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Landcare Research

Supplementary material for Analysis II

Assessing the Nationwide Economic Impacts of Farm-Level Biological GHG Emission Mitigation Options

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NZFARM model results for dairy and sheep & beef farm systems considering intensities and rate of mitigation options across regions for Analysis II

Table B1. Area of mitigation options adopted across regions by dairy farms under GHG1 price scenario (\$20.25/tCO₂) in 2030, in 1,000 ha

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 5% reduction	0	0	0	0.19	6.84	0	38.94	0	0	0	0	44.17	0	0	0	9.64
4	Output approach: 10% reduction	0	0	0	0	0	0	0	0	0	17.33	35.90	0	0	0	0	0
2	Once-a-day milking: entire season	16.00	0	0	0	0	0	0	0	44.02	0	0	0	0	0	0	0
2	Planting forestry: 5% forestry	0	0	0	0	0	6.19	0	0.25	0	0	0	0	19.49	0	53.50	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	16.00	19.54	0	0.38	13.67	0	77.88	0	44.02	0	0	88.34	0	125.80	0	19.27
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	32.0	53.74	51.91	0.24	8.55	4.13	48.68	0.17	88.05	46.21	95.74	55.21	13.00	345.95	35.67	12.05
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	19.54	207.63	0.14	5.13	0	29.21	0	0	46.21	95.74	33.13	0	125.80	0	7.23
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	4.9	86.51	0	0	0	0	0	0	5.78	11.97	0	0	31.45	0	0

Table B2. Area of mitigation options adopted across regions by dairy farms under GHG4 price scenario (\$135/tCO₂) in 2030, in 1,000 ha

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 15% reduction	0	0	0	0.19	6.84	0	38.94	0	0	0	0	44.17	0	0	0	9.64
2	Planting forestry: 5% forestry	0	0	0	0	0	6.19	0	0.25	0	0	0	0	19.49	0	53.50	0
4	Reduction in cow numbers and increase in milk production per cow: 15% reduction	0	0	0	0	0	0	0	0	0	17.33	35.90	0	0	0	0	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	32.0	19.5	0	0.38	13.67	0	77.88	0	88.05	0	0	88.34	0	125.80	0	19.27
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	32.0	53.7	51.42	0.24	8.55	4.13	48.68	0.17	88.05	46.21	95.74	55.21	13.00	345.95	35.67	12.05
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	19.54	205.68	0.14	5.13	0	29.21	0	0	46.21	95.74	33.13	0	125.80	0	7.23
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	4.89	85.70	0	0	0	0	0	0	5.78	11.97	0	0	31.45	0	0

Table B3. Area of mitigation options adopted across regions by dairy farms under GHG1 price scenario (\$28.73/tCO₂) in 2050, in 1,000 ha

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 5% reduction	0	0	0	0.19	6.84	0	38.94	0	0	0	0	44.17	0	0	0	9.64
4	Output approach: 10% reduction	0	0	0	0	0	0	0	0	0	17.33	35.90	0	0	0	0	0
2	Once-a-day milking: entire season	16.00	0	0	0	0	0	0	0	44.02	0	0	0	0	0	0	0
2	Planting forestry: 5% forestry	0	0	0	0	0	6.19	0	0.25	0	0	0	0	19.49	0	53.50	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	16.00	19.54	0	0.38	13.67	0	77.88	0	44.02	0	0	88.34	0	125.80	0	19.27
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	32.00	53.74	51.91	0.24	8.55	4.13	48.68	0.17	88.05	46.21	95.74	55.21	13.00	345.95	35.67	12.05
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	19.54	207.63	0.14	5.13	0	29.21	0	0	46.21	95.74	33.13	0	125.80	0	7.23
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	4.89	86.51	0	0	0	0	0	0	5.78	11.97	0	0	31.45	0	0

Table B4. Area of mitigation options adopted across regions by dairy farms under GHG4 price scenario (\$191.54/tCO₂) in 2050, in 1,000 ha

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 20% reduction	0	0	0	0.19	6.84	0	38.94	0	0	0	0	44.17	0	0	0	9.64
2	Planting forestry: 5% forestry	0	0	0	0	0	6.19	0	0.25	0	0	0	0	19.49	0	53.50	0
4	Reduction in cow numbers and increase in milk production per cow: 15% reduction	0	0	0	0	0	0	0	0	0	17.33	35.90	0	0	0	0	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	32.00	19.54	0	0.38	13.67	0	77.88	0	88.05	0	0	88.34	0	125.80	0	19.27
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	32.00	53.74	51.91	0.24	8.55	4.13	48.68	0.17	88.05	46.21	95.74	55.21	13.00	345.95	35.67	12.05
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	19.54	207.63	0.14	5.13	0	29.21	0	0	46.21	95.74	33.13	0	125.80	0	7.23
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	4.89	86.51	0	0	0	0	0	0	5.78	11.97	0	0	31.45	0	0

Table B5. Dairy profits with different mitigation options across regions under GHG1 price scenario (\$20.25/tCO₂) in 2030, in \$ million

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 5% reduction	0	0	0	0.13	4.59	0	26.13	0	0	0	0	29.64	0	0	0	6.47
4	Output approach: 10% reduction	0	0	0	0	0	0	0	0	0	5.67	11.74	0	0	0	0	0
2	Once-a-day milking: entire season	12.50	0	0	0	0	0	0	0	34.40	0	0	0	0	0	0	0
2	Planting forestry: 5% forestry	0	0	0	0	0	7.62	0	0.31	0	0	0	0	24.00	0	65.88	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	14.15	31.43	0	0.47	16.73	0	95.26	0	38.94	0	0	108.05	0	202.31	0	23.57
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	44.07	75.48	49.78	0.40	14.32	0.43	81.54	0.02	121.26	101.49	210.26	92.49	1.34	485.86	3.69	20.18
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	7.84	241.72	0.20	7.02	0	39.96	0	0	42.46	87.98	45.33	0	50.49	0	9.89
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	6.42	63.77	0	0	0	0	0	0	8.34	17.28	0	0	41.33	0	0

Table B6. Dairy profits with different mitigation options across regions under GHG4 price scenario (\$135/tCO₂) in 2030, in \$ million

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 15% reduction	0	0	0	0.02	0.67	0	3.84	0	0	0	0	4.36	0	0	0	0.95
2	Planting forestry: 5% forestry	0	0	0	0	0	3.64	0	0.15	0	0	0	0	11.46	0	31.47	0
4	Reduction in cow numbers and increase in milk production per cow: 15% reduction	0	0	0	0	0	0	0	0	0	-3.77	-7.81	0	0	0	0	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	7.76	19.02	0	0.20	7.29	0	41.55	0	21.36	0	0	47.13	0	122.41	0	10.28
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	28.03	39.02	14.03	0.23	8.22	-1.99	46.82	-0.08	77.12	70.86	146.80	53.11	-6.26	251.20	-17.1841	11.59
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	-3.51	77.59	0.11	3.87	0	22.02	0	0	13.42	27.80	24.97	0	-22.57	0	5.45
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	2.05	-7.51	0	0	0	0	0	0	3.79	7.86	0	0	13.23	0	0

Table B7. Dairy profits with different mitigation options across regions under under GHG1 price scenario (\$28.73/tCO₂) in 2050, in \$ million

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 5% reduction	0	0	0	0.12	4.29	0	24.42	0	0	0	0	27.70	0	0	0	6.04
4	Output approach: 10% reduction	0	0	0	0	0	0	0	0	0	4.94	10.23	0	0	0	0	0
2	Once-a-day milking: entire season	11.71	0	0	0	0	0	0	0	32.21	0	0	0	0	0	0	0
2	Planting forestry: 5% forestry	0	0	0	0	0	7.33	0	0.30	0	0	0	0	23.08	0	63.33	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	13.49	30.51	0	0.45	16.03	0	91.29	0	37.12	0	0	103.55	0	196.40	0	22.59
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	42.88	72.79	47.14	0.39	13.87	0.25	78.97	0.01	117.99	99.22	205.57	89.58	0.78	468.52	2.15	19.54
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	7.00	229.59	0.19	6.78	0	38.63	0	0	40.32	83.53	43.82	0	45.09	0	9.56
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	6.10	58.50	0	0	0	0	0	0	8.00	16.58	0	0	39.26	0	0

Table B8. Dairy profits with different mitigation options across regions under GHG4 price scenario (\$191.54/tCO₂) in 2050, in \$ million

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 20% reduction	0	0	0	-0.03	-1.04	0	-5.92	0	0	0	0	-6.71	0	0	0	-1.46
2	Planting forestry: 5% forestry	0	0	0	0	0	1.68	0	0.07	0	0	0	0	5.29	0	14.51	0
4	Reduction in cow numbers and increase in milk production per cow: 15% reduction	0	0	0	0	0	0	0	0	0	-7.94	-16.45	0	0	0	0	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	-1.02	12.90	0.00	0.07	2.65	0.00	15.08	0.00	-2.81	0	0	17.11	0	83.05	0	3.73
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	20.13	21.06	-3.59	0.15	5.22	-3.18	29.72	-0.13	55.38	55.76	115.53	33.71	-10.01	135.57	-27.47	7.35
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	-9.10	-3.29	0.06	2.31	0	13.18	0	0	-0.89	-1.85	14.95	0	-58.57	0	3.26
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	-0.10	-42.64	0	0	0	0	0	0	1.55	3.22	0	0	-0.62	0	0

Table B9. Greenhouse gas emissions for dairy farms with different mitigation options under GHG1 price scenario (\$20.25/tCO₂) in 2030, in 1,000 tCO₂

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 5% reduction	0	0	0	0.99	35.41	0	201.67	0	0	0	0	228.75	0	0	0	49.91
4	Output approach: 10% reduction	0	0	0	0	0	0	0	0	0	86.27	178.74	0	0	0	0	0
2	Once-a-day milking: entire season	93.91	0	0	0	0	0	0	0	258.40	0	0	0	0	0	0	0
2	Planting forestry: 5% forestry	0	0	0	0	0	34.69	0	1.42	0	0	0	0	109.26	0	299.88	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	78.26	108.16	0	2.297	82.186	0	468.08	0	215.34	0	0	530.95	0	696.26	0	115.84
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	139.77	317.70	311.57	1.48	53.12	21.05	302.53	0.86	384.59	266.93	553.03	343.16	66.28	2045.01	181.92	74.87
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	98.91	1430.37	0.77	27.45	0	156.35	0	0	253.11	524.41	177.35	0	636.70	0	38.69
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	38.05	621.19	0	0	0	0	0	0	39.60	82.05	0	0	244.95	0	0

Table B10. Greenhouse gas emissions for dairy farms with different mitigation options under GHG4 price scenario (\$135/tCO₂) in 2030, in 1,000 tCO₂

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 15% reduction	0	0	0	0.85	30.57	0	174.10	0	0	0	0	197.49	0	0	0	43.09
2	Planting forestry: 5% forestry	0	0	0	0	0	34.69	0	1.42	0	0	0	0	109.26	0	299.88	0
4	Reduction in cow numbers and increase in milk production per cow: 15% reduction	0	0	0	0	0	0	0	0	0	73.71	152.71	0	0	0	0	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	155.40	108.16	0	2.30	82.19	0	468.08	0	427.60	0	0	530.95	0	696.26	0	115.84
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	139.77	317.70	311.57	1.48	53.12	21.05	302.53	0.86	384.59	266.93	553.03	343.16	66.28	2045.01	181.922	74.87
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	98.91	1430.37	0.77	27.45	0	156.35	0	0	253.11	524.41	177.35	0	636.70	0	38.69
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	38.05	621.19	0	0	0	0	0	0	39.60	82.05	0	0	244.95	0	0

Table B11. Greenhouse gas emissions for dairy farms with different mitigation options under GHG1 price scenario (\$28.73/tCO₂) in 2050, in 1,000 tCO₂

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu -Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 5% reduction	0	0	0	0.99	35.41	0	201.67	0	0	0	0	228.75	0	0	0	49.91
4	Output approach: 10% reduction	0	0	0	0	0	0	0	0	0	86.27	178.74	0	0	0	0	0
2	Once-a-day milking: entire season	93.91	0	0	0	0	0	0	0	258.40	0	0	0	0	0	0	0
2	Planting forestry: 5% forestry	0	0	0	0	0	34.69	0	1.42	0	0	0	0	109.26	0	299.88	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	78.26	108.16	0	2.30	82.19	0	468.08	0	215.34	0	0	530.95	0	696.26	0	115.84
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	139.77	317.70	311.57	1.48	53.12	21.05	302.53	0.86	384.59	266.93	553.03	343.16	66.28	2045.01	181.92	74.87
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	98.91	1430.37	0.77	27.45	0	156.35	0	0	253.11	524.41	177.35	0	636.70	0	38.69
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	38.05	621.19	0	0	0	0	0	0	39.60	82.05	0	0	244.95	0	0

Table B12. Greenhouse gas emissions for dairy farms with different mitigation options under GHG4 price scenario (\$191.54/tCO₂) in 2050, in 1,000 tCO₂

Dairy system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu -Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
3	Output approach: 20% reduction	0	0	0	0.81	29.14	0	165.94	0	0	0	0	188.23	0	0	0	41.06
2	Planting forestry: 5% forestry	0	0	0	0	0	34.69	0	1.42	0	0	0	0	109.26	0	299.88	0
4	Reduction in cow numbers and increase in milk production per cow: 15% reduction	0	0	0	0	0	0	0	0	0	73.71	152.71	0	0	0	0	0
2	Reduction in cow numbers and increase in milk production per cow: 20% reduction	155.40	108.16	0	2.30	82.19	0	468.08	0	427.60	0	0	530.95	0	696.26	0	115.84
3	Reduction in cow numbers and increase in milk production per cow: 20% reduction	139.77	317.70	311.57	1.48	53.12	21.05	302.53	0.859	384.59	266.93	553.03	343.16	66.28	2045.01	181.92	74.87
4	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	98.91	1430.37	0.77	27.45	0	156.35	0	0	253.11	524.41	177.35	0	636.70	0	38.69
5	Reduction in cow numbers and increase in milk production per cow: 20% reduction	0	38.05	621.19	0	0	0	0	0	0	39.60	82.05	0	0	244.95	0	0

Table B13. Area of mitigation options adopted across regions by sheep & beef farms under GHG1 price scenario (\$20.25/tCO₂) in 2030, in 1,000 ha

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	198.0	193.0	0.0	0.0	0.0	0.0	0.0
Hill	Reduction in stocking rate – maintain production/area farmed	11.9	68.8	0.0	327.5	934.6	0.0	248.4	0.0	41.3	0.0	0.0	98.6	0.0	491.1	0.0	79.8
Hill	Reduction in stocking rate – maintain production/area farmed	0.0	2.0	0.0	3.1	6.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	1.7
Hill	Plant trees on marginal land and maintain production	0.0	0.0	1281.6	0.0	0.0	78.3	0.0	1.2	0.0	530.9	0.0	0.0	19.2	0.0	0.5	0.0
Intensive	Plant trees on marginal land and maintain production	129.1	41.2	0.0	30.5	168.7	0.0	200	0.0	318.4	0.0	0.0	57.8	0.0	174.1	0.0	77.4
Hill	Plant trees on marginal land and maintain production	0.0	0.0	60.9	0.0	0.0	10.9	0.0	0.8	0.0	260.0	43.0	0.0	16.3	0.0	0.8	0.0
Intensive	No mitigation	0.0	0.0	476.9	0.0	0.0	62.9	0.0	0.5	0.0	125.8	82.0	0.0	22.2	0.0	26.6	0.0
Intensive	No mitigation	0.0	0.0	176.4	0.0	0.0	23.3	0.0	0.2	0.0	0.0	0.0	0.0	8.2	0.0	9.8	0.0
Intensive	No mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	358.1	233.3	0.0	0.0	0.0	0.0	0.0

Table B14. Area of mitigation options adopted across regions by sheep & beef farms under GHG4 price scenario (\$135/tCO₂) in 2030, in 1,000 ha

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	198.0	193.0	0.0	0.0	0.0	0.0	0.0
Hill	Reduction in stocking rate – maintain production/area farmed	0.0	0.0	0.0	327.5	934.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hill	30% Planting forestry – maintain production	11.9	68.8	1281.6	0.0	0.0	78.3	248.4	1.2	41.3	0.0	0.0	98.6	19.2	491.1	0.5	79.8
Hill	Plant trees on marginal land and maintain production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	530.9	0.0	0.0	0.0	0.0	0.0	0.0
Intensive	Plant trees on marginal land and maintain production	129.1	41.2	0.0	30.5	168.7	0.0	200.0	0.0	318.4	0.0	0.0	57.8	0.0	174.1	0.0	77.4
Hill	30% Planting forestry – maintain production	0.0	2.0	0.0	3.1	6.0	0.0	3.9	0.0	0.0	260.0	43.0	0.0	0.0	2.6	0.0	1.7
Hill	Plant trees on marginal land and maintain production	0.0	0.0	60.9	0.0	0.0	10.9	0.0	0.8	0.0	0.0	0.0	0.0	16.3	0.0	0.8	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	476.9	0.0	0.0	62.9	0.0	0.5	0.0	125.8	82.0	0.0	22.2	0.0	26.6	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	176.4	0.0	0.0	23.3	0.0	0.2	0.0	0.0	0.0	0.0	8.2	0.0	9.8	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	358.1	233.3	0.0	0.0	0.0	0.0	0.0

Table B15. Area of mitigation options adopted across regions by sheep & beef farms under GHG1 price scenario (\$28.73/tCO2) in 2050, in 1,000 ha

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	179.9	171.6	0.0	0.0	0.0	0.0	0.0
Hill	Reduction in stocking rate – maintain production/area farmed	10.8	52.7	0.0	266.2	829.2	0.0	229.1	0.0	35.9	0.0	0.0	81.8	0.0	436.5	0.0	71.2
Hill	Plant trees on marginal land and maintain production	0.0	0.0	1146.4	0.0	0.0	76.6	0.0	1.0	0.0	514.5	0.0	0.0	15.4	0.0	0.5	0.0
Intensive	Plant trees on marginal land and maintain production	117.4	31.6	0.0	24.8	149.7	0.0	184.5	0.0	277.1	0.0	0.0	47.9	0.0	154.8	0.0	69.1
Hill	Reduction in stocking rate – maintain production/area farmed	0.0	1.5	0.0	2.5	5.4	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	1.5
Hill	Plant trees on marginal land and maintain production	0.0	0.0	54.5	0.0	0.0	10.7	0.0	0.6	0.0	247.7	38.2	0.0	13.0	0.0	0.8	0.0
Intensive	No mitigation	0.0	0.0	426.6	0.0	0.0	61.5	0.0	0.4	0.0	119.8	72.9	0.0	17.8	0.0	26.4	0.0
Intensive	No mitigation	0.0	0.0	157.8	0.0	0.0	22.7	0.0	0.2	0.0	0.0	0.0	0.0	6.6	0.0	9.8	0.0
Intensive	No mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	341.1	207.4	0.0	0.0	0.0	0.0	0.0

Table B16. Area of mitigation options adopted across regions by sheep & beef farms under GHG4 price scenario (\$191.54/tCO2) in 2050, in 1,000 ha

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	179.9	171.6	0.0	0.0	0.0	0.0	0.0
Hill	30% Planting forestry – maintain production	10.8	52.7	1146.4	266.2	829.2	76.6	229.1	1.0	35.9	514.5	0.0	81.8	15.4	436.5	0.5	71.2
Intensive	Plant trees on marginal land and maintain production	117.4	31.6	0.0	24.8	149.7	0.0	184.5	0.0	277.1	0.0	0.0	47.9	0.0	154.8	0.0	69.1
Hill	30% Planting forestry – maintain production	0.0	1.5	54.5	2.5	5.4	10.7	3.6	0.6	0.0	247.7	38.2	0.0	13.0	2.3	0.8	1.5
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	426.6	0.0	0.0	61.5	0.0	0.4	0.0	119.8	72.9	0.0	17.8	0.0	26.4	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	157.8	0.0	0.0	22.7	0.0	0.2	0.0	0.0	0.0	0.0	6.6	0.0	9.8	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	341.1	207.4	0.0	0.0	0.0	0.0	0.0

Table B17. Sheep & beef profits with different mitigation options across regions under GHG1 price scenario (\$20.25/tCO₂) in 2030, in \$ million

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0	0	0	0	0	0	0	0	0	107.69	104.92	0	0	0	0	0
Hill	Reduction in stocking rate – maintain production/area farmed	3.47	20.08	0	109.66	312.96	0	69.78	0	12.05	0	0	27.71	0	143.34	0	22.41
Hill	Plant trees on marginal land and maintain production	0	0	123.56	0	0	7.55	0	0.12	0	103.10	0	0	1.85	0	0.04	0
Intensive	Plant trees on marginal land and maintain production	40.69	12.98	0	11.60	64.22	0	64.55	0	100.38	0	0	18.65	0	54.90	0	24.99
Hill	Reduction in stocking rate – maintain production/area farmed	0.00	0.42	0	0.72	1.40	0	0.90	0	0	0	0	0.00	0	0.55	0	0.40
Hill	Plant trees on marginal land and maintain production	0	0	2.14	0	0	0.38	0	0.03	0	8.51	1.41	0	0.57	0	0.03	0
Intensive	No Mitigation	0	0.00	152.61	0.00	0.00	20.12	0.00	0.17	0.00	32.33	21.06	0.00	7.11	0	8.50	0
Intensive	No Mitigation	0	0	0.00	0	0	0.00	0	0.00	0	227.31	148.09	0	0	0	0	0
Intensive	No Mitigation	0	0	115.14	0	0	15.18	0	0.12	0	0.00	0.00	0	5.37	0	6.410948	0

Table B18. Sheep & beef profits with different mitigation options across regions under GHG4 price scenario (\$135/tCO₂) in 2030, in \$ million

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0	0	0	0	0	0	0	0	0	62.92	61.30	0	0	0	0	0
Hill	Reduction in stocking rate – maintain production/area farmed	0	0	0	43.10	123.00	0	0	0	0	0	0	0	0	0	0	0
Hill	30% Planting forestry – maintain production	0.90	5.22	-43.13	0	0	-2.64	17.82	-0.04	3.14	0	0	7.08	-0.65	37.28	-0.02	5.72
Hill	Plant trees on marginal land and maintain production	0	0	0	0	0	0	0	0	0	-8.43	0	0	0	0	0	0
Intensive	Plant trees on marginal land and maintain production	-23	-7	0	1.36	7.51	0	-22.49	0	-56.72	0	0	-6.50	0	-31.02	0	-8.70
Hill	30% Planting forestry – maintain production	0	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0
Hill	Plant trees on marginal land and maintain production	0	0	-0.20	0	0	-0.04	0	0	0	0	0	0	-0.05	0	0.0	0
Intensive	Plant trees on marginal land and maintain production	0	0	-4.37	0	0	-0.58	0	0	0	-11.96	-7.79	0	-0.20	0	-0.2	0
Intensive	Plant trees on marginal land and maintain production	0	0	34.96	0	0	4.61	0	0.04	0	0	0	0	1.63	0	1.9	0
Intensive	Plant trees on marginal land and maintain production	0	0	0	0	0	0	0	0	0	60.1	39.1	0	0	0	0	0

Table B19. Sheep & beef profits with different mitigation options across regions under under GHG1 price scenario (\$28.73/tCO₂) in 2050, in \$ million

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0	0	0	0	0	0	0	0	0	94.82	90.42	0	0	0	0	0
Hill	Reduction in stocking rate – maintain production/area farmed	2.98	14.54	0	85.14	265.21	0	60.80	0	9.92	0	0	21.70	0	120.43	0	18.89
Hill	Plant trees on marginal land and maintain production	0	0	98.89	0	0	6.61	0	0.085	0	91.93	0	0	1.33	0	0.04	0
Intensive	Plant trees on marginal land and maintain production	32.74	8.80	0	8.82	53.26	0	53.61	0	77.25	0	0	13.92	0	43.16	0	20.08
Hill	Reduction in stocking rate – maintain production/area farmed	0.00	0.30	0	0.55	1.17	0	0.78	0	0	0	0	0	0	0.45	0	0.33
Hill	Plant trees on marginal land and maintain production	0	0	1.76	0	0	0.34	0	0.02	0	7.35	1.13	0	0.42	0	0.03	0
Intensive	No Mitigation	0	0	125.56	0	0	18.10	0	0.12	0	27.45	16.70	0	5.23	0	7.77	0
Intensive	No Mitigation	0	0	97.57	0	0	14.06	0	0.10	0	0	0	0	4.07	0	6.03	0
Intensive	No Mitigation	0	0	0	0	0	0	0	0	0	204.42	124.31	0	0	0	0	0

Table B20. Sheep & beef profits with different mitigation options across regions under GHG4 price scenario (\$191.54/tCO₂) in 2050, in \$ million

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0	0	0	0	0	0	0	0	0	37.12	35.40	0	0	0	0	0
Hill	30% Planting forestry – maintain production	0.15	0.74	-93.35	14.44	44.97	-6.24	2.66	-0.08	0.51	-48.14	0	0.95	-1.25	6.16	-0.04	0.83
Intensive	Plant trees on marginal land and maintain production	-49.47	-13.29	0	-3.00	-18.13	0	-60.30	0	-116.72	0	0	-15.65	0	-65.20	0	-22.58
Hill	30% Planting forestry – maintain production	0	-0.04	-0.94	0.01	0.01	-0.18	0.01	-0.01	0	-5.44	-0.84	0	-0.23	-0.06	-0.01	0.01
Intensive	Plant trees on marginal land and maintain production	0	0	-69.6	0	0	-10.03	0	-0.07	0	-31.42	-19.11	0	-2.90	0	-4.30	0
Intensive	Plant trees on marginal land and maintain production	0	0	-1.3	0	0	-0.18	0	0.00	0	0	0	0	-0.05	0	-0.08	0
Intensive	Plant trees on marginal land and maintain production	0	0	0	0	0	0	0	0	0	-15.41	-9.37	0	0.00	0	0	0

Table B21: Greenhouse gas emissions for sheep & beef farms with different mitigation options under GHG1 price scenario (\$20.25/tCO₂) in 2030, in 1,000 tCO₂

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	390.1	380.1	0.0	0.0	0.0	0.0	0.0
Hill	Reduction in stocking rate – maintain production/area farmed	22.4	129.6	0.0	580.0	1655.4	0.0	455.5	0.0	77.8	0.0	0.0	180.9	0.0	925.4	0.0	146.3
Hill	Plant trees on marginal land and maintain production	0.0	0.0	1532.8	0.0	0.0	93.7	0.0	1.5	0.0	972.0	0.0	0.0	23.0	0.0	0.6	0.0
Intensive	Plant trees on marginal land and maintain production	555.0	177.0	0.0	89.3	494.2	0.0	758.5	0.0	1369	0.0	0.0	219.1	0.0	748.8	0.0	293.6
Hill	Reduction in stocking rate – maintain production/area farmed	0.0	3.5	0.0	5.0	9.6	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0.0	2.7
Hill	Plant trees on marginal land and maintain production	0.0	0.0	20.4	0.0	0.0	3.7	0.0	0.3	0.0	93.4	15.4	0.0	5.4	0.0	0.3	0.0
Intensive	No mitigation	0.0	0.0	1442.6	0.0	0.0	190.2	0.0	1.6	0.0	413.2	269.2	0.0	67.2	0.0	80.3	0.0
Intensive	No mitigation	0.0	0.0	715.1	0.0	0.0	94.3	0.0	0.8	0.0	0.0	0.0	0.0	33.3	0.0	39.8	0.0
Intensive	No mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1498.8	976.5	0.0	0.0	0.0	0.0	0.0

Table B22. Greenhouse gas emissions for sheep & beef farms with different mitigation options under GHG4 price scenario (\$135/tCO₂) in 2030, in 1,000 tCO₂

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	390.1	380.1	0.0	0.0	0.0	0.0	0.0
Hill	Reduction in stocking rate – maintain production/area farmed	0.0	0.0	0.0	580.0	1655.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hill	30% Planting forestry – maintain production	13.0	75.2	1082.9	0.0	0.0	66.2	264.2	1.0	45.1	0.0	0.0	104.9	16.2	536.7	0.4	84.9
Hill	Plant trees on marginal land and maintain production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	972.0	0.0	0.0	0.0	0.0	0.0	0.0
Intensive	Plant trees on marginal land and maintain production	555.0	177.0	0.0	89.3	494.2	0.0	758.5	0.0	1369.0	0.0	0.0	219.1	0.0	748.8	0.0	293.6
Hill	30% Planting forestry – maintain production	0.0	2.0	0.0	2.9	5.6	0.0	3.5	0.0	0.0	66.0	10.9	0.0	0.0	2.6	0.0	1.6
Hill	Plant trees on marginal land and maintain production	0.0	0.0	20.4	0.0	0.0	3.7	0.0	0.3	0.0	0.0	0.0	0.0	5.4	0.0	0.3	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	1298.4	0.0	0.0	171.2	0.0	1.4	0.0	371.9	242.3	0.0	60.5	0.0	72.3	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	643.6	0.0	0.0	84.9	0.0	0.7	0.0	0.0	0.0	0.0	30.0	0.0	35.8	0.0
Intensive	Plant trees on marginal land and maintain production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1348.9	878.8	0.0	0.0	0.0	0.0	0.0

Table B23. Greenhouse gas emissions for sheep & beef farms with different mitigation options under GHG1 price scenario (\$28.73/tCO₂) in 2050, in 1,000 tCO₂

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	354.4	338.0	0.0	0.0	0.0	0.0	0.0
Hill	Reduction in stocking rate – maintain production/area farmed	20.4	99.3	0.0	471.5	1468.7	0.0	420.2	0.0	67.7	0.0	0.0	150.0	0.0	822.5	0.0	130.5
Hill	Plant trees on marginal land and maintain production	0.0	0.0	1371.0	0.0	0.0	91.6	0.0	1.2	0.0	941.9	0.0	0.0	18.4	0.0	0.5	0.0
Intensive	Plant trees on marginal land and maintain production	505.0	135.7	0.0	72.6	438.5	0.0	699.7	0.0	1191.4	0.0	0.0	181.6	0.0	665.6	0.0	262.0
Hill	Reduction in stocking rate – maintain production/area farmed	0.0	2.7	0.0	4.0	8.5	0.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	2.4
Hill	Plant trees on marginal land and maintain production	0.0	0.0	18.2	0.0	0.0	3.6	0.0	0.2	0.0	89.0	13.7	0.0	4.3	0.0	0.3	0.0
Intensive	No mitigation	0.0	0.0	1290.4	0.0	0.0	186.0	0.0	1.3	0.0	393.7	239.4	0.0	53.8	0.0	79.8	0.0
Intensive	No mitigation	0.0	0.0	639.6	0.0	0.0	92.2	0.0	0.6	0.0	0.0	0.0	0.0	26.7	0.0	39.6	0.0
Intensive	No mitigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1427.8	868.2	0.0	0.0	0.0	0.0	0.0

Table B24. Greenhouse gas emissions for sheep & beef farms with different mitigation options under GHG4 price scenario (\$191.54/tCO₂) in 2050, in 1,000 tCO₂

Sheep & beef system	Mitigation options	Auckland	Bay of Plenty	Canterbury	Gisborne	Hawke's Bay	Marlborough	Manawatu-Wanganui	Nelson	Northland	Otago	Southland	Taranaki	Tasman	Waikato	West Coast	Wellington
Hill	Replace breeding cows with surplus dairy animals	0	0	0	0	0	0	0	0	0	354.4	338.0	0	0	0	0	0
Hill	30% Planting forestry – maintain production	11.8	57.6	968.7	273.5	851.8	64.7	243.7	0.8	39.3	665.5	0	87.0	13.0	477.1	0.4	75.7
Intensive	Plant trees on marginal land and maintain production	505.0	135.7	0.0	72.6	438.5	0.0	699.7	0	1191.4	0	0	181.6	0	665.6	0	262.0
Hill	30% Planting forestry – maintain production	0	1.5	12.9	2.3	4.9	2.5	3.3	0.1	0	62.9	9.7	0	3.1	2.3	0.2	1.4
Intensive	Plant trees on marginal land and maintain production	0	0	1161.4	0	0	167.4	0	1.1	0	354.3	215.4	0	48.4	0.0	71.8	0
Intensive	Plant trees on marginal land and maintain production	0	0	575.7	0	0	0	0	0	0	0	0	0	24.0	0.0	35.6	0
Intensive	Plant trees on marginal land and maintain production	0	0	0	0	0	0	0	0	0	1285.0	781.4	0	0	0	0	0