

Making Mānuka Sustainable

Linda
Newstrom-Lloyd



API—NZ Conference
June 20, 2016
Rotorua



Sustainable Farming Fund

Partners working with us



Landcare Research
Manaaki Whenua



AsureQuality



*John Hartnell, Barry Foster,
John McLean, Paul Badger*

Platinum Sponsors

Ngati Porou, Eastland Com. Trust

INGLEBY



Gold Sponsors


*Arataki Honey, Honey Trust, Honey Lab Ltd.,
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Silver Sponsors see www.treesforbeesnz.org

Outline

- Carrying Capacity and Overstocking
- Naati Beez Mānuka Pilot SFF Project
- Solutions for Sustainable Mānuka

Background Context

1. Parasites (varroa resistance)
2. Pests (wasps, GWA)
3. Pathogens (*Nosema*)
4. Pesticides
5. **Poor nutrition** 

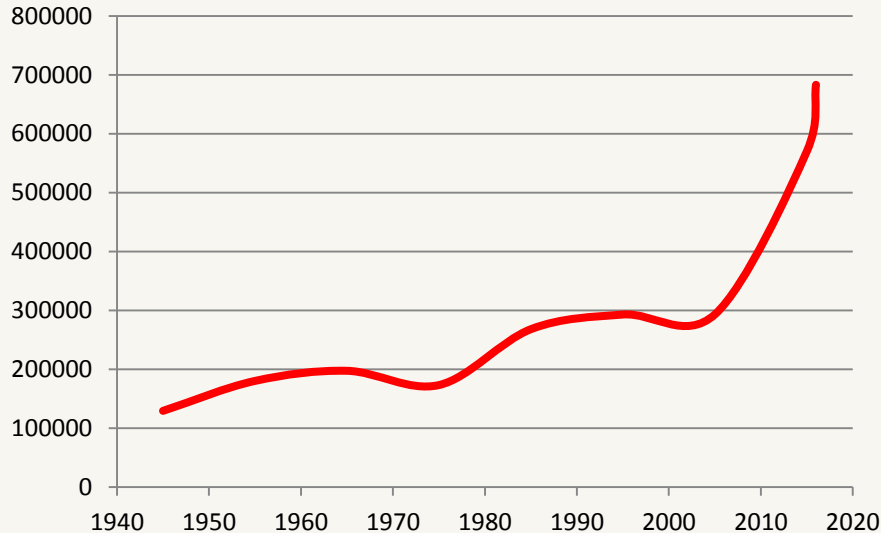
Floral resources compromised

- Land use changes (dairy, intensification)
- Elimination of weedy plants
- Giant Willow Aphid infestations



70 years of data from 1945 to 2016

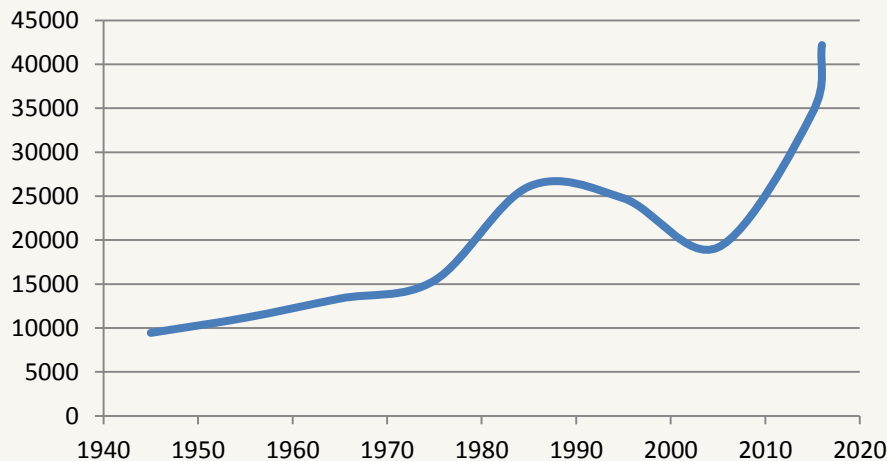
Total Hives



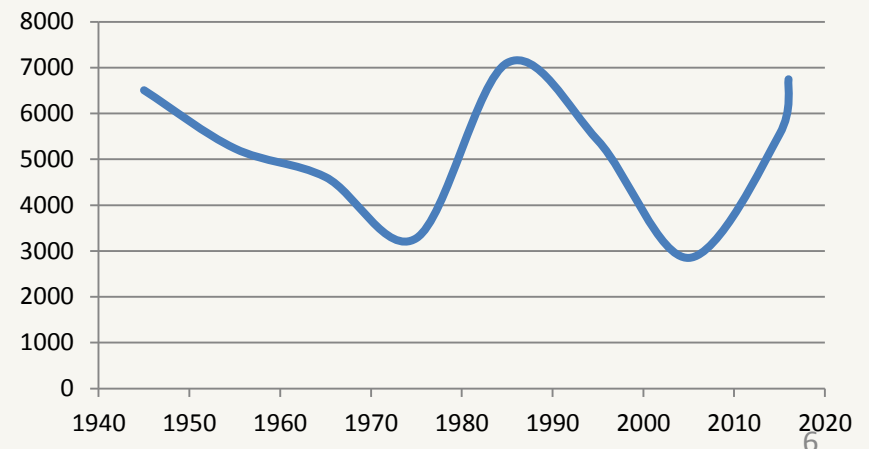
Thanks to Murray Reid for AsureQuality data

1. Hives doubled since 2005
2. Apiaries steep rise since 2005
3. Beekeepers peaks and valleys

Total Apiaries



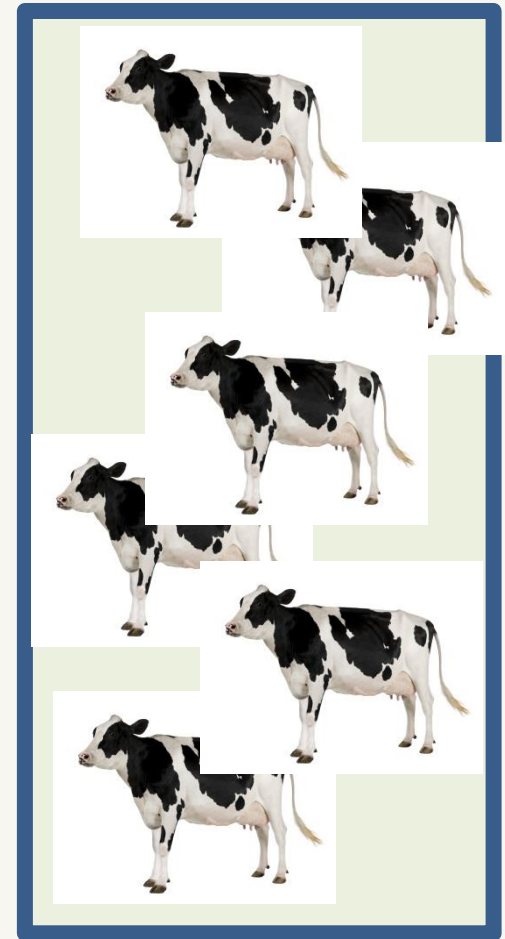
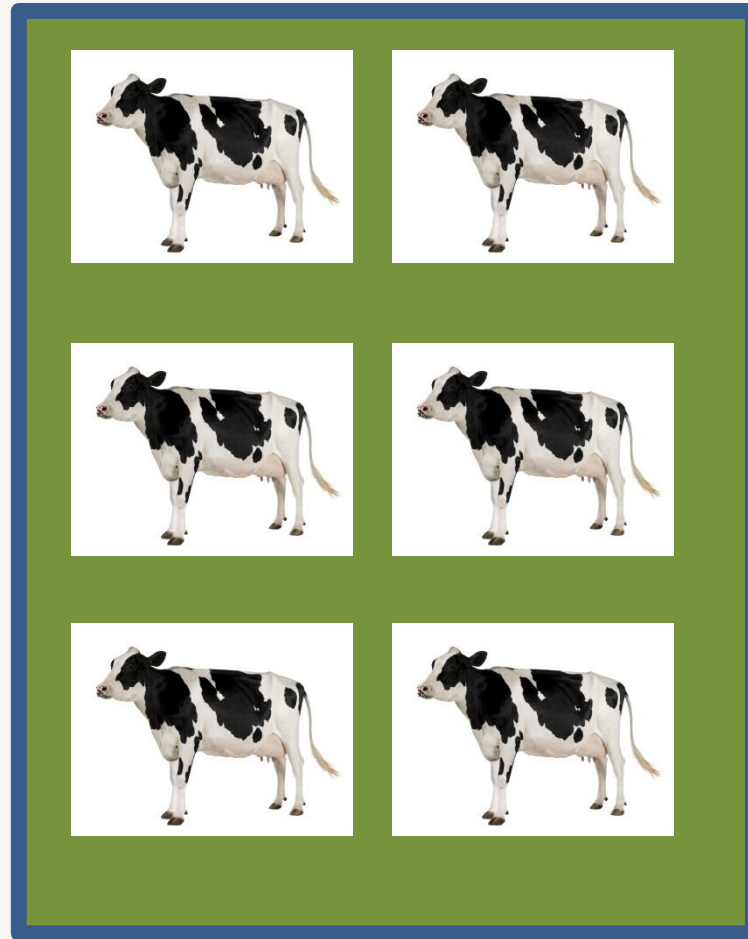
Total Beekeepers



Unprecedented New Pressures

- Competition for overwintering sites rising rapidly**
- Apiary takeovers threaten beekeeper's livelihoods**
- Overstocking new hives near traditional wintering sites**
 - Overstocking -> malnutrition -> diseases -> colony loss**
 - Pollination services threatened for growers and farmers**

Carrying Capacity for Livestock



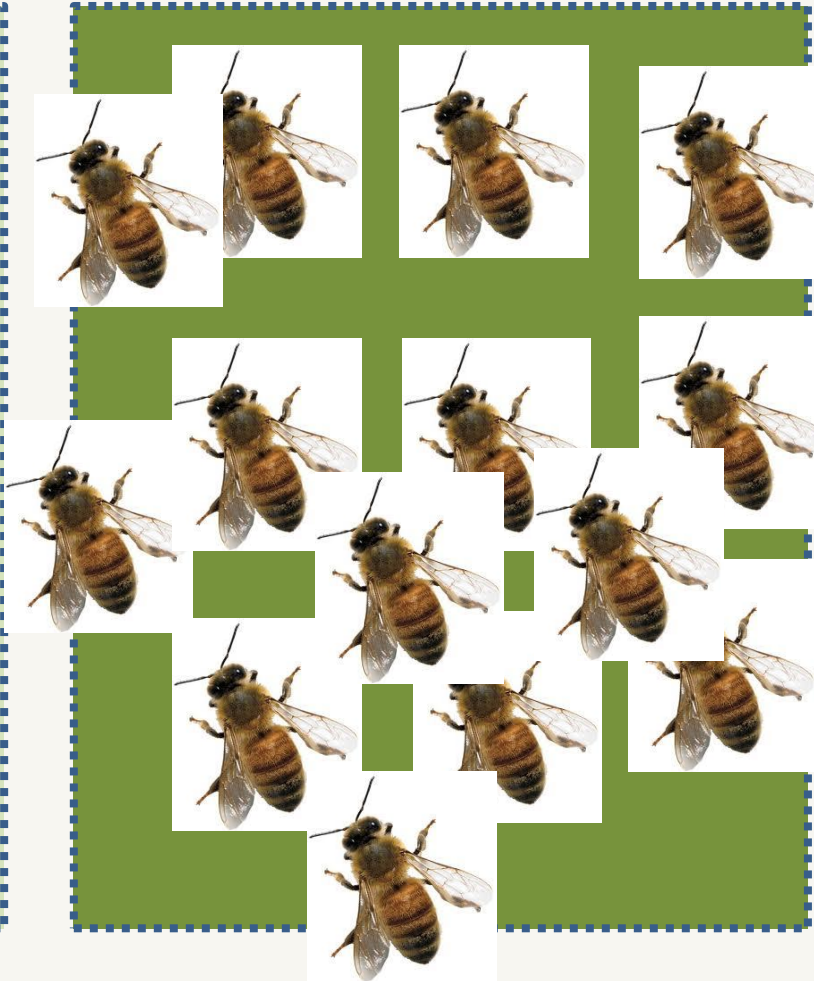
Carrying Capacity for Bees



Bees have No Fences

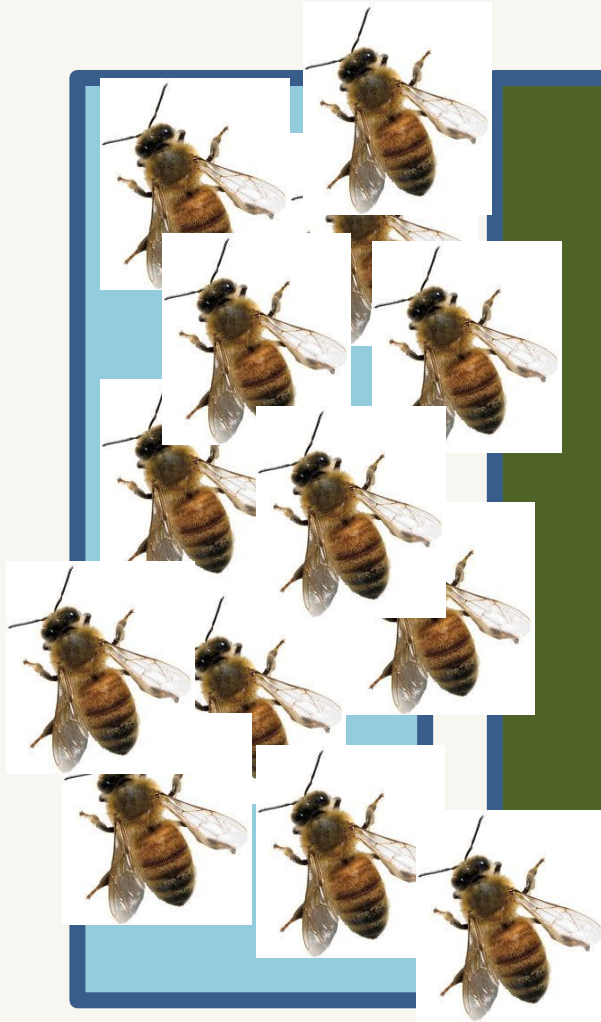
Foraging Range 5 to 12 km

Less
Attractive
FOOD



NO FOOD

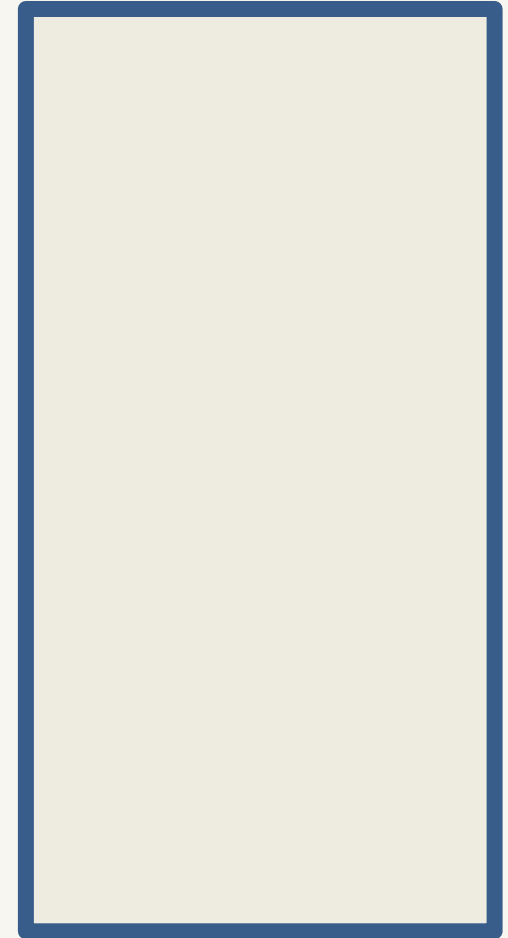
Competition for Bee's Attention



Better Flowers
Clover



Manuka Plantation



Poor Bee Food

OVERSTOCKING

- Bees use up more honey → poor harvest
- Bees malnourished → more diseases
- Bees starving → colony dwindles
- Dead out hives → loss of profit
- Everyone in foraging range loses

Solutions: strategic bee planting

1. More mānuka plantations on marginal land
2. More wintering sites to support mānuka
3. More wintering sites everywhere
 - *Helps supply pollination services*

Naati Beez SFF Team



Rangi Raroa, Director



Willie Kaa, Director

Maia
Taaremaia



Rangitukia
July 2015 to
June 2016

Rapata
Kaa



MPI - SFF Naati Beez pilot project

2015 - 2016

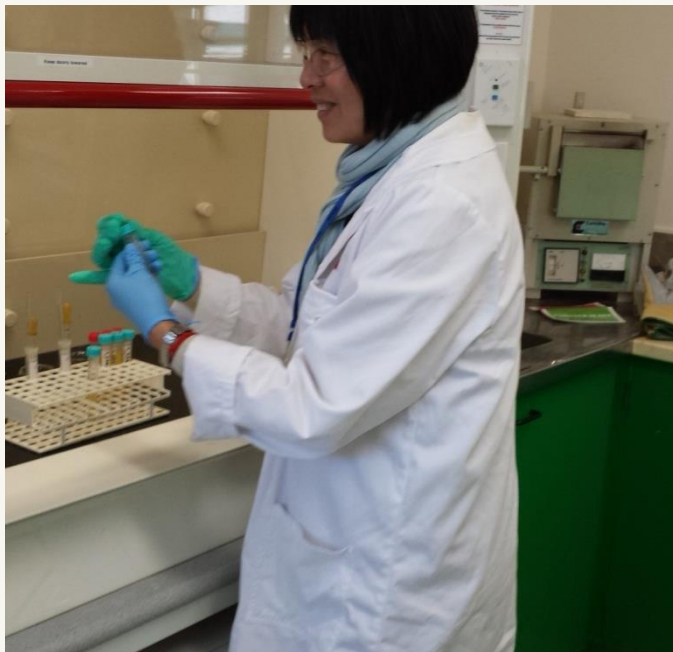
Rangitukia near Tikitiki, East Cape

- ☐ Residential apiary sites
- ☐ Spring and autumn forage
- ☐ Local employment

GNS Science Palynologist Team

Identify and photograph pollen

Dr. Xun Li



Dr. Ian Raine



Naati Beez with Sebastian Mira

French intern from Agro-campus Ouest



Planning with Angus McPherson



**Locally sourced
native plants
best for marginal land**

Toxic plants NOT wanted

FOR EXAMPLE:

- **Tutu - toxic honey kills humans**
- **Karaka – kills bees**
- **Kowhai ? – often makes bees drunk**

Fresh natural pollen in best diet



Collected pollen and honey from hives



Collected plant and pollen vouchers

Sorted pollen from hive traps



Its not easy → methods under development

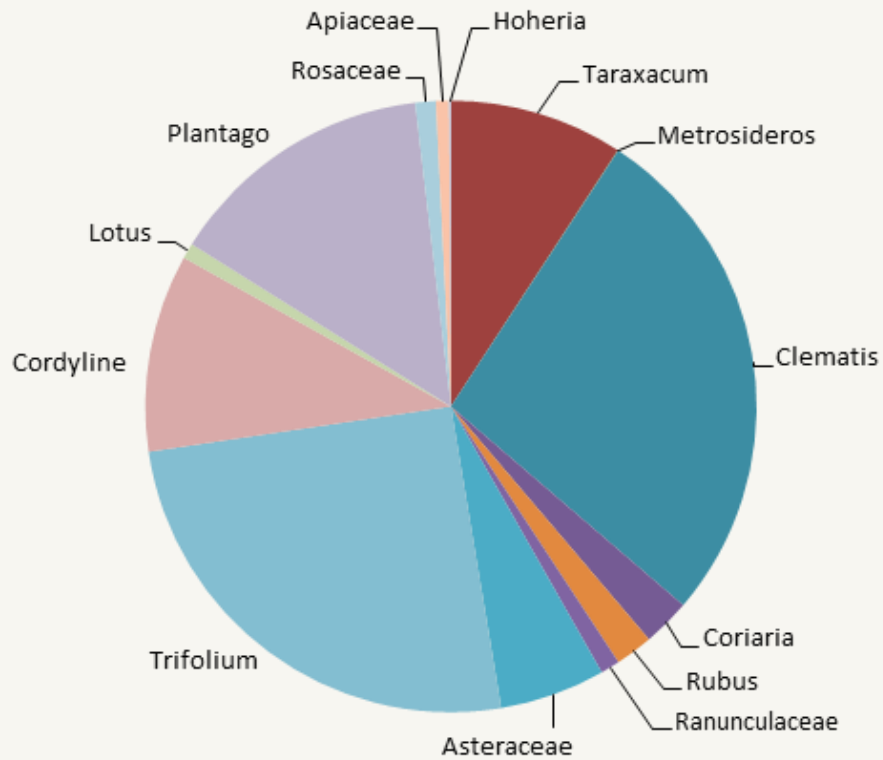


OCT 2nd
2015

TK 1
Period 4

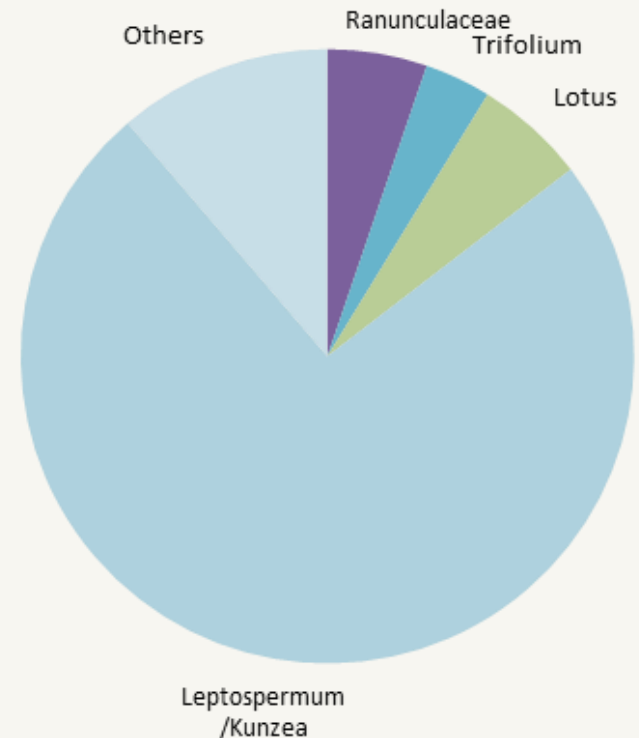
Period 9: Dec. 11th 2015

Hive trap pollen pellets



Hive TK2

Hive uncapped honey



Hive TK4

How does pollen get into honey?

1. Falls into nectar in flower, bees suck it up
2. Bees groom near open honey cells in hive
3. Wind blows some pollen types into hive
4. Pollen into honey during extraction

Mānuka nectary has pollen

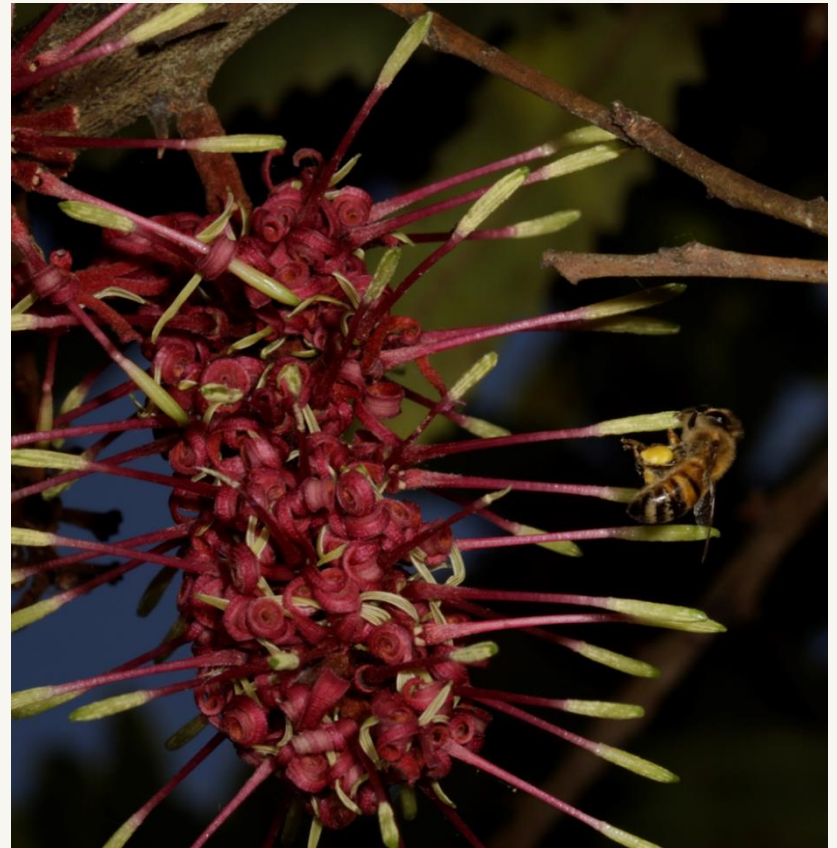


Pollen collection

Mānuka flower



Rewarewa flower



Nectar Collection

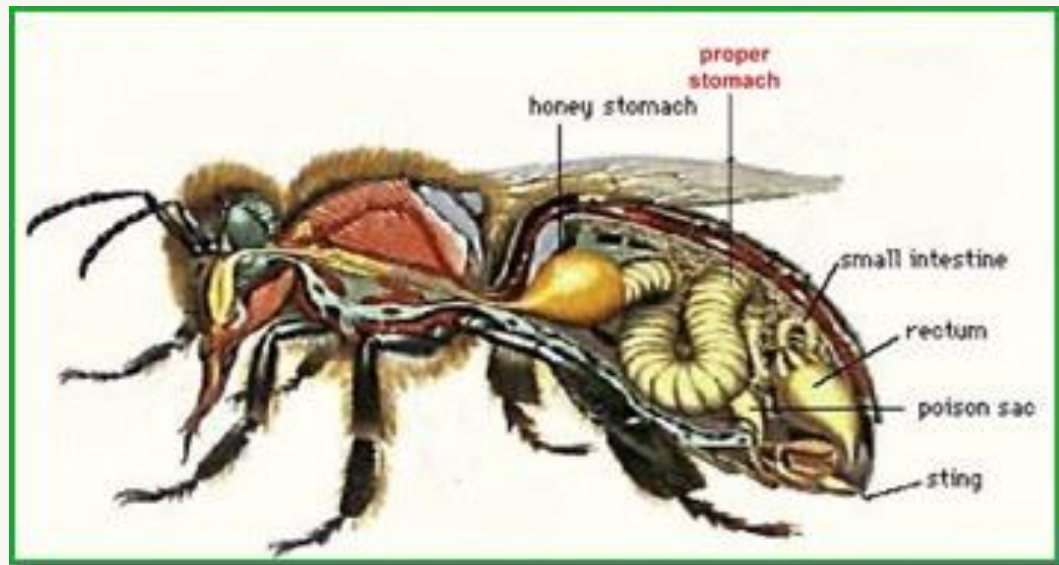
Mānuka flower



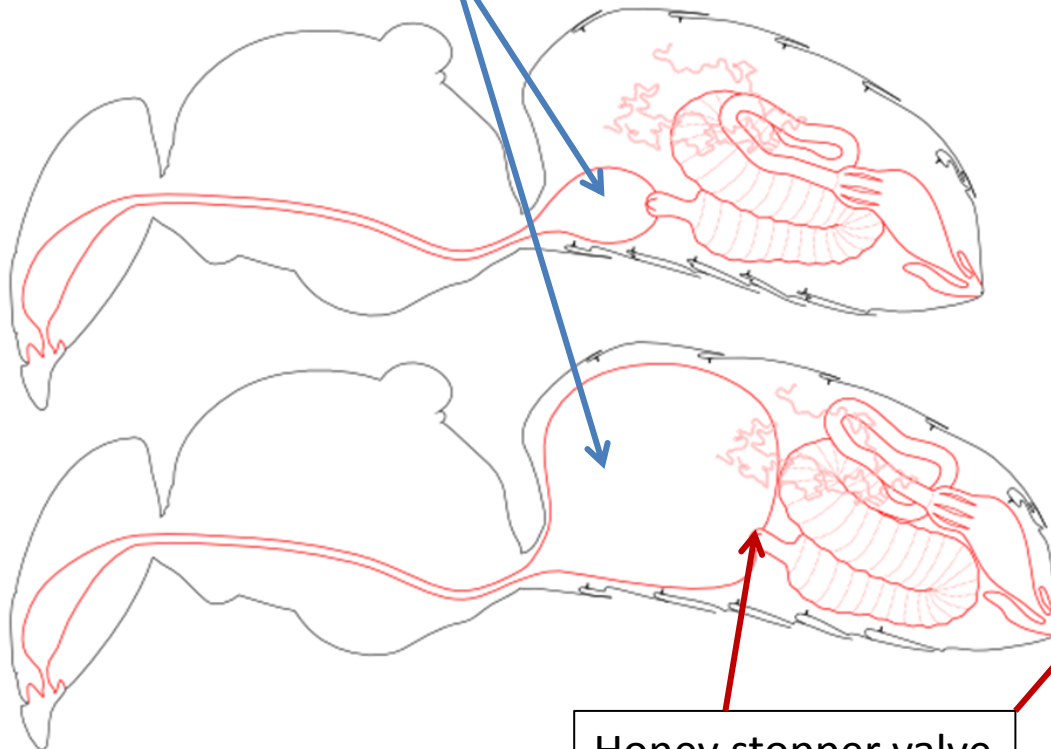
Rewarewa flower



Does pollen get filtered out?



Honey stomach



Honey stopper valve

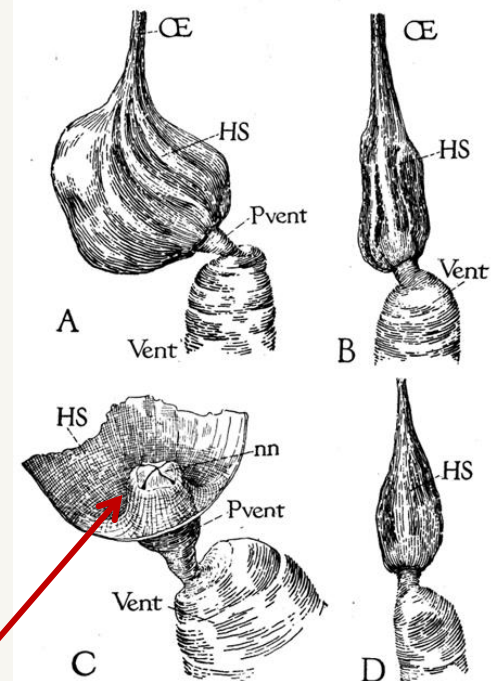


FIG. 44.—A, honey stomach (HS) of worker with posterior end of oesophagus (CE), proventriculus (Pvent), and anterior end of ventriculus (Vent); B, same of queen; C, honey stomach (HS) of worker mostly cut away exposing the stomach-mouth (nn) of proventriculus (Pvent) leading into ventriculus (Vent); D, honey stomach of drone.

Big pollen grains get filtered out



Rewarewa

Knightia excelsa

40-47 microns (from Moar 1993)



Mānuka

Leptospermum scoparium s.l. 11

(14) 18 μm (McIntyre 1963);

16.35 \pm 1.39 microns (Ian Raine measurements, Tikitiki material)

Mānuka vs rewarewa pollen

OUR NEW DATA	Mānuka	Rewarewa
Do honey bees collect nectar	Yes	Yes
Do honey bees collect pollen	No??	Yes
Pollen Size	Small	Big
Pollen found in honey	Yes	Yes
Pollen found in trap pellets	No	Yes

Same results found by

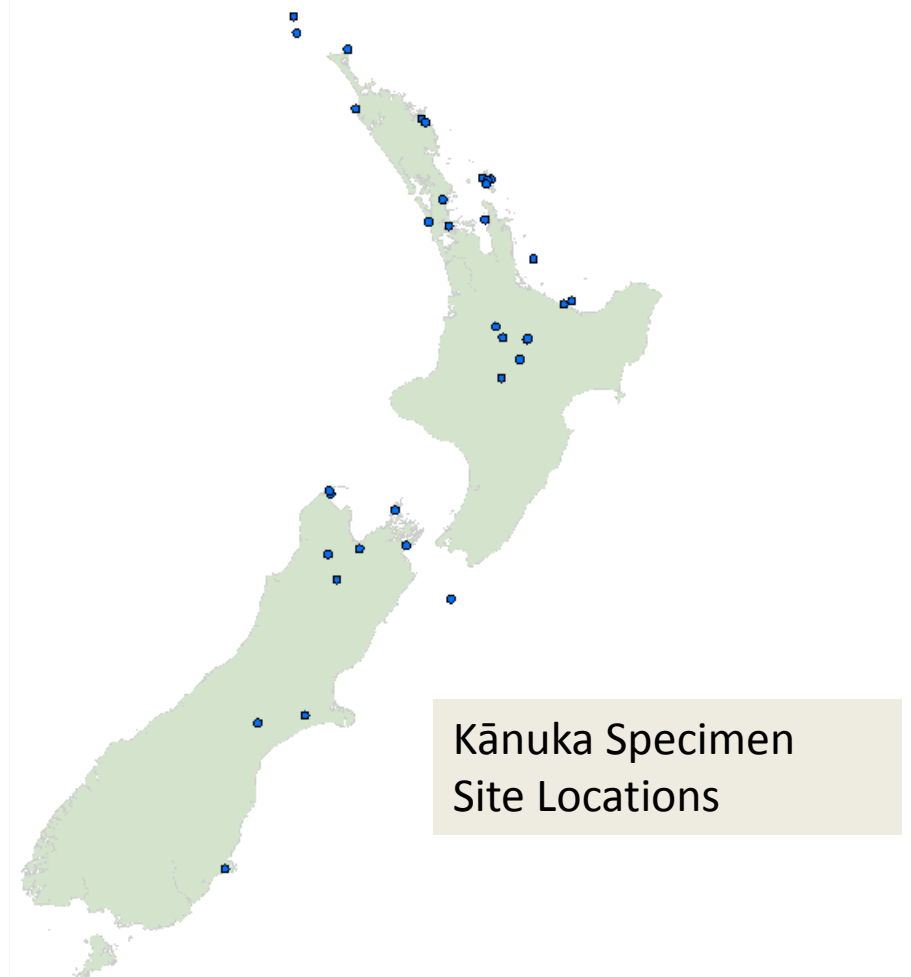
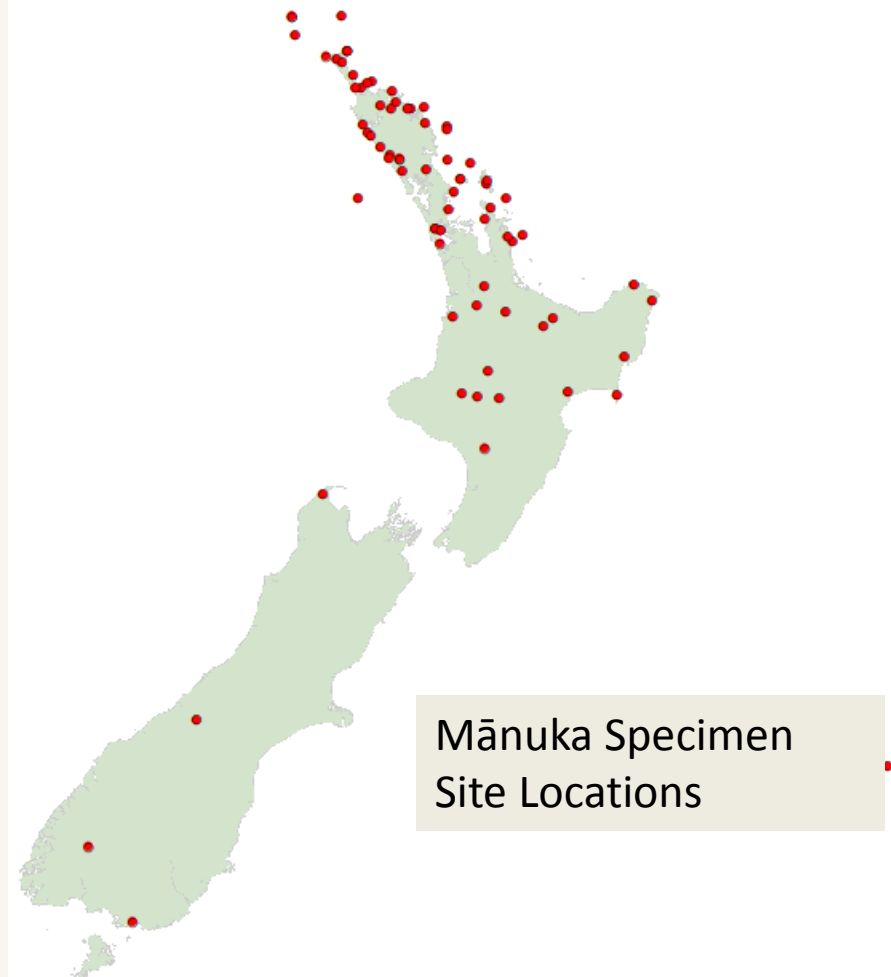
Harris & Filmer 1948 Pollen in honey and bee loads. NZ Journal of Science and Technology 30, A (3): 178-187

Does mānuka pollen differ from kānuka?

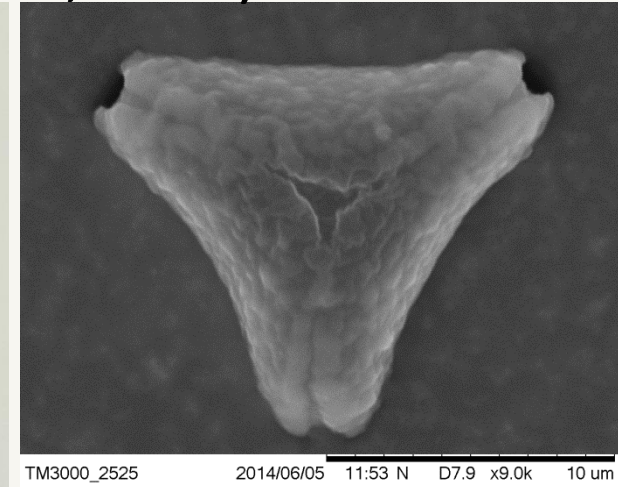
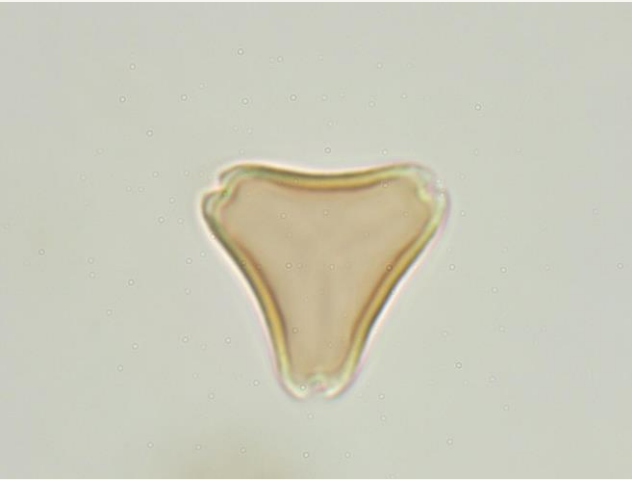
Peter de Lange

- geographic range populations
- full range of variation
- 10 species of kānuka
- all types of mānuka
- plus hybrids
- 115 samples total

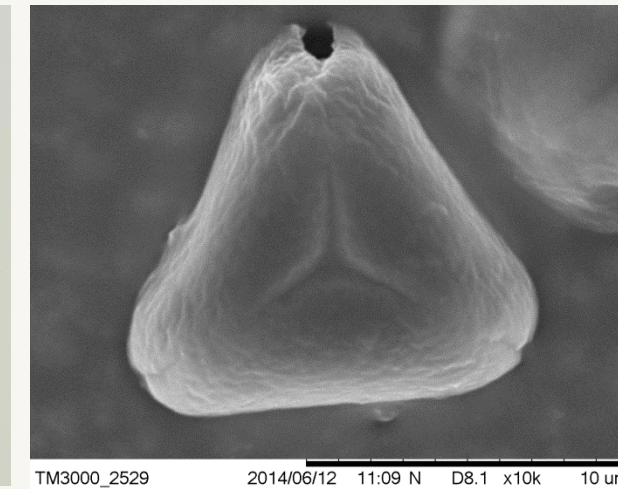
Location of Pollen Samples taken from Peter de Lange's identified collections



Mānuka Pollen Polar View (outline, surface, SEM)



Kānuka Pollen Polar View (outline, surface, SEM)



More of these results.....

Many new discoveries for bee forage:

Puriri, nikau palm,

NZ beech, tutu, macropiper,

SEE OUR POSTERS WITH XUN LI

Spring to Summer Flowering Chart

Biostatus	Botanical Name	Common Name	Winter/Early Spring				Spring/Early Summer		Summer				Early Winter	
			June	July	August	September	October	November	December	January	February	March	April	May
Native	<i>Fuchsia excorticata</i>	Tree fuchsia	1	1	1	1	1	1	1	1				
Native	<i>Melicytus lanceolatus</i>	Narrow-leaved mahoe	1	1	1	1	1	1	1					
Native	<i>Pseudopanax arboreus</i>	Five-finger	1	1	1									
Native	<i>Metrosideros carminea</i>	Crimson rata			1	1	1							
Native	<i>Leptospermum</i>	Manuka				1	1	1	1	1	1	1		
Native	<i>Kunzea ericoides</i>	Kānuka				1	1	1	1	1	1			
Native	<i>Pittosporum umbellatum</i>	Haekaro				1	1	1	1	1				
Native	<i>Pittosporum ralphii</i>	Ralph's Kohuhu	x			1	1	1	1	x	x	x	x	x
Native	<i>Pittosporum crassifolium</i>	Karo				1	1	1	1					
Native	<i>Weinmannia silvicola</i>	Kāmahi				1	1	1	1					
Native	<i>Metrosideros diffusa</i>	Rata vines					1	1	1	1				
Native	<i>Olearia furfuracea</i>	Tanguru					1	1	1	1				
Native	<i>Pittosporum eugenioides</i>	Lemonwood					1	1	1	1				
Native	<i>Knightia excelsa</i>	Rewarewa					1	1	1	1				
Native	<i>Cordyline australis</i>	Cabbage tree					1	1	1					
Native	<i>Carpodetus serratus</i>	Marble leaf						1	1	1	1	1		
Native	<i>Pennantia corymbosa</i>	Kahikōmako						1	1	1	1			
Native	<i>Melicytus ramiflorus</i>	Whiteywood						1	1	1	1			
Native	<i>Metrosideros umbellata</i>	Southern rata						1	1	1	x	x		
Native	<i>Ixerba brexioides</i>	Tāwari						1	1	1				
Native	<i>Metrosideros robusta</i>	Northern rata						1	1	1				
Native	<i>Phormium tenax</i>	NZ flax						1	1					

www.treesforbeesnz.org

Autumn Flowering Flowering Chart

Biostatus	Botanical Name	Common Name	Winter/Early Spring				Spring/Early Summer		Summer				Early Winter	
			June	July	August	September	October	November	December	January	February	March	April	May
Native	<i>Carpodetus serratus</i>	Marble leaf						1	1	1	1	1		
Native	<i>Pennantia corymbosa</i>	Kahikōmako						1	1	1	1			
Native	<i>Melicytus ramiflorus</i>	Whiteywood						1	1	1	1			
Native	<i>Metrosideros umbellata</i>	Southern rata						1	1	1	x	x		
Native	<i>Ixerba brexioides</i>	Tāwari						1	1	1				
Native	<i>Metrosideros robusta</i>	Northern rata						1	1	1				
Native	<i>Phormium tenax</i>	NZ flax						1	1					
Native	<i>Hoheria angustifolia</i>	Narrow-leaved lacebark							1	1	1	1		
Native	<i>Metrosideros albiflora</i>	Large white rata							1	1	1	1		
Native	<i>Metrosideros excelsa</i>	Painted rata							1	1	1			
Native	<i>Weinmannia racemosa</i>	Kāmahi							1	1				
Native	<i>Pseudopanax crassifolius</i>	Hoheka								1	1	1	1	
Native	<i>Metrosideros perforata</i>	Small white rata								1	1	1		
Native	<i>Hebe salicifolia</i>	Koromiko								1	1	x	x	
Native	<i>Metrosideros fulgens</i>	Scarlet rata	1								1	1	1	1
Native	<i>Schefflera digitata</i>	Seven-finger									1	1		
Native	<i>Dysoxylum spectabile</i>	Kohekohe	1									1	1	1
Native	<i>Olearia paniculata</i>	Akepiro										1	1	1
Native	<i>Hoheria populnea</i>	Lacebark	x									1	1	x
	Total species flowering each month		5	3	4	9	14	20	24	19	12	11	5	3


www.treesforbeesnz.org

Feed Budget All Year Round

Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Spring Build up			Clover & Kiwifruit Pollination		Summer Honey Flow		Autumn preparation for winter			Over-wintering		



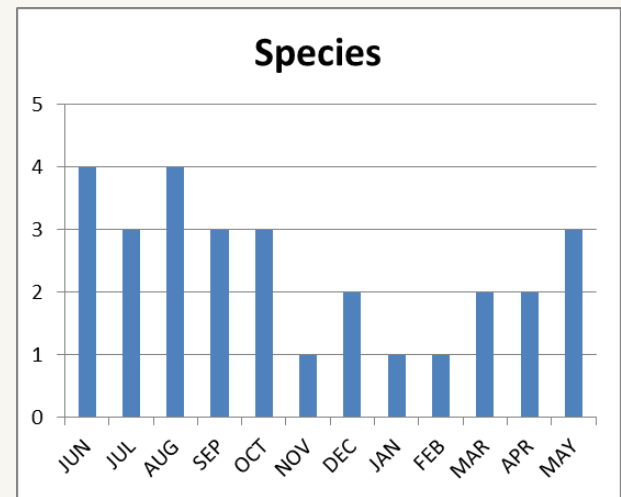
Pollen dearth
after willows?



Pollen and
nectar dearth?

Flowering Calendar & Bee Feed Budget for Species Diversity

Target Plant



Number of Species		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
	<i>Leptospermum scoparium</i> Mānuka												
1	<i>Pittosporum eugenioides</i> Tarata					1	1	1					
2	<i>Pseudopanax arboreus</i> Five-finger	1	1	1									
3	<i>Vitex lucens</i> Pūriri	1	1	1	1	1							1
4	<i>Hebe stricta</i> Koromiko		1	1	1	1							
5	<i>Coprosma robusta</i> Karangū			1	1								
6	<i>Pseudopanax lessonii</i> Houpara							1	1	1			
7	<i>Hoheria populnea</i> Houhere	0.5									1	1	0.5
8	<i>Hoheria sexstylosa</i> Houhere	0.5									1	1	0.5
TOTAL (not including target crop)		4	3	4	3	3	1	2	1	1	2	2	3

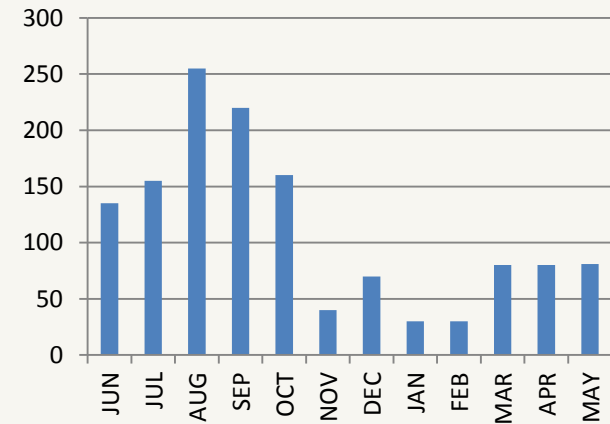
Lana Hope donated 395 native plants

www.nativegarden.co.nz in Gisborne



Flowering Calendar & Bee Feed Budget for Number of Trees

Trees



Pollen Source

NUMBER OF TREES		JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
	<i>Leptospermum scoparium</i> Mānuka												
1	<i>Pittosporum eugenioides</i> Tarata					40	40	40					
2	<i>Pseudopanax arboreus</i> Five-finger	35	35	35									
3	<i>Vitex lucens</i> Pūriri	20	20	20	20	20							1
4	<i>Hebe stricta</i> Koromiko		100	100	100	100							
5	<i>Coprosma robusta</i> Karangū			100	100								
6	<i>Pseudopanax lessonii</i> Houpara							30	30	30			
7	<i>Hoheria populnea</i> Houhere	40									40	40	40
8	<i>Hoheria sexstylosa</i> Houhere	40									40	40	40
TOTAL (not including target crop)		135	155	255	220	160	40	70	30	30	80	80	81

Installed native plants near apiary



Planted 395 native trees & shrubs

- Two days of planting
- Poplar trees nearby
- Gorse available
- Fence excludes livestock



Protected with wire mesh
Sawdust mulch outside mesh
Possum control active

Developing Planting Designs



**RESULTS FROM FIELD
WORK & LITERATURE**

**18 demo farms
21,000 plants**

**ADVICE FROM FARM
PLANTING ADVISOR,
FARMER & BEEKEEPER**



**Angus McPherson
Trees for Bees
Farm Planting
Advisor**

Peter Hair's Farm in Gisborne

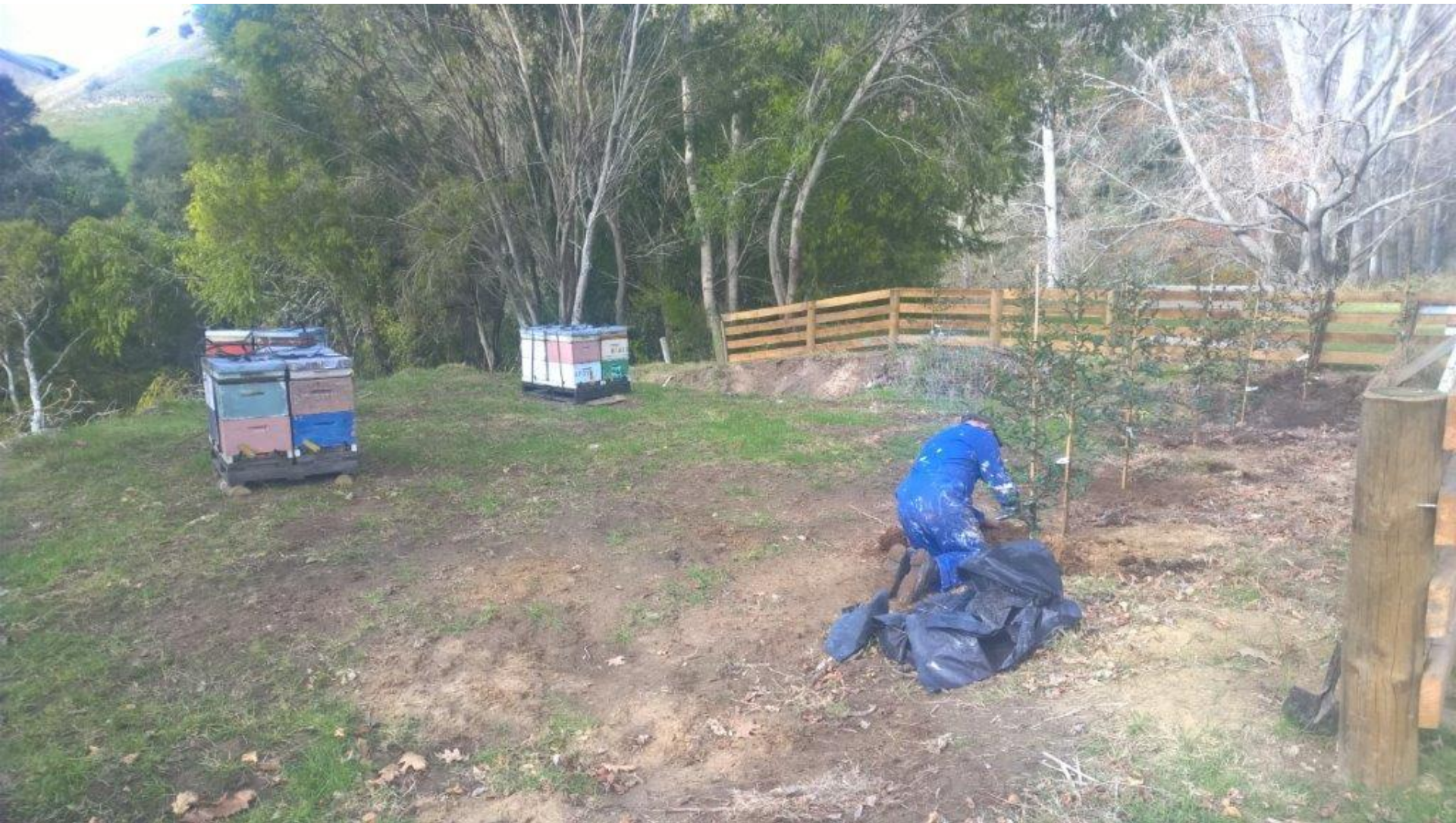
John McLean and Paul Badger



Large Scale Farm at Ingleby Shade and Shelter



Barry Foster in Gisborne - 4 farms



Kintail Honey



Shade and Shelter at Kintail Honey



Farm/Beekeeping Context

At Farm Level --- Range is 3 to 5 km

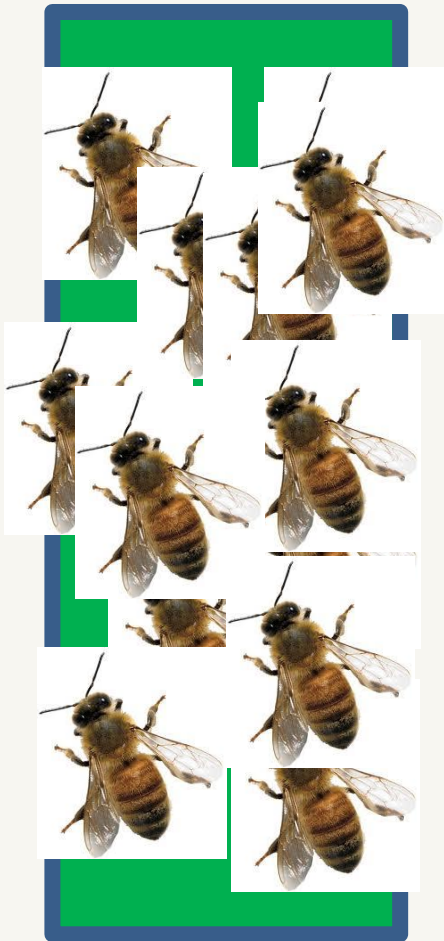
1. Large Scale Farms

- more opportunity to influence where bees forage
- plantations can sustain hives within farm all year

2. Small Scale Farms

- more chance of species planted off farm distract bees
- more vulnerable to overstocking
- farm groups for manuka to gain large scale

Know the surrounding flowers inside foraging range and time of flowering



Clover

**Manuka
Plantation**

Poor Bee Food

Solutions for Sustainable Manuka

1. More mānuka plantations on marginal land
 - *Takes pressure off native pollinators*
2. More wintering sites with mānuka
 - *Takes pressure off wintering sites*
3. More wintering sites everywhere
 - *Helps supply pollination services*



THE GOOD NEWS

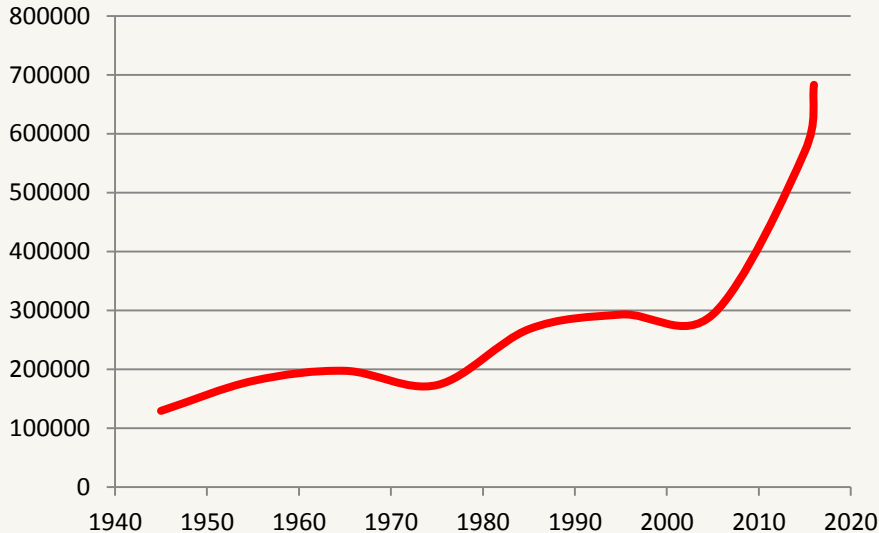
**Manuka orchards
with supporting bee feed
will help supply the manuka demand
and take the pressure off native bees
and pollination services**

**Overstocking can be resolved with
cooperation and planting more bee feed**



70 years of data from 1945 to 2016

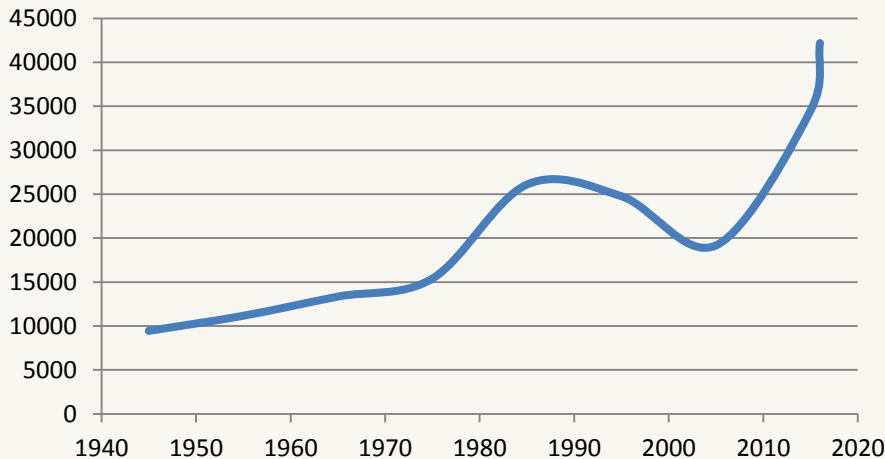
Total Hives



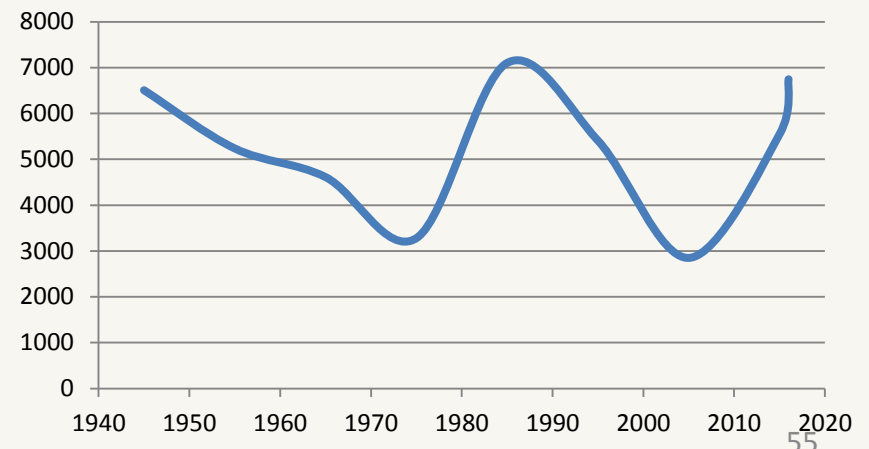
Thanks to Murray Reid for AsureQuality data

1. Hives doubled since 2005
2. Apiaries steep rise since 2005
3. Beekeepers peaks and valleys

Total Apiaries



Total Beekeepers



Towards a carrying capacity model

- Anne-Gaelle Ausseil and John Dymond



LANDCARE RESEARCH
MANAAKI WHENUA

Large Scale Map of Land Cover Classes

Number of plants /ha

Estimate pollen and nectar supply



Estimate relative amount pollen/plant
Starting on estimates of absolute amount

How many flowers to feed one bee?

Flax averages 5 mg pollen/flower (need 125 to 145 mg)
25 to 30 flowers for 1 bee from egg to adult

