MANAGED POLLINATORS IN COMMERCIAL AGRICULTURE
The case of South Africa

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Pollination in SA

• 3 biodiversity hotspots! (Cape: ~9,000 plant species, 70% endemism)
• Pollination of native plants ~83% of Fynbos plants are insect pollinated; large specialisation in Succulent Karoo – monkey beetles
• SA authors contributed ~4% of the world total of 5432 papers published in pollination biology over 2004-2009. But relatively few families, new plant-pollinator interactions discovered regularly.
• It is estimated that honeybees are pollinators for approximately 60% of flowering plants in South Africa
Pollinators of South African Crops

Honeybees are very important pollinators. Of the >1 000 known species of bees in southern Africa, one is the honeybee, *Apis mellifera*. Two subspecies have been recognized. A large amount of the pollination of cultivated crops and wild plants occurs in the winter months. These indigenous honeybees are the most important pollinators of many South African crops. They are adapted to the local climate and are able to supply the commercial pollination service for our large crops. Honeybees, in particular, are different from many other pollinators, including the honeybee, which enables them to visit many plants in a large area. Honeybees are under threat for a variety of reasons:
- Pests and diseases such as varroa mites and American foulbrood
- Intensive beekeeping
- Being confined to growing in low densities within urban areas to evade the pollinator services
- A series of local management practices with vector control and pest sprays.

Did you know:
“You can thank a pollinator for one out of three bites of food you eat!” 60% of global food production volume comes from crops that do not depend on animal pollination (e.g. wheat, maize, and rice—so-called ‘ staple’ foods): 35% from crops that depend on pollinators, and 5% are domesticated. But also remember: most comes from animals that eat plants—some of which require pollination by pollinators?

Know your veg!
Pollination requirements of vegetables can be categorized according to what part of the plant is eaten:
- If the ‘vegetable’ in a fruit—then pollination is required both for the production of the vegetable AND for seed production, e.g. tomatoes, peppers, and pumpkins.
- If the ‘vegetable’ is in the form of leaves or shoots (e.g. lettuce, cabbage, and broccoli) or in a ‘storage root’ (e.g. carrots and beetroot) then pollination is not required or desired for the production of the vegetable ONCE for seed production.
- If the ‘vegetable’ is a ‘storage stem’ then pollination is not required for either the production of the organ and seed—because seed is not required for propagation, e.g. potatoes and Brussels-sprouts.
…therefore honeybees…

- Our farms are too big and only need pollination for brief periods in a very intense manner. Most farms not able to obtain adequate pollination ES from the surrounding natural vegetation.
- SA’s commercial agriculture is almost solely reliant on an indigenous, commercialised honeybee species.
- The sustainability of pollination ES in SA requires an understanding of how managed honeybees utilise resources across landscapes (regional scale ES: forage and swarm trapping).
Honeybees in SA (Allsopp)

- Two sub-species: *Apis mellifera capensis* and *A.m. scutellata*
- Both good pollinators, especially if handled correctly
- Wild & managed populations same ← because indigenous
  Trapping + absconding!
- Limited honey production – we import. Marginal bee country
- Beekeeping is a highly managed & migratory system (~2,000km following honey flows!)
- 87% of colonies in W. Cape used for commercial pollination (~60k units)
- SA honeybees not experiencing same dramatic declines as Europe and N. America, but signs of stress in SA honeybees (over-worked, insufficient forage, pollution, diseases, *Capensis* issue, vandalism, etc).
**Natural System**

Wild Pollinators
Direct Ecosystem Service
Habitat for pollinators adjacent to crops

Crop production reliant on insect pollination

Managed Pollinators
Man-made Service
Managed beehives hired during flowering period

Indirect Ecosystem Service
1. Vegetation for forage
2. Replenishing colonies

Managed by Mouton et al in prep.
But how to manage these resources?

Nectar – energy
Pollen – protein

“How much do we have and how much do we really need?”

Current size of each forage slice
Securing and enhancing
Usage patterns and availability
Alternatives and/or replaceability?
Promoting importance & management

Indigenous natural veg
Weeds
Cultivated crops
Exotics / aliens
<table>
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<tr>
<th>Category</th>
<th>EC</th>
<th>FS</th>
<th>GP</th>
<th>KZN</th>
<th>L</th>
<th>MP</th>
<th>NC</th>
<th>NW</th>
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<td>5</td>
<td>36</td>
<td>17</td>
<td>37</td>
<td>6</td>
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<td>6</td>
<td>71</td>
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<tr>
<td>Total # of Beekeepers</td>
<td>1780</td>
<td>210</td>
<td>1522</td>
<td>5448</td>
<td>1598</td>
<td>1977</td>
<td>5562</td>
<td>1361</td>
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<td>Forage use (Total per province)</td>
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<td>Eucalyptus</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>8</td>
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<td>Crop plants</td>
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<td>1</td>
<td>13</td>
<td>10</td>
<td>8</td>
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<td>4</td>
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<td>Other Tree species</td>
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<td>4</td>
<td>13</td>
<td>4</td>
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<td>7</td>
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<td>Shrubs, succulents &amp; herbs</td>
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<td>3</td>
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<td>4</td>
<td>0</td>
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<td>3</td>
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<td>Veg. Type</td>
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<td>Number of localities</td>
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<td>55</td>
<td>21</td>
<td>5</td>
<td>17</td>
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<td>Swarm trapping</td>
<td>46.92</td>
<td>42</td>
<td>39.44</td>
<td>74.41</td>
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<td>Hive splitting</td>
<td>10.38</td>
<td>6</td>
<td>9.97</td>
<td>4.41</td>
<td>5</td>
<td>8.33</td>
<td>14</td>
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<td>New swarms</td>
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<td>0</td>
<td>2.72</td>
<td>0.29</td>
<td>0.81</td>
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<td>Removal of problem colonies</td>
<td>35</td>
<td>52</td>
<td>22.86</td>
<td>15.29</td>
<td>0</td>
<td>8.83</td>
<td>16</td>
<td>18.33</td>
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Forage provision to managed bees Western Cape

- **Jan-Feb**: eucalyptus
- **Mar-Apr**: Weeds (echium)
- **May-Jun**: canola
- **Jul-Aug**: apples
- **Sep-Oct**: eucalyptus
- **Nov-Dec**: Fynbos

**Fynbos Honey** / maintenance
**Build-up & Swarm trapping**
**Pollination season**

From **Historical** vs **Current?**
Landscape requirements

- Model the links between the pollination services used by the WCape apple industry and the resources that support them
- Investigate correlations between the key resources and measures of biodiversity (e.g. threat status)
- What is the resilience / stability of current honeybee forage availability in sustaining managed hives?
Honeybee Forage Project

• Secured pollination services via strong forage knowledge base provide solid policy advice, with possible alternate forage sources

• Estimate number of beekeepers & colonies within South Africa (supply/demand)

• Dependence of managed honeybees on various forage resources – exotic/indigenous

• Provide national information on ES upon which managed bee industry depends

• Outline management practices that positively contribution to the provisioning of quality and sustainable forage

• National Forage Species List
Outputs

- “Beeplants of South Africa” book
- Capacity building materials: poster; DVD with film & associated activities; lectures
- Public awareness: plant a bee-friendly plant campaign (forage materials)
- Profiles of farmers and beekeepers
- Management consideration documents
- Impact Pathway:
  - Building understanding of honeybees as important crop pollinators (policy makers, educators, general public)
  - Protection of existing forage resources for honeybees: management of eucalypt, indigenous and crop forage; access to unusable forage (policy makers, forestry industry, private landowners, managers of public land)
  - Establishment of new small-scale forage resources for honeybees through exploring potential to grow forage on public and private land (managers of public land, forestry industry, landowners, urban greening programmes, general public)
More to be done?

• Further forage-related research:
  • Importance of Eucalyptus plantations in the forage cake (which cultivars, euc pests, etc)
  • How the forage cake slices might be impacted by climate change
  • How pesticide issues could impact forage resources

• Other honeybee-related research:
  • *Capensis* problem
  • Basic pollination research (hives/ha, bee dynamics within crops, strength of hives, etc)

• Better coordination: agriculture ↔ beekeepers ↔ forage owners
• National ‘home’ for beekeeping + high-level champions (top-down)
• Bottom-up: public awareness – buy local, plant bee-friendly plants

“What is good for managed pollinators will be good for the wild pollinators”