Strategic Planting to Maximise Bee Nutrition

Dr. Linda Newstrom-Lloyd

www.treesforbeesnz.org

3rd Australian Bee Congress
June 29, 2018
Gold Coast Queensland

Ministry for Primary Industries
Manatū Ahu Matua

Sustainable farming Fund

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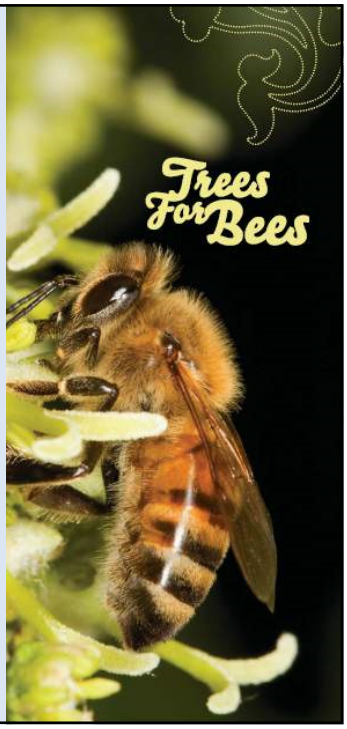
Trees for Bees Program

www.treesforbeesnz.org

Ministry for Primary Industries
Manatū Ahu Matua

Sustainable Farming Fund Grants
3 grants over 9 yrs starting 2010



Pollen Protein By Doug Somerville

Bee Friendly A Planting *G*uide … By Mark Leech

Almond Pollination and Manuka Honey

Opportunities for Australia

Outline

- Expansion and Intensification
- Problem of the Commons
- Strategic planting → BEE HEALTH

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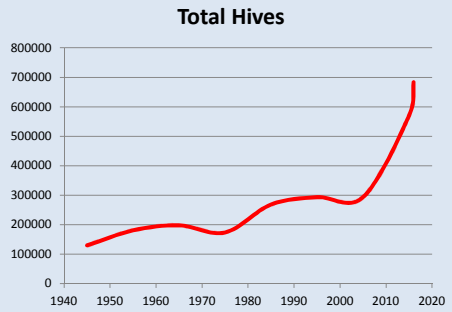
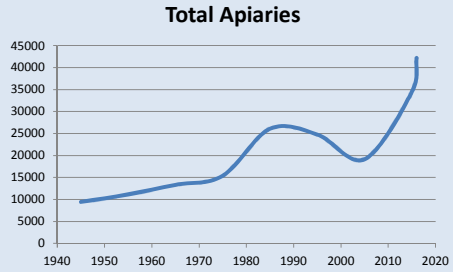
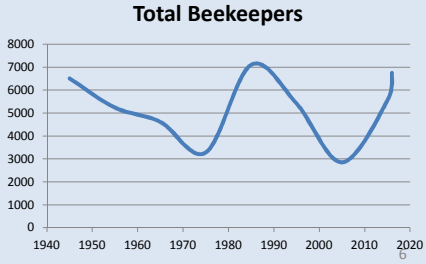
70 years data from 1945 to 2016



Thanks to Murray Reid for AsureQuality data
Data compiled by Trees for Bees NZ

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





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Numbers rising but the issue is the RATE of Colony Losses

- Queen health
- Starvation and Malnutrition
- Pest and Diseases
- Pesticides

Unprecedented New Stressors

- 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

Consequences 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 suffers

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Honey Bee Robbing
Bees at War!

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Causes Starvation or Malnutrition

- Floral resources removed or died
  - Gorse and willow
  - Weed free farming
  - Irrigation or other land uses
- Poor weather and no artificial feed
- Weird weather and no flowering or nectar
- AND NOW ADD OVERCROWDING!

Nutrition for One Bee Colony

Pollen → 20 kg per year

Nectar → 120 kg per year

Water → 25 litres per year

Data from Seeley 1995 *The Wisdom of the Hive*

Pollen for Protein, Fat, Vitamins

Weeping beech *Fagus sylvatica* var *pendula*

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Nectar for Carbs and Micronutrients

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The Role of Artificial Bee Feed?

- Protein patties and sugar water
- Excellent tool for emergency rations
- Not good for steady diet
- **BEE CAREFUL !!**
- Natural fresh pollen/nectar is <u>superior</u>

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Nutrition for Bee Health

OPTIMUM HEALTH

Nutrient deficiency or Starving

Nutrient Excess or Unbalanced

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Fresh natural and diverse diet

Native: Flax *(Phormium tenax)* - **32%** protein

Five Finger (*Pseudopanax arboreus*) 20% protein - Early Spring

Photo by Richard Toft
© Landcare Research

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Photinia *(Photinia beauverdiana)* – 25% protein

Photo : Jean-Noël Galliot
© Landcare Research

Photo : Jean-Noël Galliot
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Outline

- Expansion and Intensification
- **Problem of the Commons**
- Strategic planting → BEE HEALTH

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The Problem of the Commons

Economics of Overcrowded Apiaries

↓

"double negative reciprocal production externality"

Peter Lloyd
Emeritus Professor of Economics
University of Melbourne

Reference:
Competition in the Manuka Honey Industry in New Zealand
Department of Economics, University of Melbourne
Working Paper No. 2033, September 2017

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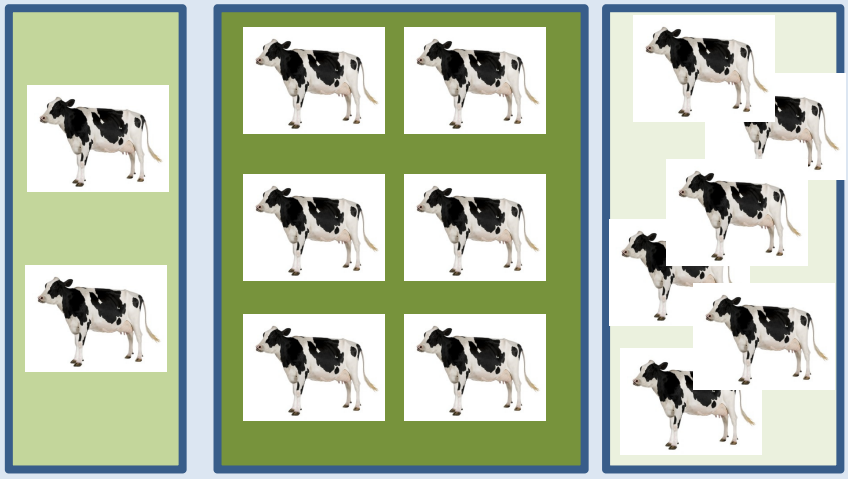
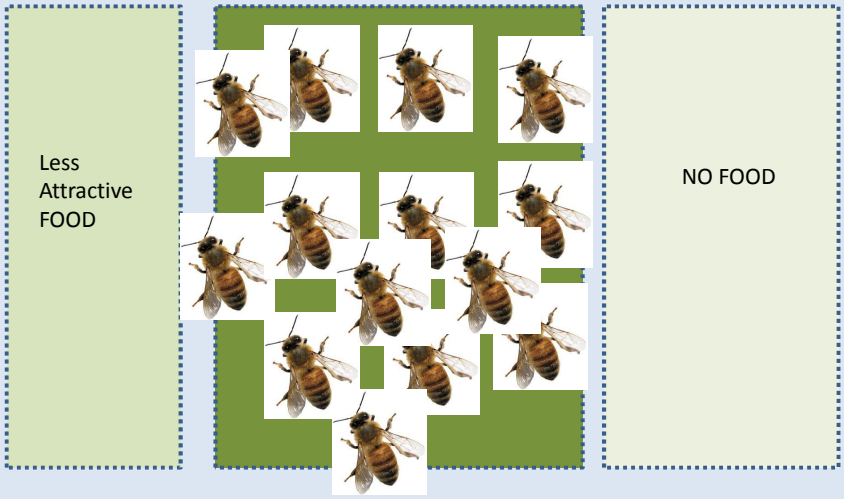
Carrying Capacity for Livestock



Carrying Capacity for Bees

Bees have no fences
Foraging Range 5 to 12 km



Difficult to regulate

Compare to:

dairy cows
fishing and hunting
oil rigs and landowners

Beekeeping is different

bees use up the honey
Bees have no fences

(Unitary authority, government regulation, voluntary cooperation, etc.)

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Overcrowding → Rising Costs

- Diseases harder to control (resistance)
- Cost and labour for feeding supplements
- Robbing risks require more visits
- More work for less money

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Too Many New Entrant Beekeepers

- No entrance licence
- Easy to start up
- Attractive to external investment

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Skills and knowledge take experience

- Hive and apiary balanced
- Weather patterns, flowering times
- Nectar and pollen yield patterns
- Diseases and foraging range
- Low quality pollination services

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Wider Risks of Overcrowding

- To Pollination Services
- To Native Bees and other pollinators

See David Pattemore's Talk at 2:10 pm SAT

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Outline

- Expansion and Intensification
- Problem of the Commons
- **Strategic planting → Bee Health**

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Carrying Capacity - Plant for Bees

RESULTS FROM FIELD LAB & LITERATURE

ADVICE FROM FARM PLANTING ADVISOR, FARMER & BEEKEEPER

Angus McPherson
Farm Planting Advisor

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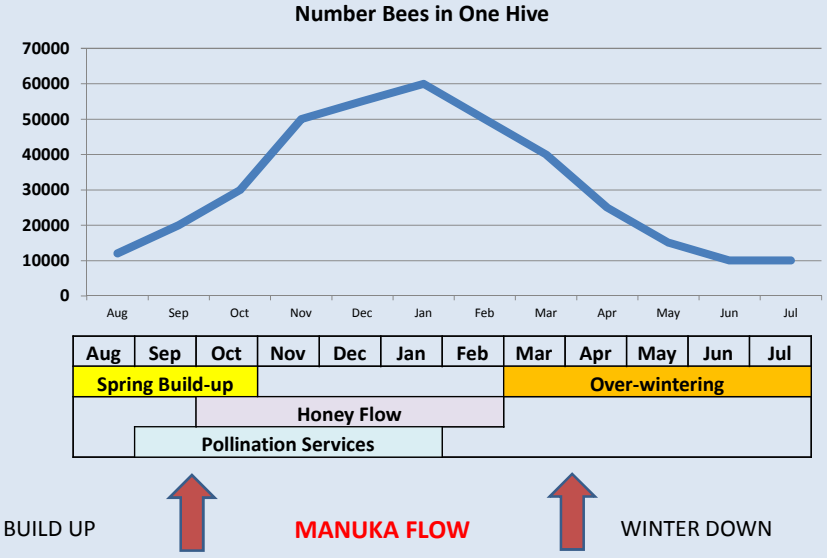
STRATEGY: ID Target Activity



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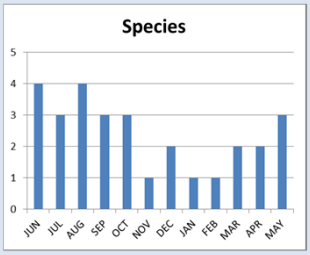
Spring to Summer Flowering

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	*Fuchsia excorticata*	Tree fuchsia	1	1	1	1	1	1	1	1				
Native	*Melicytus lanceolatus*	Narrow-leaved mahoe	1	1	1	1	1	1	1					
Native	*Pseudopanax arboreus*	Five-finger	1	1	1									
Native	*Metrosideros carminea*	Crimson rata			1	1	1							
Native	*Leptospermum*	Manuka				1	1	1	1	1	1	1		
Native	*Kunzea ericoides*	Kānuka				1	1	1	1	1	1			
Native	*Pittosporum umbellatum*	Haekaro				1	1	1	1	1				
Native	*Pittosporum ralphii*	Ralph's Kohuhu	x			1	1	1	1	x	x	x	x	x
Native	*Pittosporum crassifolium*	Karo				1	1	1	1					
Native	*Weinmannia silvicola*	Kāmahi				1	1	1	1					
Native	*Metrosideros diffusa*	Rata vines					1	1	1	1				
Native	*Olearia furfuracea*	Tanguru					1	1	1	1				
Native	*Pittosporum eugenioides*	Lemonwood					1	1	1					
Native	*Knightia excelsa*	Rewarewa						1						
Native	*Cordyline australis*	Cabbage tree					1	1	1					
Native	*Carpodetus serratus*	Marble leaf						1	1	1	1	1		
Native	*Pennantia corymbosa*	Kahikōmako						1	1	1	1			
Native	*Melicytus ramiflorus*	Whiteywood						1	1	1	1			
Native	*Metrosideros umbellata*	Southern rata						1	1	1	x	x		
Native	*Ixerba brexioides*	Tāwari						1	1	1				
Native	*Metrosideros robusta*	Northern rata						1	1	1			34	
Native	*Phormium tenax*	NZ flax						1	1					

Autumn Flowering Flowering

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	*Carpodetus serratus*	Marble leaf						1	1	1	1	1		
Native	*Pennantia corymbosa*	Kahikōmako						1	1	1	1			
Native	*Melicytus ramiflorus*	Whiteywood						1	1	1	1			
Native	*Metrosideros umbellata*	Southern rata						1	1	1	x	x		
Native	*Ixerba brexioides*	Tāwari						1	1	1				
Native	*Metrosideros robusta*	Northern rata						1	1	1				
Native	*Phormium tenax*	NZ flax						1	1					
Native	*Hoheria angustifolia*	Narrow-leaved lacebark							1	1	1	1		
Native	*Metrosideros albiflora*	Large white rata							1	1	1	1		
Native	*Metrosideros excelsa*	[illegible]												
Native	*Weinmannia racemosa*	Kāmahi							1	1				
Native	*Pseudopanax crassifolius*	Hoheka								1	1	1	1	
Native	*Metrosideros perforata*	Small white rata								1	1	1		
Native	*Hebe salicifolia*	Koromiko								1	1	x	x	
Native	*Metrosideros fulgens*	Scarlet rata	1								1	1	1	1
Native	*Schefflera digitata*	Seven-finger									1	1		
Native	*Dysoxylum spectabile*	Kohekohe	1									1	1	1
Native	*Olearia paniculata*	Akepiro										1	1	1
Native	*Hoheria populnea*	Lacebark	x									1	1	x
	Total species flowering each month		**5**	**3**	**4**	**9**	**14**	**20**	**24**	**19**	**12**	**11**	**5**	**3**

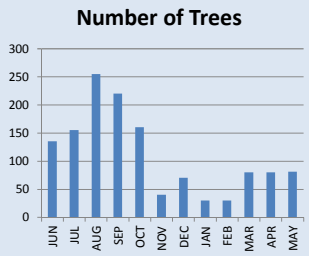
Flowering Calendar & Bee Feed Budget for Species Diversity



Target Plant

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

Flowering Calendar & Bee Feed Budget for Number of Trees



Pollen Source

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

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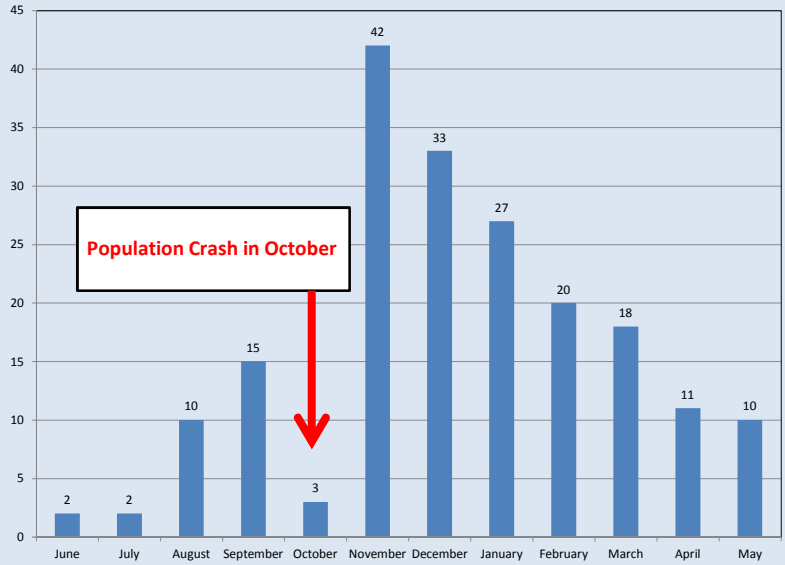
Can be problem for Spring build-up!



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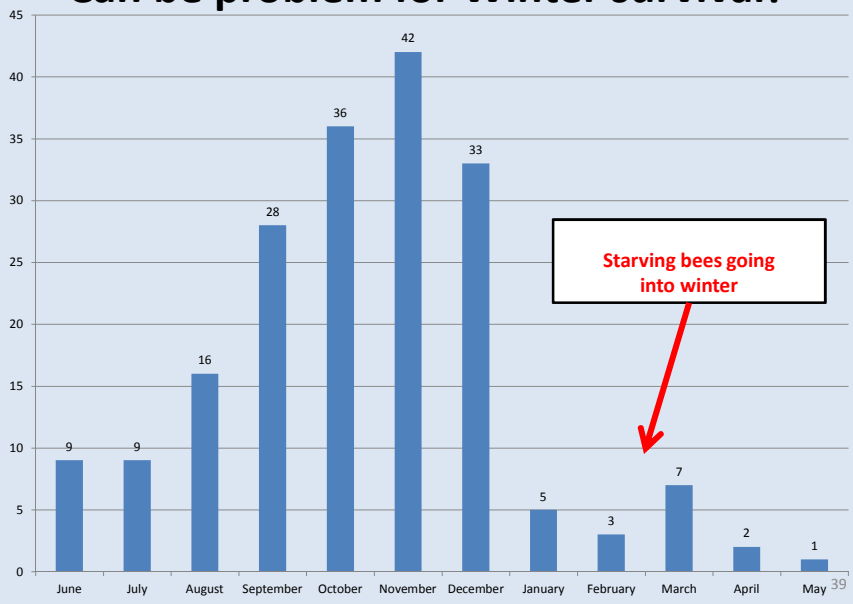
Can be problem for Winter survival!



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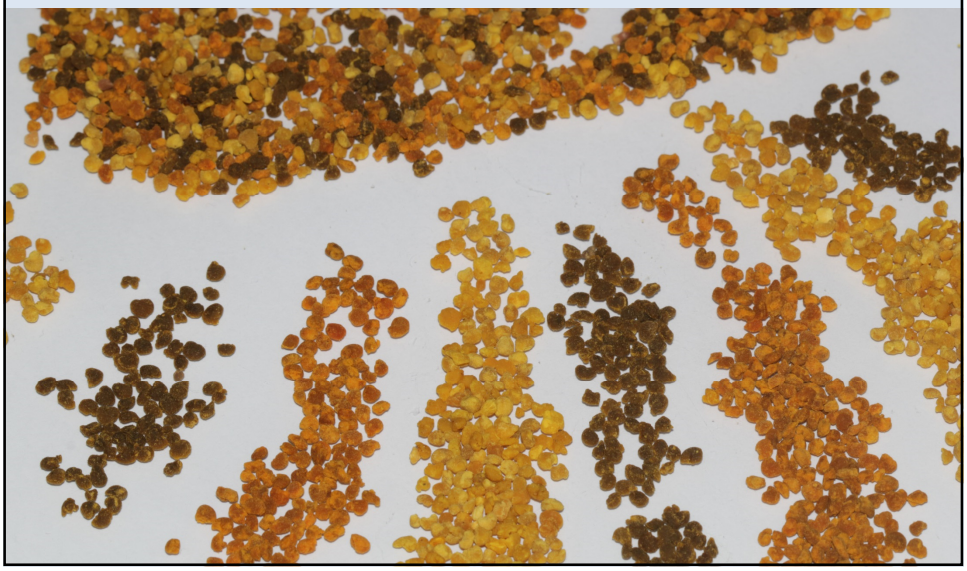
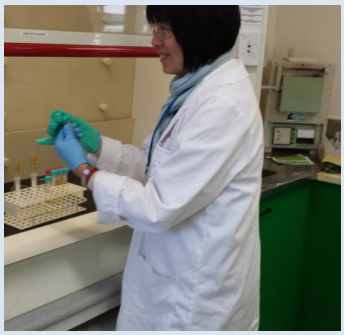
New Tools to Assess Apiary Site



GNS Science Palynology Team

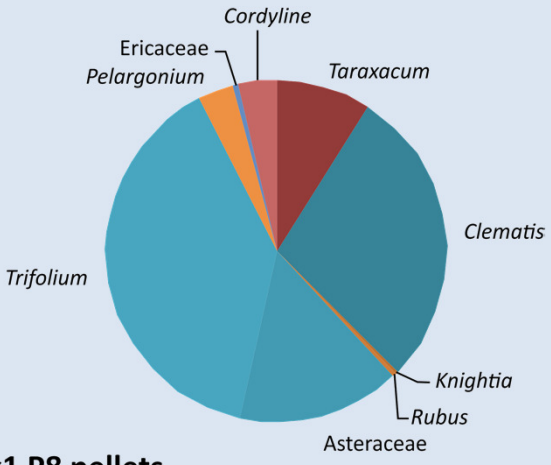
Identify and photograph pollen

Dr. Xun Li



Dr. Ian Raine

Pollen Profile for John Berry's Apiary



Tk1 P8 pellets

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Scaling up Planting

- 27 Demo Farms across NZ
- Multipurpose Planting
- Landowner pays for plants and labour
- 60,000 plants installed since 2012

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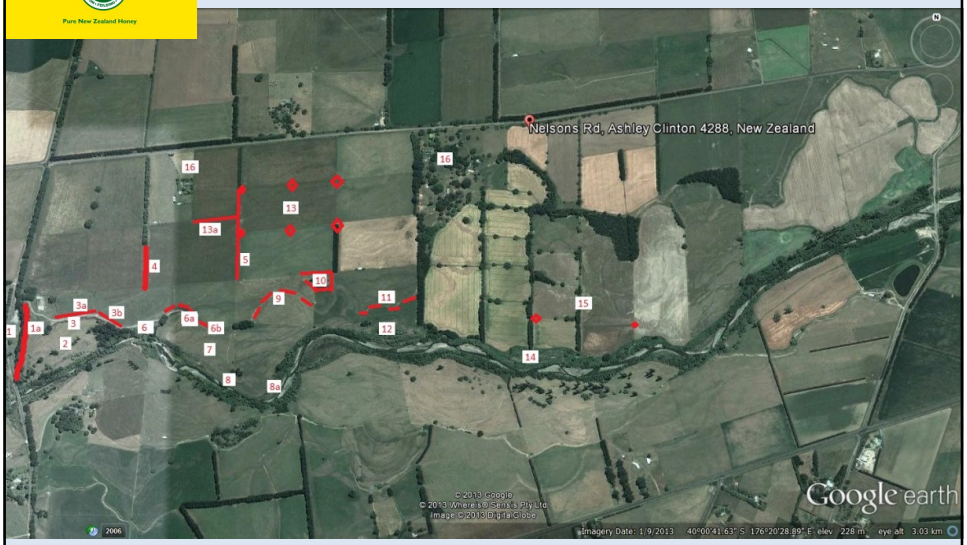
Kintail Queen Raising Yard



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TECH TRANSFER

- **Training and resources in progress:**
  - Pollen Atlas (GNS Pollen Lab)
  - Flowering Catalogue (Trees for Bees)
  - Willow Identification Key (Landcare Research)
  - Guides to Planting for Multipurpose (McPherson)

www.treesforbeesnz.org

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Sustainable Farming Fund Project 404868

Strategic Planting for Pollination and Honey

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THE NEW ZEALAND POPLAR & WILLOW RESEARCH TRUST

THE END

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How many flowers to feed one bee?

Flax averages 5 mg pollen/flower (need 125 to 145 mg)

25 to 30 flowers for 1 worker bee from egg to adult

Using Flax as an example 50,000 bees

- Need 125 mg pollen to grow 1 bee
- Need 6.25 million mg to grow 50,000 bees
- Each flax flower averages about 5 mg pollen
- So 1.25 million flax flowers for 50,000 bees

Using Flax as an example 20 kg / hive

- To supply 20 kg pollen to hive per year
- Need 20 million mg of pollen
- Need 4 million flowers
- If say 200 flowers per plant
- Need about 20,000 flax plants