TREES FOR BEES CORNER

MANAGING MĀNUKA FOR CARRYING CAPACITY AND COMPETITION

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The medical value of mānuka honey has produced a prosperous new sector in the agricultural economy, especially for landowners with unproductive marginal land. These opportunities have brought many new people into beekeeping, with hive numbers doubling in five years from 300,000 in 2010 to nearly 600,000 today (Figure 1).

Risks posed by overstocking

Such rapid growth of hive numbers has given rise to new challenges. John Berry recently said, "Beekeeping has never been more profitable but it has also never been more stressful". When Trees for Bees started in 2009, we did not imagine that the challenges to bee nutrition would reach the proportions that we see today, particularly the overstocking issues near the centres of high-value mānuka honey harvesting.

The rapid rise in hive numbers relative to beekeeper and apiary numbers (Figures 2 and 3) has generated unprecedented levels of overstocking in many regions, not only for the honey harvest but also for overwintering sites that deliver autumn and spring pollen and nectar.

Deanna Corbett told us that overstocking and carrying capacity are concepts well understood by livestock farmers. She explained:

> if a farmer puts one more cow on a pasture beyond the stocking rate for the amount of food within the fenced area, then the herd will not reach its best live weight. Put 10 or 100 excess cows on and they end up with a live weight deficit and health issues. The problem is that bees have no fences.

Newcomers to the beekeeping industry may be unaware of the carrying capacity of an apiary site because they cannot readily see it.

How can the carrying capacity be estimated for bees living in hives and flying over fences? The carrying capacity can be defined by

the foraging range of the bees (three- to five-kilometre radius) in relation to the floral resources of pollen and nectar within that range. Over time, beekeepers learn to estimate how well different vegetation types can 'carry' a given number of hives. If the carrying capacity of the foraging area is exceeded, then there will be less (or even no) surplus honey to harvest. If carrying capacity is greatly exceeded, there will be malnutrition and colony failure due to diseases or starvation. For example, malnutrition leads to susceptibility to diseases like *Nosema ceranae.*

Estimating colony food and water needs

How much food and water does a single bee colony need? Bees need pollen to raise their brood and nectar to fuel their activities. The farther they have to fly, the more fuel they use up.

John McLean has given us some estimates based on a single wild colony in a cold, temperate climate, citing Thomas D. Seeley's book *The Wisdom of the Hive* (1995). The annual hive requirements are approximately:

- 20 kilograms pollen (pre-digested by nurse bees fed to queen, brood, and other workers)
- 120 kilograms nectar (energy food for all life stages made into honey: it takes five to eight grams of honey to make one gram of wax)
- 25 litres water (evaporative cooling of hive and vital for nurse bees for royal jelly)

A rule of thumb is that about one-third to one-half of a normal nectar harvest is used up by the bees to keep the colony alive. For this reason, beekeepers have historically been careful not to encroach on the foraging range of neighbouring apiary sites based on the 'golden rule' of beekeeping.

A concentration of too many apiary sites with too many hives has an impact on all beekeepers in the area, but most of all on the traditional beekeeper who originally occupied that site, usually for decades.

Paul Badger reports:

> most mānuka sites (probably about 90%) are summer sites (approximately 3 months) for honey cropping. If these are overstocked, everyone just gets a reduced honey crop. If there is no crop and no money this should eventually be self-limiting. The rest of the year (9 months) bees are on their wintering sites. This is where the real problems are happening.
>
> Spring build-up can be compromised by lack of suitable forage as well as dealing with periods of bad weather. This is where the health problems will have the greatest effect. A hive with low bee numbers going into a mānuka flow will never gather much honey because it will use the flow for building up bee numbers. We do not want to get to the situation of trying to keep bees in sterile deserts with hundreds of hives fed on sugar syrup instead of nectar and artificial pollen as a their only protein source.

The importance of foraging range

To manage mānuka carrying capacity, a good understanding of the foraging range can help a new investor, farmer or landowner to assess the probability of successful honey harvests from their proposed mānuka installations.

The area covered by the foraging range needs to be examined not only for its carrying capacity, but also for any potential for competition from other apiary sites placed too close to the new plantation. A three- to five-kilometre radius is a huge area and few farms would be that large. A cluster of small-scale farms working together cooperatively could be managed to cover the area of a large-scale farm that encompassed most of a foraging range.

But it is not simply a matter of competition from other apiary sites placed too close. To be sure to get a good mānuka harvest, the foraging range must also be assessed for any competing plants that flower at the same time, especially if they offer better nectar than the mānuka variety planted. A flower producing more nectar with higher sugar concentration is generally preferred by bees, particularly if the nectar is more accessible. If abundant enough, these preferred flowers will distract the bees from foraging on mānuka, which deliver nectar in very tiny drops.

Another problem to watch is the composition and abundance of the pollinator fauna in the area that could compete for the mānuka flowers, such as native bees and flies that frequent mānuka flowers.

Any of these sources of competition can decimate the targeted honey yield that was planned for—encroaching apiaries for summer or overwintering, alternative nectar sources nearby, or competing pollinators. To manage carrying capacity and competition well, the investor, landowner or beekeeper need to be aware that the scale of the mānuka plantation and potential concentration of nearby apiary sites is critically important.

Respect the 'golden rule'

Equally important is the flowering calendar of the surrounding pollen and nectar sources for spring build-up, summer honey harvesting and overwintering survival of the bees. If the area is rich in diversity and abundance of bee plants, then the apiary could be resilient to competition from any of the sources. A return to the 'golden rule' of beekeeping—to respect the foraging ranges of neighbouring apiaries—will safeguard the health of bees and honey yields for everyone and make investments in mānuka honey plantations less risky.

Barry Foster has proposed that Trees for Bees plantations can help mitigate the problems arising from lack of sufficient pollen and nectar due to overcrowding on a site. We agree with this proposal and believe that mānuka plantations can be sustainable if they include sufficient forage for spring and autumn. Installing plantations of bee feed trees and shrubs to cover spring and autumn will ensure sustainability for a residential apiary system.

Planting high-performance bee feed plants can go a long way to alleviating and preventing overstocking problems. However, there is a limit to how many trees, shrubs and herbs that will fit into a hectare. Therefore, self-regulation of apiary sizes and placements will also need to be tackled by beekeepers, farmers, landowners and investors in a cooperative manner. Everyone must come to terms with the fact that carrying capacity for bees in any area will have a limit and since bees have no fences, overstocking leads to reduced profits for everyone.

Source

Seeley, T. D. (1995). *The wisdom of the hive: The social physiology of honey bee colonies.* Cambridge, MA: Harvard University Press.

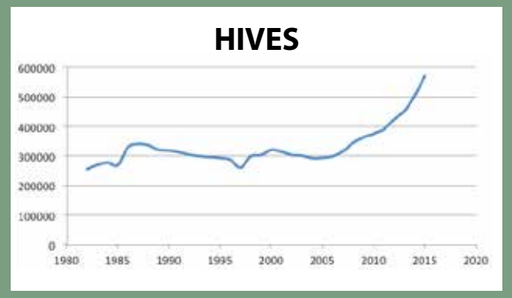

Figure 1.
Number of hives in New Zealand from 1980 to 2015. Hive numbers have nearly doubled in five years from 2010 to 2015, reflecting the growth of the mānuka honey harvesting industry. This raises the question about carrying capacity for bees.

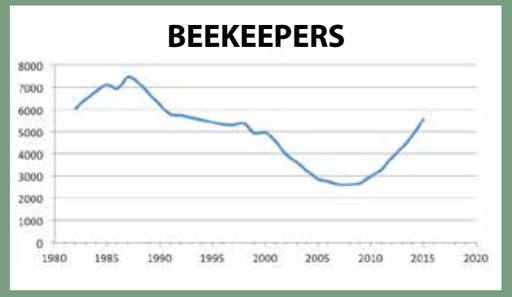

Figure 2.
Number of beekeepers in New Zealand from 1980 to 2015. Beekeeper numbers were as high as 7000 in the late 1980s, but declined after 2000 when varroa arrived in the North Island. The rise in beekeeper numbers has accelerated since 2010.

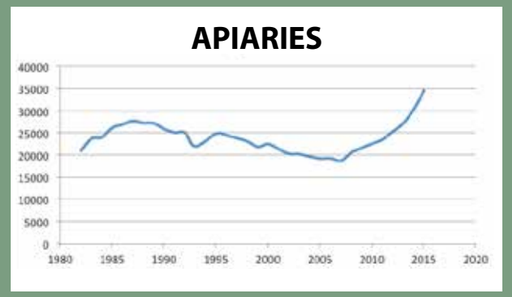

Figure 3.
The number of apiaries in New Zealand from 1980 to 2015. Apiary numbers have remained relatively stable with a slight decline after 2000, when varroa arrived in the North Island, and then a sharp rise since 2007, reflecting the growing interest in mānuka honey harvesting.