
18. Summary tables

The following summaries contain only results in which I have a reasonable degree of confidence. Data are presented in the order found in this report.

The individual results should be viewed in conjunction with the original discussion as there are factors other than those listed here that are of importance in assessing the results. I feel also that there are too many variables that impact on the values here to generalise. For example, there are vast regional differences that need to be taken into account. Comparing, say, 47% planting at the Waiwhui Stream in Northland where rainfall approaches 2000 mm per year with 100% planting at Moutere in Nelson where rainfall is about 1100 mm per year is not realistic. The immediate effects of sudden land-use change, for example, harvesting on yields, also needs to be considered in relation to the rainfall in that year, as yield increases will be very much smaller in a drought year than in a wet year. Attempts at generalisation have been known to produce nonsensical conclusions as I am aware of at least one study where a regression analysis of annual streamflow yields as a function of precipitation for a single vegetation type produced a highly significant equation

$$\text{flow} = 1.41 \times \text{precipitation} - 1477 \quad \text{precipitation} > 1400 \text{ mm}; r^2 = 0.88; \text{SE} = 134, n = 20$$

which implies that streamflow increases at a faster rate than precipitation increases.

18.1 Annual streamflow yields

Table 18.1 Streamflow yield changes (mm) as a consequence of afforestation of pasture and scrub.

Site	Precipitation (mm)	Initial cover	Change (%)	Flow difference	Comment	Section
Mangakahia @ Gorge	1700–1800	Pasture+scrub	15	-150	Assessed from rainfall records. Unexpectedly large change	3.1
Mangahahuru	1800	Scrub+native	85	No change	Woody vegetation to woody vegetation	3.2
Waiwhiu	1970	Native+pasture	47	-300	Assessed from rainfall records. Equivalent to 640 mm for 100% change	4.1
Moumoukai South	1.72017e+15	Scrub	1e+08	0 -300 -370 -170	Years -2 to 4 Years 5–12 Years 13–18 Years 19–27	5.2
Puruki	1.60016e+19	Pasture	0 100 100 100 -100	0 130 270 230 +110	Calibration Years 1–5 Years 6–15 Years 15–23 After harvest	5.4
Moutere 14	1100	Pasture	100100	-55 -170	Year 3 Years 8–16	11.2
Moutere 13	1100	Gorse	100	-26	Years 6–15	11.2
Moutere 8	1100	Gorse	100	-100	Years 6–15	11.2
Moutere 15	1000	Pasture	20	-50	Riparian zone planting	11.2
Glendhu GH2	1300	Tussock grassland	67	-220		14.2

Table 18.2 Streamflow yield changes (mm) as a consequence of other land-use changes.

Site	Precipitation (mm)	Initial cover	Change to	Flow difference	Comment	Section
Puketurua	1400	Manuka scrub	Pasture+scrub	105 mm	Assessed from rainfall records	3.1
Puketurua	1400	Manuka scrub	Reverting pasture	-70 mm	Assessed from rainfall records. Extension of above record	3.1
Glenbervie	1900	Exotics	Bare ground	270-670	Rainfall dependent	3.2
Waiwhiu	1970	Exotics+native	Bare ground+native	300	Harvesting not complete so change could be greater. Equivalent to 640 mm for 100% cut	4.1
Puruki	1630	Exotics	Bare ground	110	After harvest	5.4
Pakuratahi	1290	Exotics	Bare ground	50-100	After harvest	8.3
Mangaetoroa		Native + pasture	Exotic+pasture	0	Conversion of some native to exotics	9.1
Collins		Native	Native+exotic	0	Conversion of about 8% native to exotics	11.1
Pigeon South	1150	Exotic	Bare ground	300	After harvest	11.1
Moutere 10	1100	Gorse	Crop	130		11.2
Moutere 14	1100	Gorse	Pasture	250	Year 1 to pasture	11.2
Graham	1800	Pines 3-10 years	Pines 19-22 years	-50		11.3
Donald DC1	1550	Native	Exotic+native	3201000	Before harvest of 83% of the catchment Pines 0-3 years Pines 4-10 years Pines 11-17 years	11.4

Site	Precipitation (mm)	Initial cover	Change to	Flow difference	Comment	Section
Donald DC4	1550	Native	Exotic+native	0 350 110 -110	Before harvest of 94% of the catchment Pines 0–3 years Pines 4–12 years Pines 13–17 years	11.4
Donald DC3	1550	Native	Native	300220220	Before selection harvest 0–3 years after 4–10 years after 11–14 years after	11.4
Maimai	2450	Native	Exotic+native	200–550	4 catchments, various harvest treatment regimes, 75–100% of the catchment	12.1
Mitchell's @ Kakahu		Plantation 1–4 years	Plantation 18–19 years	-145		13.2

Table 18.3 Streamflow yield (mm) for catchments with differing land covers. Values in parentheses are rainfall (mm).

Site 1		Site 2		Comment	Section
Kaihu	1100	Opouteke	1200	Different hydrological & rainfall region	3.1
Native+exotic+pasture	(1600)	Exotic	(1750)		
Puketurua	660	Hikurangi	930	Large difference in catchment sizes	3.1
Pasture	(1470)	Pasture+native	(1570)		
Mangahahuru	700	Ngunguru	980	Reason for the large difference unknown	3.2
Exotic+native	(1800)	Native+scrub+pasture	(1800)		
Glenbervie	840	Ngunguru	1020	Three catchments at Glenbervie	3.2
Exotic	(1960)	Native+scrub+pasture	(1930)		
Topuni	510	Tamahunga	775		4.1
Exotic	(1470)	Native+pasture	(1470)		
Rangitopuni	580	Huapai	580		4.2
Native+pasture+exotic	(1410)	Pasture+horticulture	(1290)		
Rangitopuni	570	Kumeu	680		4.2
Native+pasture+exotic	(1390)	Pasture+horticulture	(1550)		
Wharekawa	1370	Tairua	1570		5.1
Exotic+native	(2100)	Native	(2100+)		
Purutaka	250	Te Waru	530	Difference geologic rather than vegetation – pumice country	5.3
Pasture		Pasture			
		Puruwai	360		
		Native			
		Puruorakau	280		
		Native			

Site 1		Site 2		Comment	Section
Ngaruroro Native+scrub+pasture	1450	Mohaka @ Glenfalls Pasture+scrub+exotic	1140	Rainfall difference	8.1
Ngaruroro Native+scrub+pasture	1390	Mohaka @ Ruapunga Pasture+scrub+exotic	950	Rainfall difference	8.1
Tamingimingi Pasture	410 (1290)	Pakuratahi (Hawke's Bay) Exotic	380 (1290)		8.3
Akatarawa Native+exotic	1430	Whakatiki Native Hutt Native Tauherenikau Native	1010 2820 2460	Rainfall differences	10
Hunters Native	1600	Graham Exotics Roughn's Exotics Kikiwa Pasture	530 440 530	Some rainfall differences	11.3
Berwick Pasture	1000	Berwick Exotics	-180	Average of two catchments in each land cover. Pines 15–23 years	14.1

18.2 Low flows

Table 18.4 Changes in minimum 7-day low flows (mm/day) as a consequence of afforestation.

Site	Precipitation (mm)	Initial cover	Change (%)	Flow difference	Comment	Section
Mangakahia @ Gorge	1700–1800	Pasture+scrub	15	-0.06 from 0.54	Not significant	3.1
Mangahahuru	1800	Native+scrub	85	No change	Woody to woody vegetation	3.2
Waiwhiu	1970	Pasture+native	47	No change		4.1
Moumoukai South	1.74017e+11	Scrub	100	-0.16 -0.24 +0.03	Years 5–12 Years 13–18 Years 19–27	5.2
Puruki	1.60016e+19	Pasture	0 100 100 100 -100	0 -0.0 -0.09 0 +0.11	Calibration Years 1–5 Years 6–15 Years 15–23 After harvest	5.4
Moutere	1100	Pasture	100	0	Catchment dries up. Number of dry days smaller after planting	11.2
Glendhu GH2	1300	Tussock grassland	67	-0.21		14.2

Table 18.5 Changes in minimum 7-day low flows (mm/day) as a consequence of other land-use change.

Site	Precipitation	Initial vegetation	Change (%)	Flow difference	Comment	Section
Glenbervie	1950	Exotic	-100	+0.25 to +0.7	Harvesting	3.2
Pakuratahi		Exotic	-100	0.05	Harvesting	8.3
Mangaetoroa		Native+pasture	48	0.04	Conversion of native to exotic	9.1
Collins		Native	8	0	Conversion of native to exotics	11.1
Pigeon South	1150	Exotic	-100	0	Harvesting. Catchment dries up. Number of dry days diminished by over 100/year	11.1
Donald DC1	1550	Native	83	0 0.08 -0.06 -0.02	Before harvest Pines 0–3 years Pines 4–10 years Pines 11–18 years	11.4
Donald DC4	1550	Native	94	0 0.14 -0.03 -0.03	Before harvest Pines 0–3 years Pines 4–12 years Pines 13–18 years	11.4
Donald DC3	1550	Native	83	0 0.09 0.05 0.08	Before selection harvest 0–3 years after 4–10 years after 11–15 years after	11.4
Maimai	2450	Native	75–100	up to 0.5	Four catchments, various harvest treatments	12.1

Table 18.6 Annual 7-day low flows (mm/day) for catchments with differing land covers.

Catchment 1		Catchment 2		Comment	Section
Kaihu	0.55	Opouteke	0.54	Different hydrological and rainfall region	3.1
Native+exotic+pasture		Exotic			
Mangahahuru	0.47	Ngunguru	0.56	Same hydrological region	3.2
Woody vegetation		Native+pasture			
Topuni	0.04	Tamahunga	0.12	Topuni goes dry	4.1
Exotic		Native+pasture			
Rangitopuni	0.04	Huapai	0.08		4.2
Native+pasture+exotic		Pasture+horticulture			
Rangitopuni	0.04	Kumeu	0.08		4.2
Native+pasture+exotic		Pasture+horticulture			
Huapai	10	Ararimu	0.11		4.2
Pasture+horticulture		Exotic+pasture+native			
Opitinui	0.63	Maharirau	0.97	Geology or rainfall the reason?	5.1
Exotic+native		Native			
Wharekawa	0.61	Tairua	0.66		5.1
Exotic+native		Native			
Ngaruroro	1.01	Mohaka @ Glenfalls	1.07		8.1
Native+scrub+pasture		Pasture+scrub+exotic			
Pakuratahi (Hawke's Bay)	0.49	Tamingmingi	0.5		8.3
Exotic		Pasture			
Pakuratahi (Wellington)	0.54	Orongorongo	0.49		10
Native+exotic		Native			
		Wainuiomata	0.61		
		Native			

Catchment 1		Catchment 2		Comment	Section
Akatarawa Native+exotic	0.84	Whakatiki Native	0.66	Rainfall difference	10
Hunters Native	0.07	Graham Plantation	0.02	Can go dry, 17 days/year	11.3
		Roughn's Plantation	0.03	Sometimes goes dry	
		Kikiwa Pasture	0.05	Does not go dry	
				There are rainfall differences	
Berwick Pasture	0.22	Berwick Exotics	0.23	Averages of 2 catchments for each land cover Pines 15–23 years	14.1

18.3 Storm peaks

Table 18.7 Changes in annual storm peak flows (L/s/ha) as a consequence of afforestation.

Site	Precipitation (mm)	Initial cover	Change (%)	Flow difference	Comment	Section
Waiwhiu	1970	Pasture+native	47	-30%	Annual series. Only part afforested. No control data	4.1
Waiwhiu	1970	Pasture+native	47	-30%	Five largest peaks/year. Only part afforested. No control data	4.1
Moumoukai South	1740	Scrub	100	-32%	Annual series. Other flow classes in Table 5.6	5.2
Puruki	1600	Pasture	100	-80+%	Annual series. Other flow classes in Table 5.13	5.4
Moutere	1100	Gorse	100	-35%	Annual series	11.2

Table 18.8 Changes in annual storm peak flows (L/s/ha) as a consequence of other land-use changes or differences between two landcover s.

Site	Precipitation (mm)	Initial cover	Change (%)	Flow difference	Comment	Section
Waiwhiu	1970	Exotic+native	up to -47	+50%	Annual series. Only part harvested. No control data	4.1
Puruki	1600	Exotic	-100	+	Post harvest. Annual series	5.4
Berwick	1000	Exotic	100	-66%	Comparison of pasture with 15–23-year-old pines. Average of two catchments in each land cover	14.1
Glendhu GH2	1300	Tussock grassland	67	-50%		14.2

Comprehensive tables with changes in peak flows for various flow classes are: Puruki, afforestation of pasture Table 5.13; Donald Creek, conversion of native forest to plantation Table 11.11; Maimai, conversion of native forest to plantation Table 12.2; Larry River, drainage of pakihi Table 12.6.

18.4 Quickflow and baseflow

Table 18.9 Changes in quickflow (mm) and baseflow (mm) as a consequence of afforestation.

Site	Initial cover	Change (%)	Precipitation	Quickflow	Baseflow	Comment	Section
Waiwhiu	Pasture+native	47	19601900	600 370	600450	Calibration 14–21 years No control data.	4.1
Moutere 15	Pasture	20	1000	0	-45	Riparian zone planting	11.2
Glendhu GH2	Tussock grassland	67	1300	-100	-110		14.2

Table 18.10 Changes in quickflow (mm) and baseflow (mm) as a consequence of other land-use change or comparisons between two land covers.

Site	Initial cover	Change (%)	Precipitation (mm)	Quickflow	Baseflow	Comment	Section
Waiwhiu	Exotic+native	0	19002130	370	450550	14–21 years	4.1
		-47		620		Part harvested. No control data.	
Puruki	Exotic	0	16301630	50110	540740	Mature trees	5.4
		-100				After harvest	
Donald DC1	Native	86		110	1703050	0–3 years after harvest and planting with pines	11.4
				40		4–10 years after	
				30		11–14 years after	
Donald DC4	Native	94		100	22012050	0–3 years after harvest and planting with pines	11.4
				60		4–10 years after	
				40		11–14 years after	
Donald DC3	Native	100% selection harvest		110	1.90e+08	0–3 years after selection harvest	11.4
				100		4–10 years after	
				80		11–14 years after	
Maimai M5	Native	100		360200	360180	Years 1–3 Years 4–9	
Maimai M13	Native	100		11060	130	Years 1–3	12.4
					-30	Years 4–9	
Berwick	Exotic	100		-90	-90	Comparison between 15–23-year-old pines and pasture Average of two catchments in each land cover	14.1