (wallaby grass) .* (sparse to mid-dense mid and lower stratum and scattered grassy to low shrubby or forby groundlayer with expanses of rock faces and outcrops)

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
3a	Very tall open forest or tall open forest or very tall woodland or tall woodland of ***Eucalyptus crebra (narrow-leaved ironbark) ( ) , + Corymbia intermedia (pink bloodwood, red bloodwood)*** ***±*** *Angophora leiocarpa (apple, rusty gum, smooth-bark apple) , Eucalyptus acmenoides (yellow stringybark, white mahogany) , Eucalyptus longirostrata (grey gum) , Eucalyptus major (grey gum, mountain grey gum) , Angophora woodsiana (smudgee) ,* [*Eucalyptus tindaliae (Tindaleís stringybark, Queensland white stringybark)* Spinach Creek only], [*Eucalyptus fibrosa subsp. fibrosa (broad-leaved ironbark)* occasional], *Allocasuarina littoralis (black sheoak)* or *Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Acacia fimbriata (fringed wattle, Brisbane wattle) , Choretrum candollei (white broom, sour bush, white sour bush) , Daviesia* spp.*, Jacksonia scoparia (broom, dogwood) , Entolasia stricta (wiry panic) .* (sparse to mid-dense mid-stratum and mid-dense shrubby to grassy groundlayer)
3b	Very tall open forest or tall open forest or very tall woodland or tall woodland of ***Eucalyptus fibrosa subsp. fibrosa (broad-leaved ironbark)*** ***±*** *Corymbia intermedia (pink bloodwood, red bloodwood) , Angophora leiocarpa (apple, rusty gum, smooth-bark apple) , Eucalyptus major (grey gum, mountain grey gum) , Corymbia citriodora (lemon-scented gum, lemon-scented iron gum, spotted gum) , Eucalyptus longirostrata (grey gum) , Eucalyptus moluccana (gum-topped box, grey box) ,* [*Eucalyptus melanoleuca (Yarraman ironbark)* only 3 known locations], *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Allocasuarina littoralis (black sheoak) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) ,* [*Eucalyptus tindaliae (Tindaleís stringybark, Queensland white stringybark)* , *Corymbia gummifera (red bloodwood) , Allocasuarina inophloia (thready-barked she-oak, flame sheoak)* Spinach Creek only], *Acacia loroloba (Ma Ma Creek wattle) , Acacia blakei* subsp. *Diphylla ( ), Acacia ixiophylla ( ) , Acacia leiocalyx (black wattle, Brisbane black wattle, curracabah) , Dodonaea triangularis (hop bush) , Entolasia stricta (wiry panic) , Scleria sphacelata ( ) , Lepidosperma laterale (sword sedge, variable swordsedge) .* (sparse to mid-dense mid and lower stratum and sparse to mid-dense grassy/low shrubby groundlayer)
3c	Mid-high open forest or very tall woodland or tall woodland of ***Eucalyptus fibrosa subsp. fibrosa (broad-leaved ironbark)*** ***±*** [*Eucalyptus sideroxylon (mugga, red-flowered ironbark) + Eucalyptus bakeri (bakerís mallee)* Silky Oak Creek area only], *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus moluccana (gum-topped box, grey box) ,* [*Eucalyptus melanoleuca (Yarraman ironbark)* Mt.Whitestone and Silky Oak Creek area only], *Acacia blakei* subsp. *Diphylla ( ), Acacia loroloba (Ma Ma Creek wattle) , Bertya opponens ( ) , Callistemon formosus (white cliff bottlebrush) , Scleria sphacelata ( ) , Entolasia stricta (wiry panic) .* (mid-dense mid and lower stratum and mid-dense grassy groundlayer)

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
3d	Very tall open forest or tall open forest or very tall woodland or tall woodland of ***Corymbia citriodora (lemon-scented gum, lemon-scented iron gum, spotted gum) + Eucalyptus crebra (narrow-leaved ironbark) ( )*** ***±*** *Angophora leiocarpa (apple, rusty gum, smooth-bark apple) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark) , Corymbia tessellaris (carbeen, Moreton Bay ash) , Eucalyptus major (grey gum, mountain grey gum) , Corymbia clarksoniana (southern long-fruited bloodwood) , Eucalyptus moluccana (gum-topped box, grey box) ,* (*Eucalyptus carnea (white mahogany, broad-leaved white mahogany)* Rocky Creek Toowoomba Range lower slope), *Allocasuarina luehmannii (bull oak) , Petalostigma pubescens (quinine tree) , Entolasia stricta (wiry panic) , Heteropogon contortus (black speargrass, bunch speargrass) , Cymbopogon refractus (barbed-wire grass) , Themeda triandra (kangaroo grass) ( ) , Aristida* spp. (sparse to mid-dense mid-stratum, mid-dense shrubby lower stratum and sparse to dense gassy groundlayer)
3e	Very tall woodland or tall woodland of ***Eucalyptus moluccana (gum-topped box, grey box)*** ***±*** *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus fibrosa subsp. fibrosa (broad-leaved ironbark) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Corymbia tessellaris (carbeen, Moreton Bay ash) , Corymbia citriodora (lemon-scented gum, lemon-scented iron gum, spotted gum) , Eucalyptus major (grey gum, mountain grey gum) , Dodonaea* spp., [often with scrub species in understorey ie. *Alyxia ruscifolia ( ) , Alectryon diversifolius (scrub boonaree)* etc.], *Cymbopogon refractus (barbed-wire grass) .* (sparse to dense mid-stratum and sparse to mid-dense grassy to low shrubby groundlayer)
3f	Very tall woodland or tall woodland or tall open woodland of ***Eucalyptus crebra (narrow-leaved ironbark) ( )*** ***±*** *Corymbia tessellaris (carbeen, Moreton Bay ash) , Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark) , Eucalyptus tereticornis (blue gum, forest red gum) ( ) , Corymbia clarksoniana (southern long-fruited bloodwood) , Angophora leiocarpa (apple, rusty gum, smooth-bark apple) , Corymbia citriodora (lemon-scented gum, lemon-scented iron gum, spotted gum) , Allocasuarina luehmannii (bull oak) , Acacia glaucocarpa (hickory wattle) , Cymbopogon refractus (barbed-wire grass) , Themeda triandra (kangaroo grass) ( ) , Heteropogon contortus (black speargrass, bunch speargrass) .* (sparse to mid-dense mid stratum and predominantly dense grassy groundlayer)
4a	Very tall open forest or tall open forest or very tall woodland or tall woodland of ***Corymbia citriodora (lemon-scented gum, lemon-scented iron gum, spotted gum)*** ***±*** *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Corymbia trachyphloia ( ) , Eucalyptus acmenoides (yellow stringybark, white mahogany) , Eucalyptus taurina (ironbark) , Angophora woodsiana (smudgee) , Eucalyptus major (grey gum, mountain grey gum) , Eucalyptus fibrosa subsp. fibrosa (broad-leaved ironbark)* [occasionally *Corymbia henryi (large-leaved spotted gum, coarse spotted gum)* or *Eucalyptus baileyana (Baileyís stringybark)*], *Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Acacia penninervis (veined wattle, mountain hickory) , Imperata cylindrica (blady grass) , Themeda triandra (kangaroo grass) ( ) , Aristida calycina (dark wiregrass) .*

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
4b	Very tall open forest or tall open forest or very tall woodland or tall woodland of ***Eucalyptus acmenoides (yellow stringybark, white mahogany) , + Corymbia trachyphloia ( )*** ***±*** *Angophora woodsiana (smudgee) , Corymbia citriodora (lemon-scented gum, lemon-scented iron gum, spotted gum) , Lysicarpus angustifolius (budgeroo) , Eucalyptus baileyana (Baileyís stringybark) , Eucalyptus taurina (ironbark) , Eucalyptus dura (gum-topped ironbark) , Eucalyptus fibrosa subsp. fibrosa (broad-leaved ironbark) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Leptospermum trinervium (woolly tea-tree) , Acacia podalyriifolia (silver wattle, Queensland silver wattle) , Xylomelum salicinum (woody pear) , Daviesia villifera (prickly daviesia, bitter pea) , Pultenaea* spp., *Xanthorrhoea johnsonii (blackboy, grasstree) / latifolia, Entolasia stricta (wiry panic) , Themeda triandra (kangaroo grass) ( ) , Imperata cylindrica (blady grass) , Lomandra* spp., (*Lophostemon confertus (brush box, pink box) , Leptospermum polygalifolium (wild may, yellow tea-tree, tantoon)* in understorey of gullies) (mid-dense mid-stratum, mid-dense to dense lower stratum and mid-dense shrubby to grassy groundlayer)
5a	Very tall open forest or tall open forest of ***Eucalyptus pilularis (blackbutt) ,*** ***±*** *Corymbia trachyphloia ( ) , Eucalyptus microcorys (tallow wood) ( ) , Eucalyptus baileyana (Baileyís stringybark) , Eucalyptus taurina (ironbark) , Angophora woodsiana (smudgee) , Eucalyptus acmenoides (yellow stringybark, white mahogany) , Eucalyptus carnea (white mahogany, broad-leaved white mahogany) ,* [*Eucalyptus planchoniana (Planchonís stringybark) and Corymbia gummifera (red bloodwood)* occur in this unit just north of this map sheet], *Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Lophostemon confertus (brush box, pink box) , Trochocarpa laurina (tree heath) , Elaeocarpus reticulatus (blueberry ash, ash quandong) , Themeda triandra (kangaroo grass) ( ) , Imperata cylindrica (blady grass) , Cymbopogon refractus (barbed-wire grass) , Pteridium esculentum (common bracken) .* (mid-dense mid-stratum and predominantly dense grassy groundlayer)
6a	Very tall open forest or very tall woodland or tall woodland of ***Eucalyptus acmenoides (yellow stringybark, white mahogany) ,*** ***±*** *Eucalyptus crebra (narrow-leaved ironbark) ( ) , Eucalyptus eugenioides (thin-leaved stringybark, white stringybark)* [silvery-leaved form], *Corymbia intermedia (pink bloodwood, red bloodwood) , Lophostemon confertus (brush box, pink box)* , *Angophora floribunda (roughbark apple, rough-barked apple) , Eucalyptus biturbinata (grey gum) , Eucalyptus moluccana (gum-topped box, grey box) , Corymbia tessellaris (carbeen, Moreton Bay ash) , Allocasuarina torulosa (mountain oak, rose sheoak, forest oak) , Lomatia silaifolia (crinkle bush, fern-leaved lomatia) , Jacksonia scoparia (broom, dogwood) , Xanthorrhoea latifolia ( ) , Podolobium ilicifolium (holly-leaf pea) , Themeda triandra (kangaroo grass) ( ) , Imperata cylindrica (blady grass) , Cymbopogon refractus (barbed-wire grass) , Pteridium esculentum (common bracken) .* (sparse mid-stratum, mid-dense shrubby lower stratum and dense grassy to ferny groundlayer)

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
7a	Extremely tall closed forest, emergents or very tall closed of ***Argyrodendron actinophyllum (black jack, blush tulip oak, tulip oak) + Araucaria cunninghamii (hoop pine) + Lophostemon confertus (brush box, pink box) + Ficus watkinsiana (Watkinís fig, strangler fig, green-leaved Moreton Bay fig) + Dysoxylum fraserianum (rosewood, rose mahogany) + Sloanea woollsii (yellow carrabeen, grey carrabeen, carobean, carrabin) + Elaeocarpus kirtonii (whitewood, Mowbullan whitewood, white beech, white quandong, silver quandong, pigeoberry ash) + Dendrocnide excelsa (giant stinging tree)*** ***±*** *Diospyros pentamera (grey persimmon, black myrtle, myrtle ebony) , Orites excelsa (white beefwood, silky oak, prickly ash) , Citronella moorei (churnwood, silky beech, soap box) , Eucalyptus saligna ( ) , Pennantia cunninghamii (brown beech) , Geijera salicifolia (green satinheart, scrub wilga)* var. *latifolia, Claoxylon australe (brittlewood) , Tasmannia insipida (brush pepperbush) , Morinda jasminoides (morinda) , Parsonsia fulva (furry silkpod) , Lastreopsis* spp., *Pellaea* spp., *Adiantum formosum (black-stem maidenhair-fern, giant maidenhair) .* (dense mid-stratum including lianes, often dense lower stratum and sometimes dense ferny groundlayer)
7b	Mid-high closed forest of ***Acmena smithii (lillipilli satinash, lilly pilly, lillypilly satinash, lilipilli satinash)*** ***±*** *Abrophyllum ornans (native hydrangea) , Acacia melanoxylon (blackwood) , Cinnamomum virens (red barked sassafras) , Cassinia compacta (tall cassinia) , Cryptocarya foveolata (mountain walnut) , Cuttsia viburnea (cuttsia, native elderberry, silver-leaf cuttsia) , Denhamia celastroides (broad-leaved boxwood) , Orites excelsa (white beefwood, silky oak, prickly ash) , Rhodamnia whiteana (white malletwood) , Kunzea ericoides (burgan) , Doryanthes palmeri (giant spear lily) , Tasmannia insipida (brush pepperbush) , Smilax australis (austral sarsaparilla, barbed-wire vine) , Hibbertia scandens (climbing guinea flower) , Doodia aspera (prickly rasp fern, rasp fern) .* (dense mid-stratum including wiry vines and mid-dense to dense lower stratum and groundlayer with boulders)
8a	Very tall closed forest or tall closed forest or mid-high closed forest of ***Flindersia collina (broad-leaved leopard tree, leopard ash) + Flindersia australis (teak, crowís ash) + Premna lignum-vitae (lignum-vitae, satinwood) + Geijera salicifolia*** var. ***Salicifolia ( ) + Acacia fasciculifera (scrub ironbark, rosewood, scalybark, scaly bark) + Ficus platypoda (small-leaved Moreton Bay fig, rock fig, rock breaker fig) /obliqua*** ***±*** *Cupaniopsis parvifolia (small-leaved tuckeroo, green-leaved tamarind) , Brachychiton discolor (brush kurrajong, lacebark, scrub bottle tree, white kurrajong) , Brachychiton rupestris (narrow-leaved bottle tree, bottle tree, Queensland bottle tree) , Arytera* spp., *Planchonella cotinifolia var. cotinifolia (coondoo, small-leaved coondoo) , Austromyrtus bidwillii (python tree, smooth-barked ironwood) , Croton insularis (native cascarilla bark, Queensland cascarilla, silver croton) , Atalaya salicifolia (whitewood) , Excoecaria dallachyana (scrub poison tree, blind-your-eye) , Callitris baileyi (Baileyís cypress) , Turraea pubescens (native honeysuckle) , Acalypha* spp., *Secamone elliptica (milkvine) , Carissa ovata (blackberry, kunkerberry, currantbush) , Alyxia ruscifolia ( ) , Jasminum* spp., *Ancistrachne uncinulata (hooky grass) .* (dense to mid-dense mid-stratum of trees and vines and mid-dense lower stratum and groundlayer

Veg Type Code	Structural Type, Predominant & Associated Species (Understorey Type)
8b	Tall closed forest or mid-high closed forest of ***Acacia harpophylla (brigalow)*** ***±*** *Casuarina cristata (belah) , Eucalyptus crebra (narrow-leaved ironbark) ( ) , Alectryon diversifolius (scrub boonaree) , Acacia fasciculifera (scrub ironbark, rosewood, scalybark, scaly bark) , Briedelia* spp.**,** *Bursaria incana (prickly pine, hoary blackthorn) , Croton insularis (native cascarilla bark, Queensland cascarilla, silver croton) , Owenia venosa (emu apple, crowís apple, rose apple) , Eucalyptus melanophloia (silver-leaved ironbark, silver ironbark) , Corymbia tessellaris (carbeen, Moreton Bay ash) , Acalypha* spp., *Carissa ovata (blackberry, kunkerberry, currantbush) , Ancistrachne uncinulata (hooky grass) .* (mid-dense mid-stratum sparse to mid-dense viney lower stratum and groundlayer)

Appendix 5.4

QUESTIONS RE VEGETATION TYPES

BEEKEEPING CRA WORKSHOP, INDOOROOPILLY NOVEMBER, 1997

Questions to be addressed for each vegetation type for each map.

1. Is this vegetation type useful for beekeeping ? YES NO
   If No, move to next vegetation type.

2. Is the vegetation type useful for honey production ? _____
   If No go to question 7

3. On average, how often does this vegetation type produce a honey crop ?
   Every _____ years

4. What is an average production per hive when this vegetation type produces a crop? _____ kg's per hive

5. Is this vegetation type capable of supporting apiaries of 100 hives at normal apiary site distances when it produces ? YES NO
   If No, answer question 6

6. How many hives per normal apiary site will this vegetation type support when it produces ? _____

7. Is this vegetation type useful for breeding bees ?

8. Is this vegetation type used for building bees, on average, how often does it provide adequate building conditions ?_____ years

9. Bees built on this vegetation type would be used for
   Honey production _____ Crop pollination_____

   Queen bee breeding _____ Package bees _____

   Other _____

10. When this vegetation type is used for bee building, how many weeks on average is it used ? _____

Appendix 5.5

Spatial Information and Mapping – Job No. 6

From: Anne Wiseman / Pauline Stewart / Fiona Anderson

Job Title: i) Joining apiary access database to vegetation community coverage to produce final apiary coverage for SEQ to be called – Apiary_SEQ
ii) Create metadata for 1
iii) Creation of potential Honey production coverage, map & area statement to be called – Honey_SEQ
iv) Create metadate for 2
v) Creation of no of build sites coverage, map & area statements to be called – Bee_building_SEQ
vi) Create metadata for 3

Date: Thursday, 4 March 1999

Required by: 5th May 98

Cost Code:

SECTION 1
Description:

1) Joining apiary Access database to vegetation community coverage to produce final apiary coverage for SEQ. The results from an apiary workshop using the GIS herbarium veg community mapping are currently stored in an Access database and to be attached to the GIS layer.

The GIS herbarium layer is quite old and is the version that is on a map sheet basis across SEQ and is not edge matched. Tony from the SIMS group produced some frequencies for Anne from these coverages a couple of months ago (job request prepared on the 20th January) and should know the coverages in question. They were located in the following directory:

/cra_b/jack/veg

for map sheets	Dingo	Scoria
	Maryborough	Monto
	Biloela	Bundaberg
	Calliope	Mount Perry
	Rosedale	Childers
	Pialba	Biggenden

/cra_c/rfa_9oct97
for the rest of the map sheets

Pauline will provide an Excel spreadsheet of the data to be joined to the coverage.
All items in the spreadsheet should be joined.
The spreadsheet has the data for all map sheets in the one file.

The join will require some work as the items in the coverage will need to be split before the join. The join item will be map sheet number and individual veg type redefined.

The veg community label and the accompanying percentages of each type in the polygon will need to be split out and the area of each calculated before the join is repeated however many times for each map sheet.

Table 1 Sample of join item from Excel

Map sheet No.	Veg type	etc.
4509	10a	
4509	5b	
4509	4c	
3509	11	
3509	15	

Table 2 Sample of join item from coverage

Map sheet No.	Veg type	Percentage split	etc.
4509	10a/5b/4c	30/40/30	
3509	11/15	60/40	

2). Using the map sheet no, vegetation type and area, generate 21 derived items to be attributed to the polygons.

The derived items are:
Kg/ha/annum for honey total
Kg/ha/annum of honey for grade 1
Kg/ha/annum of honey for grade 2
Ha/ honey grade 1
Ha/honey grade 2
honey revenue for grade 1
honey revenue for grade 2
total honey revenue
operating profit of honey and wax production for grade 1
operating profit of honey and wax production for grade 2
total operating profit of honey and wax production

Proposed calculation details
For each veg type making up a polygon, use the area percentage split and total area of the polygon to calculate the area of each veg type in the polygon.
Add hectares of same honey grade types in polygon to derive areas of each honey grade.
For each veg type in the polygon multiply its area (A) by the kg/ha/annum of honey to derive kg/annum of honey for each veg type.
Sum kg/annum of honey for like honey grades within the polygon to derive the kg/annum of honey per grade.
Then sum kg/annum of honey for both honey grades to generate the total kg/annum of honey for the polygon. ie 1400.
Divide kg of honey/annum for the polygon (E) by the total area of the polygon to generate kg/ha/annum of honey for the polygon i.e. 1400 divided by the total area – 100ha to derive a figure of 14kg/ha/annum for the polygon.

Divide kg/annum of honey for like honey grades (D) by the ha/grade to derive kg/ha/annum of honey by grade. i.e. 8 and 20.
The price ($/kg) for honey grade 1 is $1.305 and grade 2 is $1.2075. These are constants for the respective grades.
The kg/annum for each honey grade is multiplied by 0.0625 (constant), this is added to the kg/annum the honey grade. Multiply the result by $/kg for that honey grade to derive the honey & wax revenue by grade.
Sum honey & wax revenue for each honey grade (I) to derive the total honey & wax revenue for the polygon.

Multiply the cost/kg of honey production ($1.11 – constant irrespective of grade) by the kg/annum of honey for like honey grades (D) then subtract this from the honey & wax revenue by grade (I) to derive the operating profit of honey & wax by grade.
Sum the operating profit of honey & wax for each honey grade to derive the total operating profit of honey & wax for the polygon.

Eg. Polygon attributes: 4a/5c/12
20/30/50
total area 100ha for map sheet X

Table 3

Veg types	**Honey grade**	**Area of each veg type, ha (A)**	**Ha/ grade (B)**	**Kg/ha/ annum of each veg type**	**Kg honey /annum for like honey grades (C, D E)**	**Kg/ha/annum of honey by grade (G)**	**Honey price $/kg by grade**	**Honey & wax revenue $ by grade (I)**	**Operating profit $ for honey & wax by grade (K, L)**
4a	1	20% * 100 = 20		5	20 * 5 =100				
5c	1	30		10	300				
Total honey grade 1			**50**		400	400 / 50 = **8**	1.305	((400 + (400 * 0.0625)) * 1.305 = **554.625**	554.625 – (1.11 * 400) = **110.625**
12	2	50		20	1000				
Total honey grade 2			**50**		1000	**20**	1.2075	((1000 + (1000 * 0.0625)) * 1.2075 = **1282.97**	1282.97 – (1.11 * 1000 = 1**72.97**
TOTAL			100		1400			**1837.595**	**283.595**

Weeks (building)/annum
Proposed calculation details:
For each veg type making up a polygon, use the area percentage split and total area of the polygon to calculate the area of each veg type in the polygon (as in A table 3).
For each polygon use the weeks/annum of building field where the build type is one or a combination of honey, crop, queen or package building for each veg type and multiply this field by the area of each veg type.
Sum all the veg types weeks/annum multiplied by hectares to get the total building weeks/annum by hectares for the polygon.
Then divide this total figure of weeks as calculated in C by the total area of the polygon. i.e. 360 divided by the total area of 100ha to derive an average of 3.6 weeks/annum for the polygon.

Eg. Polygon attributes: 4a/5c/12
20/30/50
total area 100ha for map sheet X

Table 4

Veg types	Area of each veg type, ha (A)	Weeks/annum of building for each veg type	Weeks building per veg type (C&D)
4a	20% * 100 = 20	4	20 ha * 4 = 80
5c	30	6	180
12	50	2	100
TOTAL			**360**

No of build uses

Proposed calculation details:

For each veg type making up a polygon, use the area percentage split and total area of the polygon to calculate the area of each veg type in the polygon.

For each polygon use the no of build uses field (honey, crop, queen or package building) for each veg type and multiply this field by each new area that was calculated in A.

Then divide this total figure of build uses as calculated in B by the total area of the polygon ie. 220 divided by the total area ie. 100ha to derive a figure of **2.2 build uses** for the polygon.

Eg. Polygon attributes: 4a/5c/12
20/30/50
total area 100ha for map sheet X

Table 5

Veg types	Area of each veg type, ha (A)	Building uses for each veg type	Building uses per veg type (B)
4a	20% * 100 = 20	0	20 ha * 0 = 0
5c	30	4	120
12	50	2	100
TOTAL			**220**

Types of build uses

Summarise build uses from each veg type in the polygon to generate a final set of fields for the polygon based on the absence/presence of each build type in each veg type in the polygon.

Eg. Polygon attributes: 4a/5c/12

Table 6

Veg types	Build uses			
	Honey prod	Crop pollination	Queen breeding	Package bees
4a	N	N	N	N
5c	Y	Y	N	Y
12	Y	N	N	Y
TOTAL absence/presence	Y	**Y**	**N**	**Y**

Build weeks/ha for honey production
Build weeks/ha for crop pollination
Build weeks/ha for queens breeding
Build weeks/ha for package bees

Using the weeks per annum for each build use, derive the weeks the veg type can be used for each build use weighted by number of hectares.

Proposed calculation details:
Take the weeks/annum for each build use for each veg type and multiply it by the area of each veg type
Total the weeks/annum by hectares for each build use.
C) Take the total weeks/annum by hectares for each build use and divide by the total area of the veg polygon. ie average honey build/ha = 160/100 = 1.6 weeks/annum.

Eg. Polygon attributes used: 4a/5c/12
20/30/50
total area 100 ha
weeks per annum for each build use

Table 7

Veg type	Area of each veg type (ha)	Honey – weeks/ annum	Crop pollination – weeks/ annum	Queen breeding – weeks/ annum	Package bees – weeks/ annum	Honey – weeks/ ha	Crop pollination – weeks/ ha	Queen breeding – weeks/ ha	Package bees – weeks/ ha
4a	20	5	0	0	0	5 * 20 =100	0	0	0
5c	30	2	2	2	0	60	60	60	0
12	50	0	0	4	0	0	0	200	0
Total	**100**					**160**	**60**	**260**	**0**

3). Generate coverage for honey

Using the derived items from above for the polygon:
kg/ha/annum of honey for grade 1
kg/ha/annum of honey for grade 2
kg/ha/annum of honey total

Attribute the coverage and where like polygons occur dissolve internal lines and generate new polygons.
Then attribute the below items:
ha/ for honey grade1
ha/ for honey grade 2
honey revenue for grade 1
honey revenue for grade 2
total honey revenue
operating profit of honey and wax production for grade 1
operating profit of honey and wax production for grade 2
total operating profit of honey and wax production

4). Generate coverage for building

Using the derived item from above for the polygon:
weeks (building)/annum
no of build uses
build types (4 fields – presence or absence of honey production, crop pollination, queen breeding and package bees)
build weeks/ha (4 fields – by honey production, crop pollination, queens breeding and package bees).

Attribute the coverage and where like polygons occur dissolve internal lines and generate new polygons.

The two generated coverage's will be used to attribute the planning units and these two coverage's along with the original attributed vegetation layer will be used as a contextual layer.

SECTION 2

CALCULATIONS PRIOR TO CONTINUING ATTRIBUTING POLYGONS

(These figures are required for calculation of further data to attribute to vegetation polygons.)

Calculate the total revenue from honey and wax production for the SEQ region over State forests, timber reserves and State reserves (column I, table 3).
Calculate the total no of kg/annum of **honey** (no wax) production for the SEQ region over State forests, timber reserves and State reserves (column C,D &E, table 3).
Calculate total number of honey build weeks by hectares in SEQ over State forests, timber reserves and State reserves (table 7).

REVENUE AND OPERATING PROFIT FROM BUILD SITES

HONEY

5). Use honey build weeks multiplied by hectares for each composite veg type (Table 7) and divide it by the total number of weeks multiplied by hectares for all SF, TR & SR used for honey build in SEQ region. This derives the percentage each composite veg polygon makes up of the total number of honey build weeks by hectares in SEQ over SF, TR & SR. Use this value in conjunction with 25 per cent of the revenue from honey and wax in the SEQ region over the appropriate tenure types, to derive the revenue of honey build to be attributed to the polygon. Using each polygon percentage and 25 per cent of the costs of honey production in SEQ over the appropriate tenure types, derive the costs and operating profit from honey build to be attributed to the polygon.

Proposed calculation details:
Divide the average weeks by hectare that the polygon can be used to build for honey production per annum, by the total number of weeks by hectare that can be used in the SEQ region over the SF, TR &SR to build for honey production.
Multiply the figure calculated in A by the 25 per cent of revenue from honey and wax production within the SEQ on SF, TR & SR, to derive revenue from honey build for the polygon.
Multiply the percentage of total no. of honey build weeks in SEQ by the cost of honey building in SEQ (25 per cent of honey production costs).
Take the costs for the polygon from the revenue for the polygon to calculate the operating profit.

Eg. Polygon attributes used: weeks used for honey building per veg type weighted by hectares

Table 8

Veg types	Weeks by ha polygon can be used for honey build (Table 7)	Percentage of total no. of honey build weeks in SEQ (A)	Revenue of honey build (B)	Cost of honey build (A)	Operating profit from honey build (B)
Total	**160**	160/20,000 = 0.006	0.006 * 500,000 = $4000	0.006 * 350,000 = $2100	$4000 – $2100 = $1900

CROP POLLINATION

6) Use the weeks per hectare available for building for crop pollination for each composite veg polygon to derive the operating profit.

Multiply the average number of weeks by hectare that the polygon can be used to build for crop pollination per annum, by the operating profit/week/ha from building for crop pollination for the beekeepers.
Multiply the average number of weeks by hectare that the polygon can be used to build for crop pollination per annum, by the operating profit/week/ha from building for crop pollination for the crop owners.

Table 9

Veg types	Weeks/ha polygon can be used for crop build (Table 7)	Operating profit from crop build (for beekeepers)	Operating profit from crop build (for crop owners)
Total	**60**	60 * $1.30 = $78	60 * $50 = $3000

QUEEN BEE

7) Use the weeks per hectare available for building for queen bee breeding for each composite veg polygon to derive the operating profit.

Multiply the average number of weeks by hectare that the polygon can be used to build for queen bee breeding annum, by the operating profit/week/ha from building for queen bee breeding.

Table 10

Veg types	Weeks/ha polygon can be used for crop build (Table 7)	Operating profit from queen bee build
Total	**260**	260 * $0.80 = $208

8) Add to build coverage using derived items above for the polygon:
Revenue from honey build
Operating profit from honey build
Operating profit from crop pollination build for beekeepers
Operating profit from crop pollination build for crop owners
Operating profit from queen bee breeding build

Spatial Information and Mapping – Job No. 6.1

From: Anne Wiseman / Pauline Stewart / Fiona Anderson
Job Title: Apiary
Date: Thursday, 4 March 1999
Required by: 5th May 98
Cost Code:

Description:

Following the request titled job 6, the following maps and tables are required from the spatial join of the apiary database to the herbarium's vegetation coverage and the subsequent coverage's produced for the **SEQ RFA region.**

1. Frequency of composite veg type, map sheet no, and potential honey production kg/ha/yr summed by area.

2. Frequency of composite veg type, map sheet no, honey build weeks/yr, queen build weeks/yr, crop build weeks/yr and package build weeks/yr summed by area.

3. Generate table 1 detailing potential honey production and revenue by area and tenure (for SF, TR and SR only)

TABLE 1 ñ honey production

Tenure description eg SF no	Tenure unique id eg lot plan no	Total area (ha)	Average kg/ha/yr honey	Total kg/yr honey & wax	Total operating profit $ for honey & wax	Total revenue $ for honey & wax
SF 146	SF 146FTY 673	2000	5.5	11000		
etc						

4. Generates table 2 for SF, TR and SR respectively (ie 3 tables or a large singular table) detailing summary information of potential honey and wax prod, revenue and operating profit by area and tenure

TABLE 2 – Potential honey production of SF, honey prod of TR, honey prod of SR

	SF				
	Area ha	Honey kg/ha/yr	Honey and wax kg/yr	Revenue $ honey & wax	Operating profit $ honey and wax
Honey grade 1					
Honey grade 2					
TOTAL					

5. Generate table 3 for each build type (ie 4 tables or a large singular table) detailing build usage by area and tenure.

TABLE 3 – Honey build, Queen build, Crop build, & Package build

Tenure description eg SF no	**Tenure unique id eg lot plan no**	**Weeks/yr classes**	**Area (ha)**
SF 146	SF 146FTY 673	0	20 000
SF 146	SF 146FTY 673	>0 ≤ 2	45 000
SF 146	SF 146FTY 673	>2 ≤ 4	14 000
SF 146		>4 ≤ 6 etc	2 500
etc			

6. Generate table 4 for each honey, crop and queen bee building by SF, TR & SR, operating profit and revenue.

TABLE 4 – Build type and usage on SF, build type and usage on TR, build type and usage on SR

	SF		
Build use	Area ha	Revenue $	Operating profit $
Honey			
Queen		x	
Crop – beekeeper		x	
Crop – crop owner		x	
TOTAL		x	

7. Generate table 5 for SF, TR and SR detailing summary information of build usage by area and weeks/yr in classes.

TABLE 5 – Build usage by area and weeks/yr for SF, TR and SR.

Build use	Area (ha) by weeks/yr classes			
	0–5	5–10	10–15	etc
Honey				
Crop				
Queen				
Package				

8. Using the generated honey coverage, create a new dissolved coverage that has the item, kg/ha/annum of potential honey only. Determine potential honey prod classes for map display. Generate a map from this new coverage detailing potential honey kg/ha/yr for SF, TR and SR only within the SEQ RFA region.

9. Using the generated building coverage, create a new dissolved coverage that has the item, weeks building/yr only. Determine building weeks classes for map display. Generate a map of this new coverage detailing weeks building/yr for SF, TR and SR only within the SEQ RFA

Appendix 5.6

Apiary Economic Survey

NO. OF HIVES:

COST	1995/96 $	1996/97 $
Labour – owner		
Labour – additional to owner, plus superannuation		
Truck depreciation (10%) and/or		
Lease truck cost – lease term.....years		
.....% residual		
Light vehicle depreciation (15%) and/or		
Lease cost – lease term.....years		
.....% residual		
Fuel and oil		
Vehicle repairs and tyres		
Hive maintenance and replacements		
Queen replacement		
Worker's compensation		
Depreciation (10%) – replacements, extracting		
and other plant		
Depreciation (3%) – sheds		
Repairs and maintenance extracting and		
other plant		
Containers		
Living away and meals while travelling		
Freight		
Administration		
Interest		
Bee feed		
Electricity		
Site rental		
Telephone		
Insurance		
Vehicle registration		
Land rates		
Association subscription and professional		
expenses		
Other Costs (that you feel do not fit into the above)		

APIARY PRODUCTION

Average annual honey production (kg/hive)	kg	kg
% of beekeeping income derived from honey	%	%
and beeswax		
Average number of sites hives visit per annum		

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ABBREVIATIONS

APPD	Apiary Productivity Potential Database
NRDA	Natural Resources Database of the Apiary Industry
OCL	Other Crown land
SF	State forest
SR	State reserve
TR	Timber reserve

ANZLIC Core Metadata Elements - Directory Item Report

Title : **SEQ RFA - Report - SE4.2 - Apiary: Potential Productivity for Beekeeping Over Vegetation Types in South East Queensland (master coverage: APIARY_SEQ)**

Custodian Details

Name : Department of Natural Resources

Jurisdiction : Queensland

Description

Abstract : A spatial data set produced from an apiary database compiled by DNR in 1998. An Arc/Info Coverage created by relating the DNR Microsoft Access database recording estimates of potential productivity for beekeeping to vegetation types on the Qld Herbarium's vegetation community mapping of SEQ.
The extent of data is inclusive of the SEQ Regional Forest Agreement Area, (inc SEQ Biogeographic Region & Blackdown Tableland). The actual coverage extent is the result of appending the Qld Herbarium, vegetation covers which are based on 1:100,000 map sheets.

Search Words :

AGRICULTURE Production

FORESTS Production

VEGETATION

Geographic Extent Names :

Geographic Extent Polygons :

-23.43683 151.26352, -24.67050 152.62821, -24.68347 153.40996, -25.44804 153.45442,
-26.84368 153.58082, -28.46849 153.61112, -28.48029 152.19031, -26.66238 151.31014,
-25.50255 151.35426, -24.24535 150.70376, -24.02017 151.01975, -23.43542 150.65602,
-23.43683 151.26352

-23.62896 149.06753,-23.70714 149.23289,-23.95568 149.28120,-24.00664 149.00212,
-23.73762 148.92008,-23.62896 149.06753

Currency and Status

Beginning Date :	17 Apr 1998	**Progress :**	Complete
Ending Date :	25 May 1998	**Maintenance and Update Frequency:**	As required
Metadata Date :	25 Feb 1999		

Access

Stored Data Format : DIGITAL Arc/Info v.7.1.2 under Solaris v2.6 - Vector Data

Available Format Types :

DIGITAL Arc/Info Export file

Access Constraints : Internal use - Regional Forest Assessment only (Available to RFA stakeholders - No charge)

Data Quality

Lineage : Source Data: 1. Queensland Herbarium's vegetation mapping; 1:100,000 map sheet format. Note: Due to time constraints, vegetation data was received in map sheet format (two batches -Aug 1997 and Oct 1997), prior to availability of the continuous dataset (SEQ) and is therefore pre-validation for data mismatches at map sheet boundaries. 2. Apiary - potential production data - DNR access database - 1998.
Coverage Development: On each map sheet:
1.The items: 'VEG' and 'PERCENT' contain up to four separate vegetation types, and the percentage of each vegetation type within the polygon.
2. These items were split up into items : VEG1, VEG2, VEG3, VEG4 and PERCENT1, PERCENT2, PERCENT3, PERCENT4 respectively.
3. Each polygon on each map sheet was attributed with its respective map sheet number.
4. New items: MAP_VEG1 ..... MAP_VEG4 were created, containing a concatination of map sheet number and veg type, (format required for linking the production data).
5.Map sheets were appended to make a continuous cover - APIARY_SEQ
On Apiary cover: APIARY_SEQ

1. Polygons checked for (a) completeness of attributes (derived VEG & PERCENT items); (b) ensure each VEG item has a complementry 'PERCENT' value; (c) check that PERCENT items sum to 100.
All problems were referred to Qld Herbarium and resolved.
2. Areas were calculated for each VEG type in a polygon as items:
AREA(HA)_V1.....AREA(HA)_V4.
APIARY - Potential Production Database in ACCESS:
1. The database was exported to a textfile
2. An INFO datafile was defined with items to reflect the Access fields and data added from .txt file.
On cover: APIARY_SEQ
1.Initial join of the data was made on the MAP_VEG1 item and cover checked for non-attributed polygons.
2. All items received in the 'JOINITEM' were renamed to reflect their association with the veg type in 'MAP_VEG1'.
3. The above sequence was repeated to to provide a complete set of production attributes for each veg type .

Positional Accuracy : Refer to metadata record for Department of Environment, Qld Herbarium - Vegetation Survey and Mapping of SEQ Biogeographic Region

Attribute Accuracy : Refer to metadata record 'Apiary Database: Potential Productivity for Beekeeping Over Vegetation Types in South East Queensland (MS Access database: APPD)'.

Logical Consistency : A numeric check field was added to the Access data prior to joining to the vegetation coverage. This simplified checking for vegetation types that did not receive production attributes upon joining.
All such instances were checked and corrected.

Completeness : Complete

Contact Information

Organisation Name :	Department of Natural Resources		
Position :	Project Officer - Graphics Coordinator		
Mail Address 1 :	RSK, Natural Sciences Precinct	**State :**	QLD
Mail Address 2 :	Block C, 80 Meiers Road	**Country :**	Australia
Suburb or Locality :	Indooroopilly	**Post Code :**	4068
Telephone Number :	07 3896 9882	**Facsimile Number :**	07 3896 9882
Email Address :	Geoff.Gibson@dnr.qld.gov.au		

Additional Metadata

Refer to README.APIARY_SEQ (provided with data set) as well as metadata for derived A/I covers : HONEY_SEQ & BEE_BLD_SEQ (completed 22nd Jun 1998)

Refer to README.APIARY_SEQ for description of polygon attributes.

For additional information refer to the metadata record for Department of Environment, Qld Herbarium - 'Vegetation Survey and Mapping of SEQ Biogeographic Region'

For additional information refer to the metadata record 'Apiary Database: Potential Productivity for Beekeeping Over Vegetation Types in South East Queensland (MS Access database: APPD)'

ANZLIC Core Metadata Elements - Directory Item Report

Title : **Apiary: Honey Production & Economic Data (potential) - Selected Tenure Classes in SEQ Regional Forest Assessment Area**

Custodian Details

Name : Department of Natural Resources

Jurisdiction : Queensland

Description

Abstract : This is a derived cover from APIARY_SEQ (Apiary master dataset).
This cover contains Honey (& wax) production & economic data within State Forests, Timber Reserves & State Reserves of the South East Queensland Regional Forest Assessment Area.
Refer to Job Request documents (additional metadata) for specifics of cover development.

Search Words :

AGRICULTURE Production

FORESTS Production

Geographic Extent Names :

Geographic Extent Polygons :

-23.43683 151.26352, -24.67050 152.62821, -24.68347 153.40996, -25.44804 153.45442,
-26.84368 153.58082, -28.46849 153.61112, -28.48029 152.19031, -26.66238 151.31014,
-25.50255 151.35426, -24.24535 150.70376, -24.02017 151.01975, -23.43542 150.65602,
-23.43683 151.26352

-23.62896 149.06753,-23.70714 149.23289,-23.95568 149.28120,-24.00664 149.00212,
-23.73762 148.92008,-23.62896 149.06753

Currency and Status

Beginning Date :	17 Apr 1998	**Progress :**	Complete
Ending Date :	23 Jun 1998	**Maintenance and Update Frequency:**	As required
Metadata Date :	25 Feb 1999		

Access

Stored Data Format : DIGITAL ArcInfo v7.1.2 under Solaris v2.6 - Vector Data

Available Format Types :

DIGITAL ArcInfo, ArcView and MapInfo

Access Constraints : Internal Use - Regional Forest Assessment only. (Available to RFA Stakeholders - No charge

Data Quality

Lineage : 1.This cover is the result of the union of APIARY_SEQ (Apiary Master Cover) and TENCLASS (Land Tenure Classes) and further clipping to SEQ RFA boundary. Polygons within State Forests, Timber Reserves & State Reserves were further selected to create the final coverage.
2. Refer to README.HONEY_SEQ & README.HONEY_CALCS in 'Additional Metadata'- Further derived item Information.
3. Refer to Job request documents (additional metadata) for specifics of honey production & economic data development.

Positional Accuracy : Refer Metadata - "Apiary: Potential Productivity for Beekeeping over Vegetation Types for South East Queensland (master dataset APIARY_SEQ)"

Attribute Accuracy : Refer Metadata - "Apiary: Potential Productivity for Beekeeping over Vegetation Types for South East Queensland (master dataset APIARY_SEQ)"

Logical Consistency : Refer Metadata - "Apiary: Potential Productivity for Beekeeping over Vegetation Types for South East Queensland (master dataset APIARY_SEQ)"

Completeness : Complete

Contact Information

Organisation Name :	Department of Natural Resources		
Position :	Project Officer - Graphics Coordinator		
Mail Address 1 :	RSK, Natural Sciences Precinct	**State :**	QLD
Mail Address 2 :	Block C, 80 Meiers Road	**Country :**	Australia
Suburb or Locality :	Indooroopilly	**Post Code :**	4068
Telephone Number :	07 3896 9882	**Facsimile Number :**	07 3896 9882
Email Address :	Geoff.Gibson@dnr.qld.gov.au		

Additional Metadata

For original job requests ref. documents : g:\anzlic\forest\attrib\apiary-honey production\ bees_req_FA.doc
& g:\anzlic\forest\attrib\apiary-honey production\bees_req_FA_2.doc

Refer to METADATA - Apiary, Potential Productivity for Beekeeping over Vegetation types - SEQ (Master Cover - APIARY_SEQ)

ANZLIC Core Metadata Elements - Directory Item Report

Title : **Apiary: Bee Building - South East Queensland Regional Forest Assessment Area**

Custodian Details

Name : Department of Natural Resources

Jurisdiction : Queensland

Description

Abstract : This cover is derived from APIARY_SEQ (Apiary master cover).
The cover contains attribute information specific to bee building ,ie the time spent on build sites to build up their numbers and strength for a specific economic activity. Refer to report: (a) Job request documents (additional metadata). (b) The report: SE4.2 APICULTURE; Regional Forest Assessment, Department of Natural Resources.
The extent of data is State Forest,Timber Res., and State Res. within SEQ Regional Forest Assessment Area.

Search Words :

AGRICULTURE Production

FORESTS Production

Geographic Extent Names :

Geographic Extent Polygons :

-23.43683 151.26352, -24.67050 152.62821, -24.68347 153.40996, -25.44804 153.45442,
-26.84368 153.58082, -28.46849 153.61112, -28.48029 152.19031, -26.66238 151.31014,
-25.50255 151.35426, -24.24535 150.70376, -24.02017 151.01975, -23.43542 150.65602,
-23.43683 151.26352

-23.62896 149.06753,-23.70714 149.23289,-23.95568 149.28120,-24.00664 149.00212,
-23.73762 148.92008,-23.62896 149.06753

Currency and Status

Beginning Date :	17 Apr 1998	**Progress :**	Complete
Ending Date :	23 Jun 1998	**Maintenance and Update Frequency:**	As required
Metadata Date :	18 Nov 1998		

Access

Stored Data Format : DIGITAL Arc/Info v7.1.2 under Solarisv2.6 - Vector Data

Available Format Types :

DIGITAL Arc/Info export file

Access Constraints : Internal use - Regional Forest Assessment (Available RFA Stakeholders - No Charge)

Data Quality

Lineage : 1. This cover was derived from APIARY_SEQ (apiary master cover) and its union with the land tenure classes (TENCLASS). The cover was clipped to SEQ RFA boundaryand State Forests, Timber Reserves & State Reserves were selected out.
2. Refer to Job request documents and additional metadata for specifics of cover development.

Positional Accuracy : Refer Metadata - master cover: APIARY_SEQ

Attribute Accuracy : Refer Metadata - master cover: APIARY_SEQ

Logical Consistency : Refer Metadata - master cover: APIARY_SEQ

Completeness : Complete

Contact Information

Organisation Name : Department of Natural Resources

Position : Project Officer - Graphics Coordinator

Mail Address 1 :	RSK, Natural Sciences Precinct	**State :**	QLD
Mail Address 2 :	Block C, 80 Meiers Road	**Country :**	Australia
Suburb or Locality :	Indooroopilly	**Post Code :**	4068
Telephone Number :	07 3896 9882	**Facsimile Number :**	07 3896 9882
Email Address :	Geoff.Gibson@dnr.qld.gov.au		

Additional Metadata

For original Job Request refer to documents: g:\anzlic\forest\attrib\apiary - bee_building\bees_req_FA.doc & bees_req_FA_2.doc

Refer to METADATA - Apiary: Potential productivity for Beekeeping over Vegetation Types of SE Queensland (master cover - APIARY_SEQ)

ANZLIC Core Metadata Elements - Directory Item Report

Title : **Apiary: Natural Resource Database for the Apiary Industry**

Custodian Details

Name : Department of Primary Industries

Jurisdiction : Queensland

Description

Abstract : A survey of the Queensland apiary industry was undertaken to establish the productivity and economic value of apiary sites currently in use. The survey was sent to to all registered beekeepers in Qld with greater than 50 hives. Information collected by sites included production and economic details as well as usage, species targeted and disease history of sites. Valuable and reliable honey flora in Queensland was recorded and an attempt was made to identify areas for potential commercial production.

The questionaire was developed to document current natural resources of the Queensland Beekeeping Industry. It is a collabrative project with DPI- Intensive Livestock Services, Queensland Beekeepers Association (QBA), Honey Bee Research and Development Council and DNR.

The aim of the data collection is to provide productivity and economic data on current and future sites enabling the apiary industry to discuss and negiote with land managers for the retention of ans access to honey and pollen resources.

Search Words :
AGRICULTURE Production

Geographic Extent Names :

Geographic Extent Polygons :

Currency and Status

Beginning Date :	01 Jun 1995	**Progress :**	Complete
Ending Date :	01 Feb 1996	**Maintenance and Update Frequency:**	Not Planned
Metadata Date :	25 Feb 1999		

Access

Stored Data Format : DIGITAL Access 97

Available Format Types :
DIGITAL Access 97

Access Constraints : Conditions of use, copyright and charges apply.

Data Quality

Lineage : Survey forms were mailed to the 457 beekeepers in Queensland owning more than 50 hives. Two reminder notices were sent and some beekeepers were visited or telephoned to obtain information. Useable surveys were received from 59.2% of beekeepers.

Positional Accuracy : Not applicable

Attribute Accuracy : All beekeepers with 50 hives or greater were approached and the 59.2% response rate would support an accurate survey.

Logical Consistency : Not applicable

Completeness : An accurate representation of the production and resources of the Queensland apiary industry were obtained.

Contact Information

Organisation Name : Department of Primary Industries

Position : Industry Manager

Mail Address 1 : Block D, Animal Research Institute **State :** QLD

Mail Address 2 :	665 Fairfield Rd	**Country :**	Australia
Suburb or Locality :	Yerongpilly	**Post Code :**	4105
Telephone Number :	07 3362 9484	**Facsimile Number :**	07 3362 9440
Email Address :	truemaf@prose.dpi.qld.gov.au		

Additional Metadata

ANZLIC Core Metadata Elements - Directory Item Report

Title : **Apiary Database: Potential Productivity for Beekeeping Over Vegetation Types in South East Queensland (MS Access database: APPD)**

Custodian Details

Name : Department of Natural Resources

Jurisdiction : Queensland

Description

Abstract : A Microsoft Access database produced by DNR in 1998 from 2 workshops conducted with the Queenland Beekeepers Association (QBA). Information collected included potential honey production details as well as bee building types and duration information for vegetation types in SEQ RFA (Regional Forest Agreement) region.

The database was created for the SEQ RFA. It's purpose is to describe the signifcance of State Forests, Timber Reserves and State Reserves to the industry and to provide quantitative data (potential) to allow the economic significance of the apiary industry to be described, and impacts of land use changes estimated.

The extent of the data is inclusive of the SEQ RFA area, (inc SEQ Biogeographic Region and Blackdown Tableland).

An Arc/Info coverage was subsequently created by relating the database to the vegetation types contained in the Qld Herbarium's vegetation community mapping of SEQ.

Search Words :

AGRICULTURE Production

FORESTS Production

VEGETATION Mapping

Geographic Extent Names :

Geographic Extent Polygons :

-23.43683 151.26352, -24.67050 152.62821, -24.68347 153.40996, -25.44804 153.45442,
-26.84368 153.58082, -28.46849 153.61112, -28.48029 152.19031, -26.66238 151.31014,
-25.50255 151.35426, -24.24535 150.70376, -24.02017 151.01975, -23.43542 150.65602,
-23.43683 151.26352

-23.62896 149.06753,-23.70714 149.23289,-23.95568 149.28120,-24.00664 149.00212,
-23.73762 148.92008,-23.62896 149.06753

Currency and Status

Beginning Date :	01 Dec 1997	**Progress :**	Complete
Ending Date :	01 Mar 1998	**Maintenance and Update Frequency:**	Not Planned
Metadata Date :	25 Feb 1999		

Access

Stored Data Format : DIGITAL Microsoft Access v 97

Available Format Types :

DIGITAL Access v 97

Access Constraints : Conditions of use, copyright and charges apply.

Data Quality

Lineage : Source Data History:
DNR conducted 2 workshops over 3 days in the latter half of 1997, involving representatives of the QBA. The base data set was a series of 1:100,000 vegetation map sheets covering the SEQ RFA produced from the Qld Herbarium's vegetation coverage. The vegetation map sheets detailed vegetation types and their percentage occurrence in each composite vegetation polygon. Potential production information in each vegetation type was recorded using the legend for each map shee

Workshop participants were selected by the QBA based on their direct experience of beekeeping in the vegetation types in the SEQ RFA region. They utilised their experience and knowledge of vegetation types in the region to estimate potential production for honey and building over time, for each vegetation type.

Data Collected:
Q1. Is the vegetation type useful for beekeeping
Q2. Is the vegetation type useful for honey production
Q3. On average, how often does this veg type produce a honey crop
Q4. Av prod per hive when veg type produces
Q5. Veg type capable of supporting 100 hives
Q6. If Q5 no, how many hives per apiary site
Q7. Is veg type useful for breeding bees
Q8. If veg type used for building bees, av time provides adequate build conditions
Q9. Bee built on this type, would be used for honey prod, crop pollination, queeen bee breeding, package bees or other
Q10. When veg type used for bee building, av weeks used

Database Processing
After the data was entered a number of fields were calculated. These are;
Honey kg/ha/yr
Build weeks/yr
no of build uses (only honey, crop, queen and package were included)
weeks per build use
weeks per each specified build use

Spatial Processing
The database was subsequently linked to Arc/Info vegetation coverage.

Positional Accuracy : Refer to metadata record for Department of Environment, Qld Herbarium - Vegetation Survey and Mapping of SEQ Biogeographic Region.

Attribute Accuracy : Data assumptions:
A number of assumptions were used in the estimation of productive potentials. These are;

1. Estimates of productive potential for all veg types are based on historical use and expert knowledge. Estimates are long term average potential values, taking into account seasonal fluctuations.
2. Veg types were assessed and valued based on beekeepers experience. Estimates of known sites on a given veg type were applied to all occurrences of the particular veg type, whether they have been used or not.
3. All veg types were assessed of their potential irrespective of their current use by the apiary industry.
4. Any level of use of a veg type was assumed to be economical.
5. Each apiary site is assumed to have an area of 200 ha.
6. A number of veg types were unknown to the beekeepers. They were entered as not useful but were flagged as having unknown potential.
7. Plantations were not valued in this process as this assessment is ony concerned with native forests. For the purposes of this assessment, plantations have been given a production value of zero.
8. Veg types on Fraser Is were not assessed as beekeepers do not have access to Fraser.
9. Veg types on Curtis Is were not assessed as the veg mapping work was not available at the time of the workshops and it was considered that this was not a major honey producing area.

Data Limitations
1. Veg coverage utilised at the workshop was in draft format at the time and had only been edged matched in part. The veg coverage is considered to be representative of the final data set.
2. The composite vegetation types on the final vegetation coverage were reclassified and grouped to the extent that it was not possible to translate the workshop data to the final vegetation coverage.

Logical Consistency : Logical consistency tests done were:
- a test of valid values in each calculated fields
- a visual check of draft maps, which led to a reassessment of some vegetation map sheets

Completeness : 100 %. All vegetation types were assessed and valued.

Contact Information

Organisation Name :	Department of Natural Resources		
Position :	Forest Planner		
Mail Address 1 :	RSK, Natural Sciences Precinct	**State :**	QLD

Mail Address 2 :	Block C, 80 Meiers Road	**Country :**	Australia
Suburb or Locality :	Indooroopilly	**Post Code :**	4068
Telephone Number :	07 3896 9838	**Facsimile Number :**	07 3896 9858
Email Address :	Jim.Burgess@dnr.qld.gov.au		

Additional Metadata

Refer to file: Apiary: Potential Productivity for Beekeeeping Over Vegetation Types in South East Queensland (Master coverage: Apiary_SEQ)

For additional information refer to the metadata record for Department of Environment, Qld Herbarium - Vegetation Survey and Mapping of SEQ Biogeographic Region

ANZLIC Core Metadata Elements - Directory Item Report

Title : **Costs and Production Data for Honey in Native Forests in South East Queensland 1998**

Custodian Details

Name : Department of Natural Resources

Jurisdiction : Queensland

Description

Abstract : Survey data on costs and production levels from honey producers operating in the South East Queensland Biogeographic Region, collected in 1998.

Search Words :

AGRICULTURE Horticulture Production

FORESTS Natural Surveys

Geographic Extent Names :

Name	Category	Code/Number	Jurisdiction
SOUTH EASTERN QUEENSLAND	IBRA	SEQ	

Geographic Extent Polygons :

Currency and Status

Beginning Date : 16 Mar 1998

Ending Date : 03 Apr 1998

Metadata Date : 23 Nov 1998

Progress : Complete

Maintenance and Update Frequency: As required

Access

Stored Data Format : DIGITAL Excel spreadsheet

Available Format Types :

DIGITAL Excel

NON DIGITAL Printouts

Access Constraints : Conditions of use, copyright and charges apply

Data Quality

Lineage : Survey forms were distributed by mail to 10 beekeepers chosen by Don Keith the Chairman of the Queensland Beekeepers Resource Committee. Seven were returned with two forms not used, one due to lack of data and the other due to only 20-50 per cent of the apiarist's business being honey production.

Positional Accuracy : Not applicable

Attribute Accuracy : Convenience sampling was used and sample size was too small to project these figures to all apiarists operating in SEQ Biogeographic region. Used in this case to compare against NSW report. Note that data was collected from only commercial operators with more than 450 hives.

Logical Consistency : Data matches well with similar cost survey from NSW (Mansfield Report 1996) on a cost per hive basis. However, due to the surveying of only larger commercial operators with higher production levels, the cost per kilogram of honey is lower.

Completeness : Not a truely representative sample of the apiary industry in SEQ.

Contact Information

Organisation Name : Department of Natural Resources

Position : Project Officer - Economist

Mail Address 1 : RSK, Natural Sciences Precinct

Mail Address 2 : Block C, 80 Meiers Rd

Suburb or Locality : Indooroopilly

State : QLD

Country : Australia

Post Code : 4068

Telephone Number : 07 3896 9451 **Facsimile Number :** 07 3896 9858

Email Address : Fiona.Anderson@dnr.qld.gov.au

Additional Metadata

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