Mythology, carbon and radiata pine

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Outline

- New Zealand's GHG neutrality target
- Forests as carbon sinks
- Options
- Myths
- Where to from here?





New Zealand's greenhouse gas inventory



New Zealand's greenhouse gas inventory



Carbon contents (Pg)







Mahli (2002)

Forests are carbon reservoirs









Reaching greenhouse gas neutrality by 2050

- Globe innovative scenario - 2050 GHG neutral target - Required sequestration





"Billion tree" planting programme



"Billion tree" programme0.5 M ha in total70% Indigenous forest30% Harvested *P. radiata*

SequestrationRequired sequestration



Proposed 32 year planting programme (Evison & Mason in prep.)



1.75 M ha *P. radiata* in total75% Pruned and harvested25% Plant and leave

Actual Sequestration Required sequestration



Proposed 22 year planting programme



0.66 M ha *P. radiata* in total 100% Plant and leave

SequestrationRequired sequestration



Myth: Nothing grows under radiata pine



Image: Jeff Tombleson







Biodiversity in plantations



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Long-term consequences of "plant and leave"

- Ecological succession to native forest on some sites
 - Radiata pine = shade-intolerant pioneer
- Plenty of indigenous biodiversity in plantations
 - Allen et al. (1995), Norton (1998), Brockerhoff et al. (1999)
- Indigenous biodiversity in exotic plantations increases with
 - Warm and wet sites (naturally high diversity)
 - Stand age
 - Proximity of seed sources









Hall, G. M. J. (2001). Mitigating an organisation's future net carbon emissions by native forest restoration. *Ecological Applications*, *11*(6), 1622-1633.



Myth: More CO₂ sequestered in native forests





Top indigenous CO₂ sequestration reports

Species	Location	Age (years)	Stocking (stems/ha)	Height (m)	DBH (cm)	CO ₂ * (t/ha)	MAI ⁺ (t/ha/yr)
Kauri	Northland	67	492	25.6	40.8	926	13.8
	Taranaki, Fred Cowling Reserve	38	1402	14.3	20.2	413	10.9
		51	1256	15.0	25.6	614	12.0
		69	1325	23.1	31.0	1306	18.9
	Taranaki, Brooklands Park	50	630	20.1	33.6	663	13.3
		71	630	21.6	40.7	1027	14.5
		83	630	22.3	41.9	1116	13.4
	Hawkes Bay	48	1700	18.9	25.3	966	20.1
	Northland	36	650	13.0	30.0	393	10.9
Totara	Northland	102	1225	25.3	38.4	1770	17.4
	Northland	102	1825	23.3	28.4	1357	13.3
	Northland	58	816	8.7	31.4	376	6.5
	Hawkes Bay	48	1975	11.8	18.6	382	8.0
	Waikato	30	1475	8.2	16.6	182	6.1
Kahikatea	Waikato	30	2831	10.2	14.4	289	9.6
Puriri	Bay of Plenty	69	588	18.3	43.8	1046	15.2
Red Beech	Waikato	16	738	12.4	17.3	147	9.2
	Southland	14	1579	8.4	10.4	87	6.2
Black Beech	Southland	14	1508	8.6	10.5	98	7.0

Kimberley *et al.* (2014)

CO₂ sequestration in native forest plantations





"Plant and leave" option data





Woollons & Manley , Forestry, Vol. 85, No. 1, 2012.



"Plant and leave" option data





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Woollons & Manley , Forestry, Vol. 85, No. 1, 2012.

Estimated comparative sequestration on productive sites



Myth: Radiata pine is a high country wilding risk

• Species

- Radiata pine, Muricata pine
- Ponderosa pine
- Larch
- Lodgepole pine and Douglas fir
- Scots pine and Corsican pine
- "Take off site"
- Low intensity down-wind management













Where to from here?

- Ideal solutions
 - ~1 M ha plant & leave exotic species and succession to indigenous forest; or
 - 1.75 M ha of mixed production and C forest with exotic species
- 1 Billion tree programme
 - Actually 500 million trees in new forests (~0.5 M ha)
 - ~70% native
 - Cannot fill the gap in our C accounts
- Emissions trading scheme
 - Flawed but could result in enough new forest
 - Higher C price needed (Manley 2016)



