Asian honey bee Transition to Management Program

Final report – June 2011 to July 2013

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Summary

The Asian honey bee[1] (AHB) Transition to Management (T2M) Program (herein referred to as 'the Program') was funded by the Australian and Queensland Governments and the Australian Honey Bee Industry Council (AHBIC) following a National Management Group decision that eradication of AHB in Australia was not technically feasible.

To assist the community and industry in transitioning to managing AHB, the Program has delivered the following key elements:

- Developed tools to raise public awareness and help industry, the community and other stakeholders identify and manage AHB including:
  - Enhanced Website capabilities with improved tools for the identification and online reporting of AHB, what to do if threatened and a portal for all AHB T2M outcomes.
  - Hands on technical workshops provided to critical stakeholders.
  - Asian honey bee fact sheet for the community.
  - Guidelines for industry— destroying swarms or nests of Asian honey bees.
  - Check your load transport poster – building awareness around minimising spread.
  - YouTube video - Destruction techniques for industry use.
  - Asian honey bee manual - a document describing techniques for the identification, detection and destruction of AHB.
- Developed and adapted tools and strategies to control AHB in a range of urban, business, rural and natural environments.
- Undertaken research focussed on developing and optimising methods to detect, identify and destroy AHB.
- Maintained measures aimed at reducing long distance spread of AHB.
- Informed the *Varroa* action plan through knowledge gained from the AHB incursion.

This report details the key objectives and achievements delivered during the life of the Program.

[1] *Apis cerana* Java genotype

Background

Asian honey bees (AHB) were first detected in Cairns, Queensland in May 2007. The Queensland Government immediately commenced an eradication program with the aim of delimiting and containing the incursion within a 50 km radius of Cairns whilst the pest was eradicated.

In April 2010, the National Management Group agreed to cost shared funding for the Asian honey bee eradication, backdating the funding to 1 July 2009, under the provisions of Australia's formal emergency pest response arrangements. The program was nationally funded between 1 July 2009 and 31 March 2011.

In January 2011, the National Management Group agreed that eradication was not technically feasible. However, it did agree to consider whether any further action was warranted on a national scale to mitigate the potential impact of the AHB.

In response to the National Management Group decision, a national Transition to Management Plan was developed to help industry and the community adapt to the pest. The Australian and Queensland Governments and the honey bee industry agreed to jointly fund the implementation of the plan.

In June 2011, a two-year Asian Honey Bee Transition to Management Program was established in Biosecurity Queensland to implement key components of the plan.

In November 2011, the Australian Government released the Plan for Transition to Management of the Asian honey bee[2] as a national pilot program. The plan identified a range of actions to transition from a state of eradication to a program of management, acknowledging that the AHB would continue to spread and become established in urban and rural areas of Australia where the environment favours its survival.

An Asian honey bee Transition Management Group (TMG) was established to oversee the Program, monitor its delivery and ensure that the Program outcomes were achieved. The TMG was chaired by the Australian Government and consisted of senior representatives from Australian Department of Agriculture, Fisheries and Forestry (ADAFF), Queensland Department of Agriculture, Fisheries and Forestry (QDAFF), and AHBIC. The TMG also included Plant Health Australia as an observer in recognition of its role as administrator of the Program.

An Asian honey bee Scientific Advisory Group (SAG) was also established to provide technical advice, feedback and consideration of specific projects and activities within the Program. The AHB SAG consisted of honey bee scientists and industry experts.

[2] The Plan for Transition to Management Program of the Asian honey bee can be downloaded from www.asianhoneybee.net.au

Objectives of the AHB T2M Program

The key objectives of the Program were to provide tools for a range of stakeholders to apply mitigating and control measures, as appropriate, to limit the pest's impact on human health, social amenity and honey production.

Stakeholders included the community, land owners, commercial and hobby apiarists, pest controllers, transport industries, indigenous rangers and environmental groups. Some of these were deemed to be critical stakeholders as they may be required to assist the community to manage the pest bee. These were identified as pest control operators, the transport industry, the beekeeping industry, indigenous rangers, and those who work in environmental management.

Through the Program, stakeholders were educated to better understand the likely spread of AHB, the potential impact of AHB on the community and environment, and what actions they could take to manage and minimise those impacts.

The objectives of the Program were achieved through the implementation of the following eight projects.

1. Limiting impact on urban communities (AG1)

Tools were identified, developed and made available to the community to help reduce the bee's impact on health and safety.

This was achieved by:

- Identifying critical stakeholders and, in consultation, developing tools relevant to their needs. Evaluating the effectiveness of these tools to ensure that they would be useful to industry and the community in the long term.
- Educating critical stakeholders about AHB identification and control options to reduce the impact of the bee on business, the community and local environment. Training workshops also emphasised that the Program was transitioning away from managing AHB.
- Revitalising existing information sources and increasing social media and other interactive communication.
- Ensuring critical stakeholders and the wider community had access to information about AHB and relevant control measures and other management tools through an updated website, an Asian honey bee factsheet, step-by-step guides for the detection, identification and destruction of AHB, and a video on YouTube showing different destruction techniques.

Website and Facebook site established (adapted from existing sites)

Biosecurity Queensland's website was periodically reviewed and underwent six updates during the Program to ensure stakeholder's needs were addressed and that it reflected the transitional phases of the Program and objectives of the cessation strategy.

The number of AHB-related web pages on the Biosecurity Queensland website increased from 11 in 2011-2012 to 25 in 2012-2013. For the 11 AHB web pages that existed for the entirety of the AHB T2M Program, the greatest increase was recorded for the number of viewers accessing information regarding AHB self-identification, reporting suspect bees and the impact of AHB. For these three information sources the page views increased by 1444%, 608% and 188% respectively, reflecting the extensive content and customer journey

improvements made. Substantial increases were also observed for all other core AHB pages, with an increase in the number of times they were viewed ranging from 68% to 128%.

Web page views were greater in 2012-2013 for all except two web pages, specifically the (i) Asian honey bee Transition to Management program and (ii) restricted area and movement restrictions pages. Views of these pages decreased by 42% and 5% respectively, highlighting the community's greater interest in user-friendly practical resources to help them identify and manage AHB.

Of the 14 AHB-related pages introduced in 2012-2013, the most accessed pages were (i) Asian honey bee nests and swarms (320 views), (ii) Asian honey bee image gallery (310 views), and (iii) History of Asian honey bees (174 views).

A regular social media reporting framework, including an event calendar, was developed and implemented in consultation with the QDAFF's social media unit. Regular reports were provided on social media activities including a number of posts from Biosecurity Queensland and the public. In total, 13 AHB-related posts were published on Facebook by Biosecurity Queensland in the 17 months between 22 November 2011 and 15 April 2013. Of these, eight (58%) related to reporting AHB sightings, three (25%) related to identification and surveillance for AHB, and two (17%) related to AHB transition to management strategies. The total number of Facebook users viewing AHB-related posts was greatest for posts addressing reporting AHB sightings, followed by identification and surveillance, and Transition to Management.

All posts made to Facebook during this time were replicated as Twitter messages. An additional two tweets related to reporting AHB sightings were made by Biosecurity Queensland between October 2012 and November 2012.

Information reviewed and updated as Program outcomes are delivered and information is tested

Informative training workshops were developed, following a consultation phase with critical stakeholders, to provide hands-on training in how to identify and perform destruction on AHB swarms and nests. These training sessions also helped to identify what other tools were needed for each stakeholder group for the ongoing management of AHB. Training workshops were offered to critical stakeholders in northern Queensland.

Evaluation of the workshops identified the following tools to be developed, which are now available for download from the Biosecurity Queensland website (www.biosecurity.qld.gov.au):

- Video footage of nest and swarm management – *Asian honey bee destruction techniques for industry use* (available on YouTube).
- A step-by-step guide on swarm and nest management - *Guideline for industry - destroying swarms and nest of Asian honey bees*.
- An information sheet for businesses to distribute to the community - *Asian honey bee* fact sheet.
- Improved online resources including a complete overhaul of website information to be more interactive with the stakeholder and improved identification material.
- Information for the transport industry that could be displayed in tearooms, depots, ports and possibly in vehicles and vessels to build awareness about the importance of not moving bees – *Check your load* poster.

Further information can be found in the report *An evaluation of Asian honey bee workshops conducted in the known infested area for critical stakeholders*.

Customer journeys developed for website

Customer journeys were developed and improved, e.g. during training workshops provided to critical stakeholders, with attendees providing feedback on the website, its usability and their journey to find information. This feedback was considered and incorporated when revitalising the web pages to make them more stakeholder-friendly, interactive, easy to access and provide clear pathways to find information.

Develop a comprehensive strategy to manage the cessation of government funding of transition by June 2013, underpinned by a significant engagement and communications plan

The *Asian honey bee Transition to Management Program Communication and Community Engagement Strategy* (November 2011) and *Asian honey bee Transition to Management Cessation Strategy* were developed to identify and set targets to be achieved through the transition phases from eradication to management.

2. Control measures for AHB (AG2)

Control measures to manage AHB in a range of urban, business and rural situations were investigated in project AG2. Key outcomes are summarised below.

Desktop review to better understand AHB and how others manage AHB

To better understand AHB, and how others manage AHB, a preliminary review of the literature was conducted. In addition, nest and swarm characteristics of 486 detections were analysed. Results were published in *Asian honey bee (Apis cerana javana) in Cairns, Far North Queensland foraging, nesting and swarming behaviour Report of field observations April 2007 – September 2011 in March 2012*.

This desktop review was followed by an extensive literature review as well as an analysis of 807 nests and swarms detected between 2007 and early 2013 (see below in AG2 and AG3).

Develop integrated control strategies for different industries to minimise impacts of AHB, including identifying any off-target impacts (especially the balance between AHB and commercial European honey bee in the same environment to minimise impact on honey production)

Efficacy of detection and destruction methods that had previously been used in the Program was determined (see below). The most appropriate detection and destruction methods for different situations were identified. The balance of AHB and EHB within the same environments was established in the above mentioned behaviour reports, and tipped in favour for EHB. Four times as many EHB than AHB were found with EHB successfully outcompeting AHB.

Validate the efficacy of detection and destruction methods and strategies as essential elements of deploying different control methods

Efficacy of detection and destruction methods that had previously been used in the Program was determined, and results reported in *Detection efficacy of Asian honey bee (Apis cerana) in Cairns, Australia* and *Destruction efficacy of Asian honey bee (Apis cerana) in Cairns, Australia*. The detection efficacy report identified strengths and weaknesses of individual techniques. For instance, Rainbow bee-eater pellet analysis was found to be excellent for determining the presence or absence of AHB in a general area, but it was found to be poor

for detecting AHB nests. The destruction efficacy report similarly identified strengths and weaknesses of different detection techniques. For instance, flying insect killer was good for killing some nests but poor at killing nests in wall cavities that were difficult to access. Permethrin dust was more effective in these instances.

Practical guides for the detection and destruction of AHB were also developed, i.e. *Guideline for industry - Destroying swarms and nest of Asian honey bees* and *Asian honey bee manual: Techniques for identification, detection and destruction*. These guides will assist biosecurity agencies, industry and other affected parties deploy effective detection and destruction techniques for AHB.

Determine the timing of implementing these methods and strategies to maximise the effectiveness of control methods

Scientific research was conducted throughout the Program and continued until the end of the Program. Determining the timing of implementation of the methods and strategies developed during the program will be highly dependent on the rate of spread of AHB to other parts of Australia and the location and frequency of any new incursions of AHB.

Understand AHB behaviour to better inform development of targeted control measures

An extensive literature review sourced and reviewed 448 scientific journal articles and published reports. It summarised the findings of research previously conducted on AHB. No research was published on Australian AHB, and the majority of Asian research focussed on temperate AHB.

The Asian honey bee (Apis cerana) and its strains – with special focus on Apis cerana Java genotype – Literature review highlighted that AHB differs from EHB in that it is generally smaller, lives in smaller colonies, nests in smaller cavities (often in non-natural structures), and has a smaller foraging range. AHB also display greater hygienic behaviour, making them more disease resistant and enabling them to coexist with *Varroa* mites. AHB is regarded as an excellent crop pollinator in Asia including playing an important role in the pollination of both wild and native flora. While AHB are successfully kept in hives for honey production, they produce distinctly less honey than EHB. Interestingly, the review indicates that as Asia shifts towards keeping EHB due to their capacity for greater honey production relative to AHB, dramatic declines (and sometimes local extinction) of AHB have occurred due to mating interference and competition for floral sources.

In addition, the *Ecology and behaviour of Asian honey bees (Apis cerana) in Cairns, Australia* report advanced the existing scientific knowledge of AHB nesting and swarming characteristics, floral visitation, foraging times, drone flight times and competition with EHB in the Cairns region. Two opportunities to develop novel measures to either control AHB or mitigate the potential adverse effects of exotic bee pests and diseases were identified: (1) the possibility to use mating interference between EHB and AHB to potentially suppress the expansion of AHB within Australia, and (2) the capacity to exploit selective breeding of EHB strains for increased resistance to *Nosema ceranae* fungus that is already present in Australia and for *Varroa jacobsoni* and *V. destructor* mites that may accompany future introductions of AHB.

Determine effectiveness of bait stations, their design and attractant effectiveness

Successful control of any introduced species requires methods that allow quick detection, followed by control/destruction. In terms of AHB, a successful attractant is needed in order to attract foragers, which can then be bee-lined to their nest. No such attractant was available.

A range of different attractants and trap designs were trialled, and results reported in the Program reports *Bee trap efficacy* and *Optimising AHB bait/feeding station design & attractants*. No trap designs were satisfactory although simple bottle traps did trap some AHB. No attractants were successful, or species-specific, except for the orchid *Cymbidium floribundum.* This orchid is native to Japan and has been used there to lure swarms into hive boxes. In the Cairns trial, the orchid flowers had an immediate attraction to AHB workers. Dr. David Guez has been engaged to further pursue this research in a project funded jointly by the Rural Industries Research and Development Corporation (RIRDC) and AHBIC.

Investigate alternative control techniques and attractants

See above, "*Determine effectiveness of bait stations, their design and attractant effectiveness*".

Finalise development of remote poisoning

Between February and June 2012, 19 remote treatment trials with fipronil-laced sugar syrup were conducted on 15 AHB nests. The treatments showed that fipronil was effective at suppressing and killing individual AHB colonies as long as more than 20% of bees (relative to nest entrance activity) took fipronil back to the nest. The percentage of bees taking back fipronil relative to the nest entrance activity was the best predictor of treatment success.

Remote nest treatment was found not to be an efficient and successful means to kill exotic bees for several reasons: (1) treated nests did not always die; (2) treatments required extensive person-hours to conduct (average of 93 hours per treatment); (3), unacceptable risk to non-target species, and (4) the necessity to locate the nest in order to determine treatment success.

Results were reported in *Asian honey bee (Apis cerana) remote nest treatment - Final report*.

Tomato dust – a potential control to be researched and validated

The SAG recommended[3] and the TMG approved that this research not be progressed.

Nectar analysis – analysis of nectar that AHB is foraging on to identify potential attractants for use in trap

The SAG recommended[4] and the TMG approved that this research not be progressed.

Research into pheromone use to attract and/or detect AHB in order to increase trap sensitivity

As part of determining the effectiveness of bait stations, their design and attractant effectiveness, several different pheromone lures were trialled. Two *A. cerana* Java genotype queen mandibular pheromone (QMP) lures (5-component[5] and 6-component[6]; synthesised by Michael Lacey, CSIRO) were trialled as well as synthesised 9-ODA (QMP component) sourced from Prof. Ben Oldroyd. The synthetic 5-QMP lure was more attractive to AHB than 6-QMP, and 9-ODA attracted some AHB drones.

3. Limiting impact on honey industry (AG 3)

Project AG3 key outcomes overlapped greatly with AG2 outcomes. AG2 investigated general control measures for AHB whereas AG3 investigated control measures with a focus on

[3] SAG meeting 3, 19 January 2012.
[4] SAG meeting 3, 19 January 2012.
[5] 5-component queen mandibular pheromone
[6] 5-component queen mandibular pheromone plus sting venom pheromone (Eicosanol)

limiting the impact of AHB on the honey industry. In effect, AG3 was an extension of AG2, and all outcomes from AG2 also apply to AG3.

It is important to note here that no negative impact of AHB on EHB or EHB honey production has been observed or reported throughout the Program. On the contrary, projects in AG2 have shown that EHB appear to negatively impact AHB. Therefore, general control strategies from AG2 were also deemed appropriate for the honey industry.

AHB behaviour research is critical to identify elements of differential control of AHB and European honey bees in the context of honey production. Developing an understanding of AHB behaviour will guide development of targeted control measures through:

Literature review and engagement with apiarists in the Cairns area who have had experience with both honey bees

Analysis to understand what is known and not known about AHB in relation to mating, behaviour, foraging habits, weather impacts, etc

Compare the behaviour between AHB and EHB to identify opportunities that support differential controls

These key outcomes overlapped greatly with each other as well as with AG2 key outcomes. They were addressed by conducting an extensive literature review (*The Asian honey bee [Apis cerana] and its strains – with special focus on Apis cerana Java genotype – Literature review*) as well as research into the ecology and behaviour of AHB (*Ecology and behaviour of Asian honey bees [Apis cerana] in Cairns, Australia*).

Experiments, observations and the literature review shed light on AHB mating biology. This research will continue past the end of the Program through Prof. Ben Oldroyd's research. AHB behaviour, foraging habits, floral preferences, climatic and temporal fluctuations, as well as a comparison of AHB/EHB behaviour were reported in *Ecology and behaviour of Asian honey bees (Apis cerana) in Cairns, Australia*. The most notable finding was that EHB appear to be outcompeting AHB on floral sources and that EHB is a superior robber and fighter when compared to AHB.

Engagement of apiarists in the Cairns region included attendance of AHB T2M team members at monthly Cairns and Tableland Beekeeping Club meetings, as well as some Townsville Beekeeping Club meetings. Cairns and Tableland Beekeeping Club members were involved in establishing a liaison committee at a local and state level. Information and training sessions were delivered to both the Cairns and Townsville Beekeeping Clubs in order to extend AHB identification, detection and destruction skills as well as for Program and Science updates. In addition, AHB knowledge and concerns were gauged through two surveys specifically aimed at Cairns and Townsville beekeepers. Results (presented in *North Queensland Apiarist Survey Report*) showed that local beekeepers were not concerned about the current AHB incursion, but were greatly worried about new incursions that may introduce new bee pests and diseases in the future.

Development of management strategies

Based on outcomes of Project 2, develop and test management strategies targeted at limiting impact of AHB on honey production in areas where AHB is established

This project overlapped greatly with the previous AG2 as well as AG3 outcomes. Due to the fact that no negative impact of AHB on EHB or EHB honey production has been observed or reported throughout the Program, no specific strategies were developed. Rather, general detection and destruction methods established in AG2 also apply to the honey industry.

Model the population dynamics and drivers of spread as they impact on the management of EHB hives

A stochastic, cellular automaton model was designed to simulate the spread and control of AHB in north Queensland. It incorporated short distance spread and long distance jumps, estimated habitat suitability for AHB, as well as a probability that AHB would be found and destroyed. When using input parameters for long distance dispersal of 60 km and control effectiveness of 95%, and starting the simulation in 2007, the predicted spread for 2012 somewhat matched the actual 2012 spread. Unfortunately, a 'glitch' in the model was apparent. Due to this 'glitch', any predictions made by the model need to be taken with utmost caution, and it is advised to disregard any output of the model until it is repaired.

A detailed spatial analysis of the spread of AHB between 2007 and 2012 was conducted, including stages of spread and spread rates. Interestingly, the rate of spread seemed to have slowed from 2010 onwards, which may be due to reduced surveillance efforts and/or AHB coming across climatic or other barriers to spread. Results can be found in *Asian honey bee Transition to Management Program, Spread of Apis cerana in Australia, 2007 – 2012.*

Develop technology to assist industry to mitigate AHB impacts

Stakeholder and industry engagement identified no further needs and priorities for technology development than those already identified.

Develop PCR testing to more quickly detect the presence of AHB in trap syrup etc as indicators of the need for management of European honey bee hives

Polymerase Chain Reaction (PCR) technology was employed to investigate whether DNA left behind in AHB trap syrup and Rainbow bee-eater pellets could be detected, which would negate the necessity to trap whole bees, as well as manually examine bee-eater pellets. Results can be found in *Detection of Apis cerana DNA from bee eater pellets and trap liquor* and *Detection of Apis cerana DNA from sugar syrup*.

Proof of concept was shown for both methods, which could lead to a molecular AHB surveillance program in far north Queensland if these methods are further developed and refined.

In addition, a different molecular genetic technique (microsatellites found in nuclear DNA) was tested in a preliminary study to determine whether AHB in Cairns descended from one or several incursions, and to pinpoint their country of origin. The preliminary study showed that AHB in Cairns are descendants from one single incursion, but the country of origin could not be ascertained given the small sample size. Results are reported in *May 2012: Short study of microsatellite alleles in Asian honey bees sourced from PNG/Solomon Islands and north Queensland: summary of data interpretation*. Following advice from the SAG[7] this work was not continued.

Develop approaches with the honey industry for adoption and implementation of management strategies

The Program liaised closely with the honey industry at a local, state and national level to ensure that research findings, management tools and other relevant information was extended. This was done through:

- a liaison committee at the local and state level
- Program team members participating in local beekeeping club meetings

[7] SAG meeting 6, 12 July 2012.

- information and training sessions delivered to Cairns and Townsville beekeeping clubs
- liaising with local beekeepers for research projects
- conducting a survey to gauge local apiarists' knowledge and concerns about AHB
- provision of an article for distribution to various industry publications
- delivering a public lecture on the science achievements of the Program ('*What we know about Asian honey bees in Queensland*', conducted in Cairns on 6 June 2013).

4. Limiting impact on natural environments (AG 4)

Engagement with indigenous communities and environment sectors

This project overlapped greatly with AG1. Indigenous communities and stakeholders from the environment sector were included in all Community Engagement activities listed in AG1.

Additional engagement included:

- Participation in forums such as the Cape York Peninsula Pest Advisory Committee, Far North Queensland Pest Advisory Forum, and Joint Operations Group (JOG) meetings with North Australian Quarantine Strategy (NAQS) staff.
- Presenting Program and science updates at scientific committee meetings held by the Wet Tropics Management Authority.
- Delivering a public lecture on the science achievements of the Program ('*What we know about Asian honey bees in Queensland*', conducted in Cairns on 6 June 2013).

Utilise tools and strategies developed for control measures (Project 2) and limiting impact on honey production (Project 3)

The detection and destruction methods that were evaluated in AG2 and AG3 are also applicable for AG4. These methods have been extended to traditional owners and environmental stakeholders through the above mentioned channels (listed in A1, AG3 and AG4).

5. Optimising early detection of new AHB incursions (AG 5)

The NAQS group, a part of ADAFF, played a key role in this part of the Program and provided significant resources to assist. The main focus of responding to new incursions is to find nests in order to destroy them and to check bees and comb for pests and diseases. Some detection methods were found to be better than others when needing to find nests (see AG2), and some are more appropriate to use in high-risk areas such as ports.

The SAG advised[8] that the establishment of bee free zones was not practical. Through discussions between NAQS and QDAFF it was decided that the term 'High Intensity Surveillance area' was more appropriate. NAQS conducted a separate detection efficacy trial in the High Intensity Surveillance area around the Cairns sea port.

The Program conducted a pathway analysis for long distance spread of AHB: *An analysis of movement controls and compliance for the Asian honey bee incursion in Cairns including a strategy to minimise the spread of Asian honey bee through pathways, 2012 – 2013.*

[8] SAG meeting 1 23 November 2011 and SAG meeting 6 12 July 2012

Conduct differential sensitivity testing to determine the comparative effectiveness of all available detection methods e.g. sentinel hive strategy vs. strategic sampling of surveillance traps

In the Cairns Port area, all detected nests and swarms are destroyed and then checked for exotic bee pests and diseases, as swarms and nests found in this area may be from a new incursion. NAQS conducted a surveillance trial restricted to the High Intensity Surveillance area. Any nests or swarms collected by the Program were provided to NAQS for this trial. Results showed that floral observations were not sufficient in finding enough nests for effective emergency pest and disease detection. Public reporting was also evaluated.

The Program's Science team also determined the comparative effectiveness of all available detection methods, but independently to NAQS and outside the High Intensity Surveillance area so as not to interfere with the NAQS trial. Results have been detailed in AG2 above and can also be found in the report *Detection efficacy of Asian honey bee (Apis cerana) in Cairns, Australia*.

Determine efficacy of surveillance strategies and techniques to determine likely detection rate in bee free zones and around ports in the context of established AHB populations

Efficacy of surveillance strategies were determined and reported in *Detection efficacy of Asian honey bee (Apis cerana) in Cairns, Australia*, which included a discussion on which methods were most appropriate in high risk areas (e.g. floral observation and public reporting) and which methods would not be suitable (e.g. Rainbow bee-eater surveillance).

NAQS investigated and reported on resource models for floral surveillance as well as public reporting as a detection method for AHB in a high-risk port area, using QDAFF staff and indigenous rangers. This included assessing the efficacy of joint operations between QDAFF and NAQS to convert, bee-line, find and collect AHB nests. Through this work, NAQS then developed a document to guide staff tasked with surveillance for new AHB incursions in an environment where AHB are already established.

Establish a strategy for laboratory analysis of AHB detections within bee free zones and around ports as an early detection strategy for any new incursions that could carry mites or viruses

All AHB detections were routinely tested for presence/absence of mites and bee diseases. No mites were detected during the term of the Program. The NAQS group investigated and established their own laboratory techniques to check nest material and swarms for parasitic mites.

Partner with the Northern Australian Quarantine Strategy (NAQS) program of DAFF to develop integrated operations focused on early detection of new AHB incursions and any quarantine pests that they may carry

Liaison between NAQS and QDAFF involved meetings throughout the Program. NAQS and QDAFF collaborated on surveillance options for the Cairns air and sea port areas. The Biosecurity Queensland policy *Responding to public notifications of Asian honey bee* was implemented and is working with good cooperation between ADAFF and QDAFF, e.g. Townsville detection January 2013.

In addition, it is envisaged that the *Asian honey bee manual: Techniques for identification, detection and destruction of Apis cerana* will be used by biosecurity agencies involved in either responding to a suspect new incursion of AHB or trying to prove an area is free of AHB.

6. Critical intervention to limit long distance spread (AG 6)

Measures to reduce the long distance spread of AHB have been maintained throughout the life of the Program. These measures will continue post 30 June 2013 through the Biosecurity Queensland apiary program. An analysis of the pathways and risk of potential spread of AHB was conducted with a view to minimising long distance spread through transport vectors (see AG5 above).

Maintain existing movement controls for an interim period and collect information on their efficacy, cost, compliance etc.

A Restricted Area for AHB remains in force around Cairns and movement licenses are required to move bees into the area or to move bees, bee products or beekeeping equipment within or out of the area. The Restricted Area will remain in place until issues associated with the export trade in live bees are resolved.

The process for applying for movement licences was enhanced to remove the requirement for apiarists to apply for multiple licences throughout the year. Apiarists can now be granted an annual licence to move bees, bee products and equipment within the Restricted Area.

Conduct pathway analysis to better understand likely pathways and potential for spread through pathways implicated in the long distance spread of AHB with a primary focus on effective strategies to minimise long distance spread through transport vectors

A pathway analysis was conducted. It identifies likely pathways and potential for long distance spread of AHB and may inform future development of biosecurity plans: *An analysis of movement control efficiency and compliance for the Asian honey bee incursion in Cairns including a strategy to minimise the spread of Asian honey bee through pathways, 2013 – 2013*.

Implement operations to minimise spread through those pathways, including developing bee free zones around transport hubs, ports, etc and review and revise their efficacy after one year

The SAG advised[9] that the establishment of bee free zones was not practical. Instead 'High Risk areas' were established. Consultation with transport industries identified: (1) the impracticality of putting restrictions on these transport modes, and (2) that the use of education, training and public awareness was the most practical way to minimise spread. An awareness campaign built around "Check your load" was implemented, including a poster distributed throughout north Queensland (including high risk transport hubs[10]), published articles, attendance at Transport Workers Union (TWU) meetings, and updated web information, to increase the awareness of transport bodies to not aid the spread of bees. To date, no instances of long-distance transportation of AHB out of the Restricted Area have been detected.

Work with transporter businesses in the development of monitoring systems, providing training in the recognition of AHB and what to do when AHB is suspected

As the transport industry was identified as a critical stakeholder, any extension identified in AG1 was also extended to this industry. The "*Check your load" poster*[11] mentioned above reinforced the message not to move bees.

[9] SAG meeting 1 23 November 2011 and SAG meeting 6 12 July 2012

[10] Posters were distributed to 240 transport businesses around Cairns and 26 transport business in the Townsville region.

Review the Varroa mite management plan and revise, as appropriate

Biosecurity Queensland reviewed the document '*A honey bee industry and pollination continuity strategy should Varroa become established in Australia – May 2011'*. Queensland has been strengthening its research work under the Program while also enhancing preparedness for pest bees and bee pests through a range of other activities that form the 'Queensland Bee Surveillance Program'. These activities are aligned with the recommended actions in the continuity strategy.

7. Protecting Queensland's social amenity and public assets (QG 1)

The Program has continued to protect Queensland's social amenity and public assets while educating and training the community and other key stakeholders to accept and learn to live with AHB. The Program has developed and implemented a strategy to cease government intervention (the *Cessation Strategy*), while at the same time preparing Biosecurity Queensland officers to respond to notifications of AHB or other pest bees and bee pests.

Contain AHB to the vicinity of known infested area

The AHB known infested area (KIA) has spread over time but spread has slowed considerably post 2010 and during the two years of the Program. Details of the spread of AHB since its arrival in Cairns in May 2007 can be found in *Asian honey bee Transition to Management Program, Spread of Apis cerana in Australia, 2007 – 2012.* Destruction of any nests or swarms reported within 10km either side of the edge of the KIA, or outside the KIA have been a priority during the Program to minimise the risk of further spread.

Suppress AHB infestations in strategic areas

Although suppression of AHB infestations in the KIA ceased in December 2012, it continued at high risk port areas and transport centres beyond this date. Suppression has continued on the edge of the KIA and will continue past the completion of this project in accordance with the '*Responding to public notifications of Asian honey bee*' policy as part of Biosecurity Queensland's ongoing bee-related activities.

Destroy AHB infestations around edges of infested area and in areas with high social amenity value

The Program responded to public reports of AHB on the edge of the KIA through until the end of the Program. Biosecurity Queensland will continue to respond to AHB reports in accordance with the Biosecurity Queensland '*Responding to public notifications of Asian honey* bee' policy.

Conduct surveillance to determine extent of infested area

Surveillance occurred throughout the life of the project and was documented in quarterly reports that are available on the Asian Honey Bee Transition to Management Program website (www.asianhoneybee.net.au). Surveillance for AHB and other bee pests and diseases will continue past the cessation of this Program as part of the Queensland Bee Surveillance Program.

There have been 831 detections of AHB nests and swarms since May 2007. The area of the KIA was 522,122 hectares as at 30 June 2013.

A map of the KIA as at 30 June 2013, including all known detections of AHB, is included at the end of this report.

8. Improving operational efficiency and effectiveness (QG 2)

Throughout the Program research results guided improvements to operational efficiency and effectiveness.

Quantify efficacy of current operational techniques

Efficacy of current operational techniques was analysed and reported in *Detection efficacy of Asian honey bee (Apis cerana) in Cairns, Australia* and *Destruction efficacy of Asian honey bee (Apis cerana) in Cairns, Australia* (see also AG2).

Review of efficacy of odour detection dog surveillance. With eradication no longer being the focus of the program, determine whether odour detection dog is a cost effective operational tool

Efficacy of odour detection dog surveillance was conducted and reported in *Asian honey bee Odour detection dog review* as well as in *Detection efficacy of Asian honey bee (Apis cerana) in Cairns, Australia*. Use of the detector dog had advantages and disadvantages. However, it was deemed ineffective as a long term surveillance tool for AHB as the majority of surveillance was in open urban or rural areas where human surveillance was more efficient and effective. Use of the detector dog ceased in 2011 but during its evaluation the dog successfully detected 47 AHB nests (42 trial nests and 7 new nests. Use of detector dogs for AHB and other exotic bee surveillance may be appropriate in some situations or environments. For example, areas that are difficult or dangerous for people to access or to sight nests and swarms (e.g. ports, ships, container storage areas and transport hubs) are well suited to use of the detector dogs. However, the cost of training and maintaining the dog is likely to outweigh the benefits of their use for bee surveillance.

Undertake spatial analysis of current AHB infestation to guide to future surveillance activities

Details of AHB spread are reported in *Asian honey bee Transition to Management Program, Spread of Apis cerana in Australia, 2007 – 2012.* As at October 2012, the AHB KIA covered 490 685 hectares. Average spread rates were found to be between 1.42 and 1.86 km/month depending on the method used. However, the actual spread of AHB did not match the spread estimates based on the average spread rates. This may be due to several factors: (1) the spread has indeed slowed, or (2) it has come across climatic or other boundaries (e.g. the western edge may be becoming too dry), or (3) it is an artefact of reduced surveillance along the increasing (and less populated) edge of the KIA.

Undertake spread analysis of current AHB infestation to guide future management strategies

Details of AHB spread are reported in *Asian honey bee Transition to Management Program, Spread of Apis cerana in Australia, 2007 – 2012.*

Undertake technical analysis of all nests and honeycomb to guide the spread and spatial analysis

A detailed analysis of all extractable nests and honeycomb was conducted, including information such as comb length, width and thickness; comb mass; comb area; number of cells containing honey and pollen; number of queen cells/cups, drone cells and worker cells; number of empty cells; diameter of queen cells/cups, drone cells and worker cells; and mass of all bees collected from a nest. Results clearly showed that AHB nests (and swarms) in Cairns were substantially smaller than AHB nests in tropical Asia. Details are reported in *Ecology and behaviour of Asian honey bees (Apis cerana) in Cairns, Australia*.

Post Transition to Management

The primary goal of the Program was to transition from a state of AHB eradication to long term community and industry management of the pest bee. The Program was conducted acknowledging that the bee will continue to spread and become established within urban and rural areas of Australia where the environment favours its survival.

As of July 2013, government management of the established population of AHB around Cairns has ceased following the achievement of key objectives under the AHB Transition to Management Plan. From 1 July 2013, the community and relevant industries are capable of playing their part in managing the impacts of AHB.

A number of research and development projects were commenced during the Program and a number of these will continue through 2013-14. Projects are underway on opportunities to further reduce the incidence and impact of bee pests and diseases and build capacity to apply research findings through extension and education. Organisations including the Rural Industries Research and Development Corporation, Commonwealth Scientific and Industrial Research Organisation and Horticulture Australia Limited are delivering this research.

Governments remain committed to managing the health status of EHB. The Australian Government will continue to respond to incursions of exotic bee pests through its surveillance activities at the border and under the Northern Australia Quarantine Strategy (NAQS).

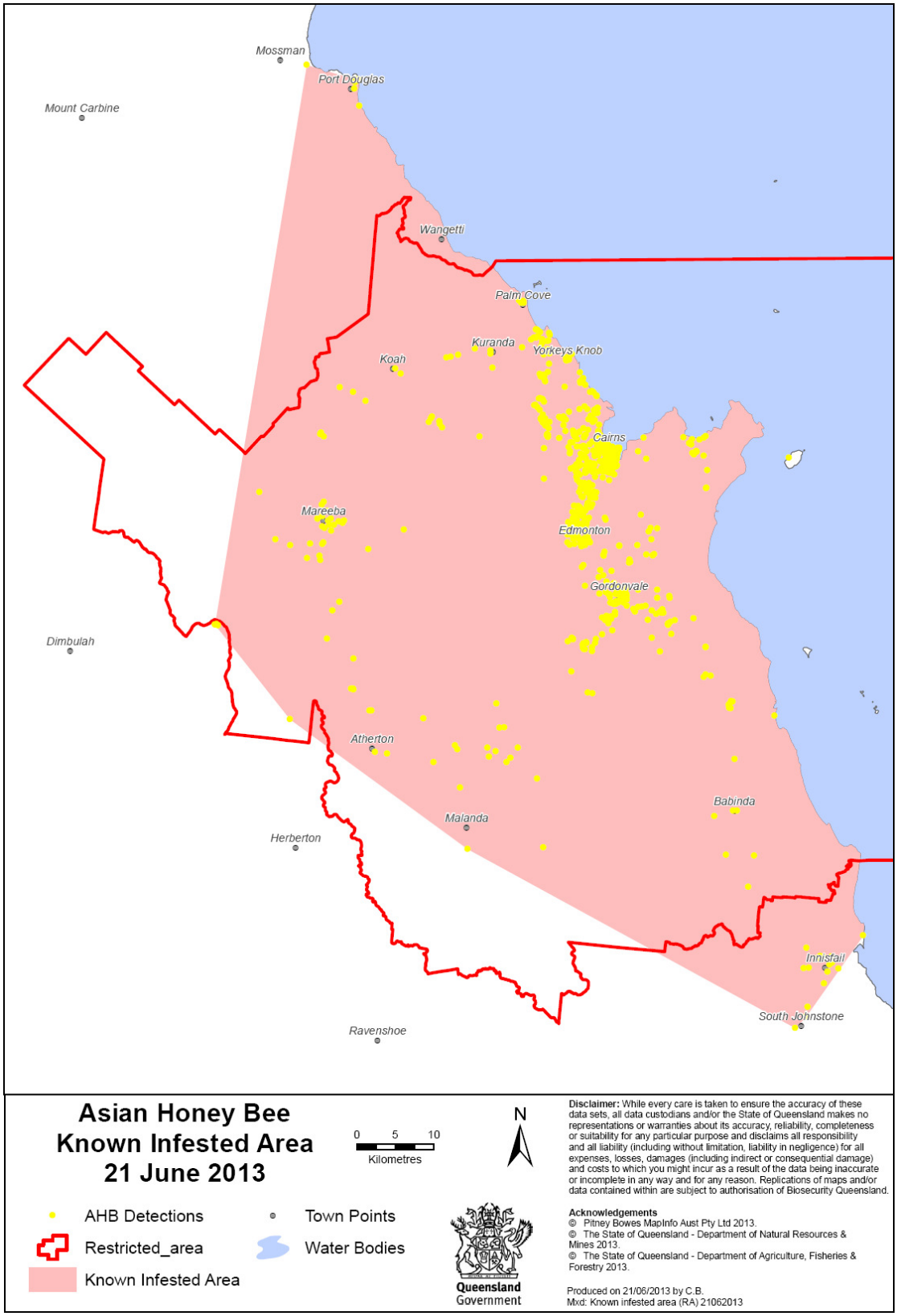
Surveillance is an ongoing priority and ADAFF, Horticulture Australia Limited and the AHBIC are contributing funding to the National Bee Pest Surveillance Program. This initiative builds on its predecessor, the National Sentinel Hive Program, and provides an early warning system to detect new incursions of exotic bees and bee pests such as *Varroa*, *Tropilaelaps* and tracheal mites. An expanded network of sentinel hives has been established at locations considered high risk throughout Australia. Hives are monitored at two month intervals with targeted surveillance at the three highest risk areas in each jurisdiction. This program will also implement new surveillance techniques and provide improved data management capability.

A focus for this national program is improved integration with the Queensland Government and Queensland Beekeepers' Association Queensland Bee Surveillance Program. This program includes early detection of new incursions of AHB and other bee pest and diseases through monitoring high risk areas such as ports and land areas at greater risk of receiving or transporting pest bees and bee pests. Laboratory diagnostic support for these programs is provided through Australian and Queensland government laboratories.

Plant Health Australia facilitates emergency preparedness activities including implementation of the *Honeybee industry and pollination continuity strategy should Varroa become established in Australia* and arrangements with industry and government members to support responses to new incursions under the *Emergency Plant Pest Response Deed*.

The Australian Government will continue to manage international market access negotiations with bee industry trading partners.

AHB Known Infested Area as at 21 June 2013



Reports and other key documents produced during the AHB T2M Program

The following reports, documents and communications material were created during the two years of the AHB T2M Program.

All reports and other key documents produced by the Program are available for download from the Asian Honey Bee Transition to Management Program website (www.asianhoneybee.net.au) maintained by Plant Health Australia or by contacting the Queensland Department of Agriculture, Fisheries and Forestry (details are included on the back page of this report).

Community Engagement

Asian honey bee Fact Sheet

Guidelines for industry - Destroying a swarms and nests of Asian honey bees

An evaluation of Asian honey bee workshops conducted in the KIA for Critical Stakeholders

Asian honey bee Transition to Management Program Communication and Community Engagement Strategy

Destruction techniques for Industry use – YouTube video

Asian honey bee manual: Techniques for identification, detection and destruction of Apis cerana

Ross-Reid, B, Foley, B, et al. (2013). North Queensland apiarist survey report. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Operations

Gilmour, R. Bell, C.; Docherty, G. (2012) Asian honey bee Odour Detection Dog Review. Department of Employment, Economic Development and Innovation. Cairns

An analysis of movement controls and compliance for the Asian honey bee incursion in Cairns including a strategy to minimise the spread of Asian honey bee through pathways, 2012 – 2013

Asian honey bee Surveillance Report: July–December 2011, January–March 2012, April–June 2012, July–September 2012, October–December 2012, January–March 2013, April–June 2013

Program management including policy

Asian honey bee Transition to Management Program, Biosecurity Queensland Work Plan to Deliver T2M Projects

Asian honey bee Transition to Management Program, Biosecurity Queensland Work Plan to Deliver T2M Projects, Progress Report at 31 January 2012

Monthly Asian honey bee Transition to Management Program, Progress Summary Report 2012-2013

Asian honey bee Transition to Management 2011 – 2012 Report

Asian honey bee Transition to Management – Cessation Strategy

Policy documents included:

- Responding to public notifications of Asian honey bee
- Responding to public notifications of bee pests and pest bees other than Asian honey bee

Science

Commerford, M. M. and A. H. Koetz (2013). Ecology and behaviour of Asian honey bees (*Apis cerana* Java) in Cairns, Australia. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Commerford, M. M., N. Wittmeier, et al. (2013). Optimising Asian honey bee (*Apis cerana*) trap design and attractants. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Hyatt, S. (2011). Asian honey bee (*Apis cerana javana*) in Cairns, Far North Queensland: Foraging, nesting and swarming behaviour - Report of field observations April 2007 - September 2011. Department of Employment, Economic Development and Innovation. Queensland.

Koetz, A. H. (2013). The Asian honey bee (*Apis cerana*) and its strains - with special focus on *Apis cerana* Java genotype - Literature Review. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Koetz, A. H. (2013). Detection efficacy of Asian honey bees (*Apis cerana*) in Cairns, Australia. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Koetz, A. H. (2013). Spread of *Apis cerana* in Australia, 2007 – 2012. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Koetz, A. H. and S. Hyatt (2013). Asian honey bee (*Apis cerana*) remote nest treatment. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Koetz, A. H. and J. C. Scanlan (2013). Asian honey bee spread modelling. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Wittmeier, N. (2013). AHB nest & swarm analysis: A guide for laboratory use. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Wittmeier, N., S. Hyatt, et al. (2013). Destruction efficacy of Asian honey bees (*Apis cerana*) in Cairns, Australia. Asian honey bee Transition to Management Program, Department of Agriculture, Fisheries and Forestry (DAFF). Queensland.

Detection of *Apis cerana* DNA from bee eater pellets and trap liquor

May 2012: Short study of microsatellite alleles in Asian honey bees sourced from PNG/Solomons and north Queensland: Summary of data interpretation

Detection of *Apis cerana* DNA from sugar syrup. Internal report to the Asian honey bee Transition to Management Program

Progress updates:

Asian honey bee Transition to Management Science projects – Progress update November 2012

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