Manaaki Whenua
Landcare Research

Ruamahanga Economic Catchment Model Results

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27th November 2017

Sediment & on-farm mitigation

Approach:

- Farm impacts – NZFARM modelling
- Farm systems based on Ag Research report
- Environmental impacts from Jacobs
- Regional impacts – multiplier for Wellington

NZFARM
NEW ZEALAND FOREST AND AGRICULTURE REGIONAL MODEL

WWTP costs

Approach:

- Based on Carterton DC estimates
- Extrapolated to other districts based on population
- Population estimates & projections from StatsNZ
- Assumed a linear relationship between costs & % discharge to land

Water allocation

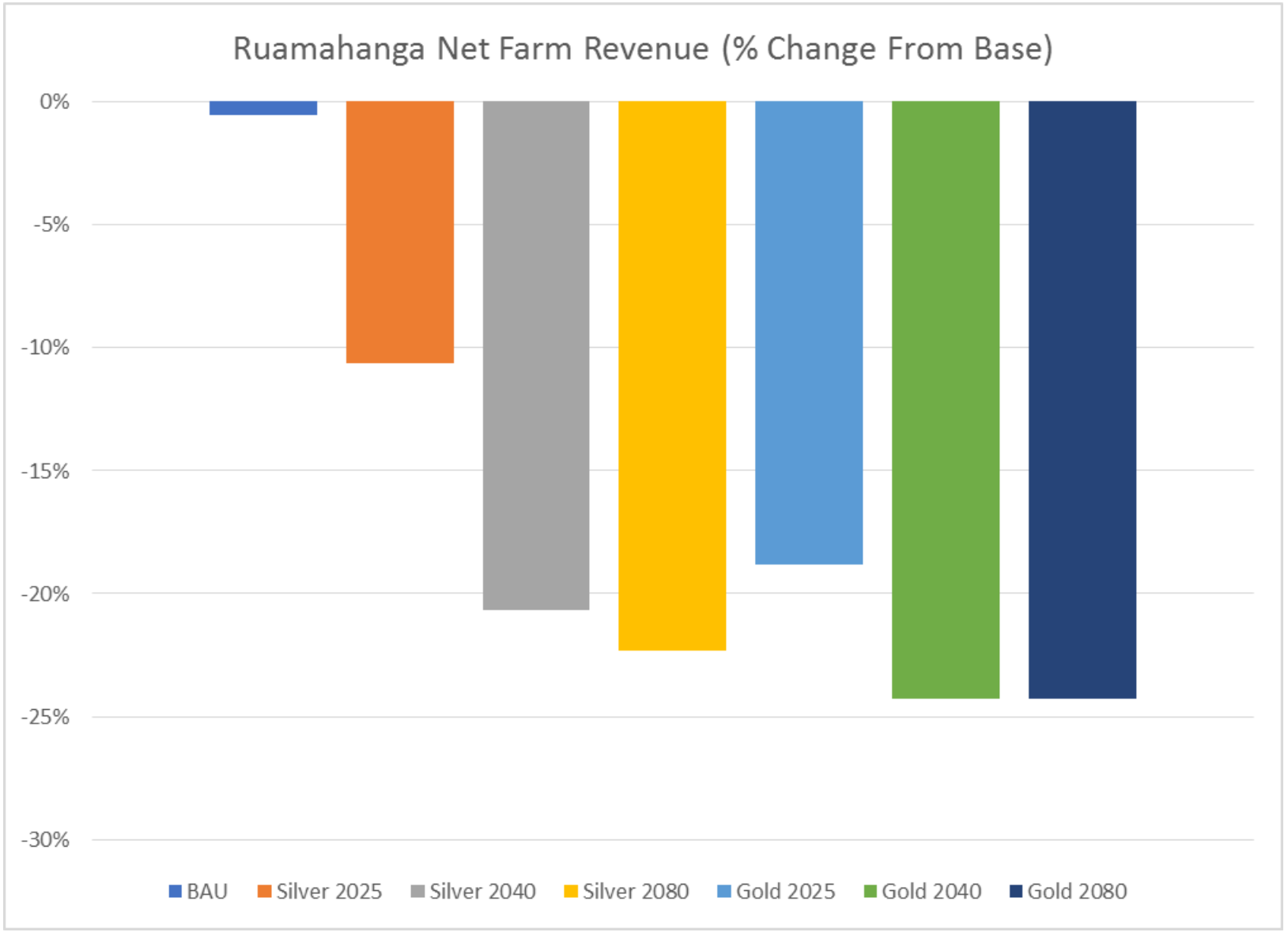
Approach:

- Upper/middle Ruamahanga & Waipoua sub-catchments
- Used consents information from GWRC
- Reliability change estimates from increases in minimum flows from GWRC
- Impacts on cash operating surplus of changes in water supply reliability from Aqualinc
- Ag systems being irrigated was unknown – ran scenarios using average farm system & most intensive farm system

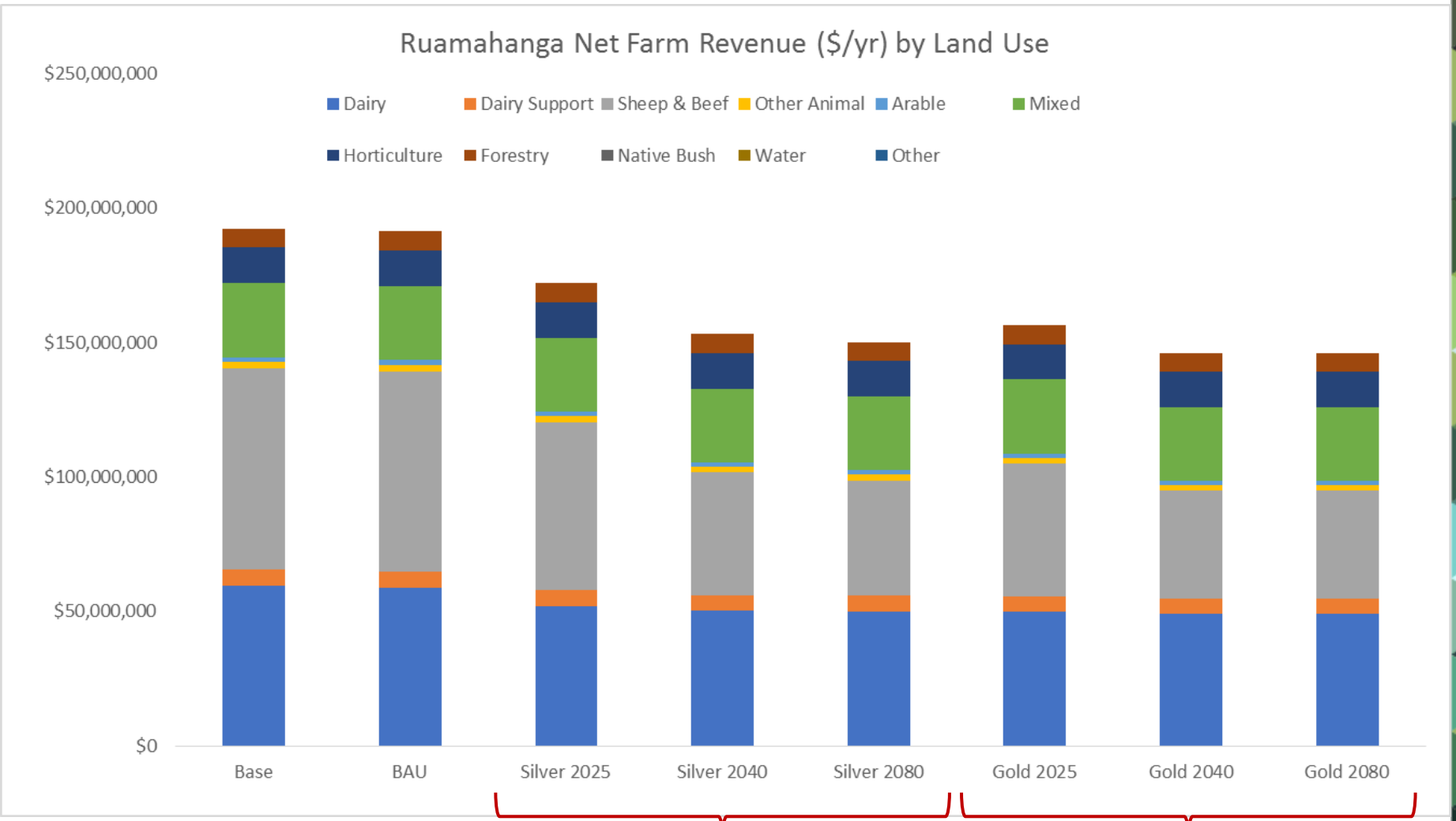
Scenario Summary

Mitigation option	BAU	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Retirement of steep slopes	retire rate		X	X	X	X	X
Space planting on steep slopes	Planting rate	X	X	X	X	X	X
Additional riparian planting (+5m)					X	X	X
Stock exclusion	X	X	X	X	X	X	X
WWTP discharge to land	Staggered	60%	100%	100%	100%	100%	100%
Minimum flow and allocation set	X	X	X	X	X	X	X
On-farm mitigation options	Tier 1	Tier 1	Tier 2	Tier 3	Tier 2	Tier 3	Tier 3

Sediment & On-farm Mitigation



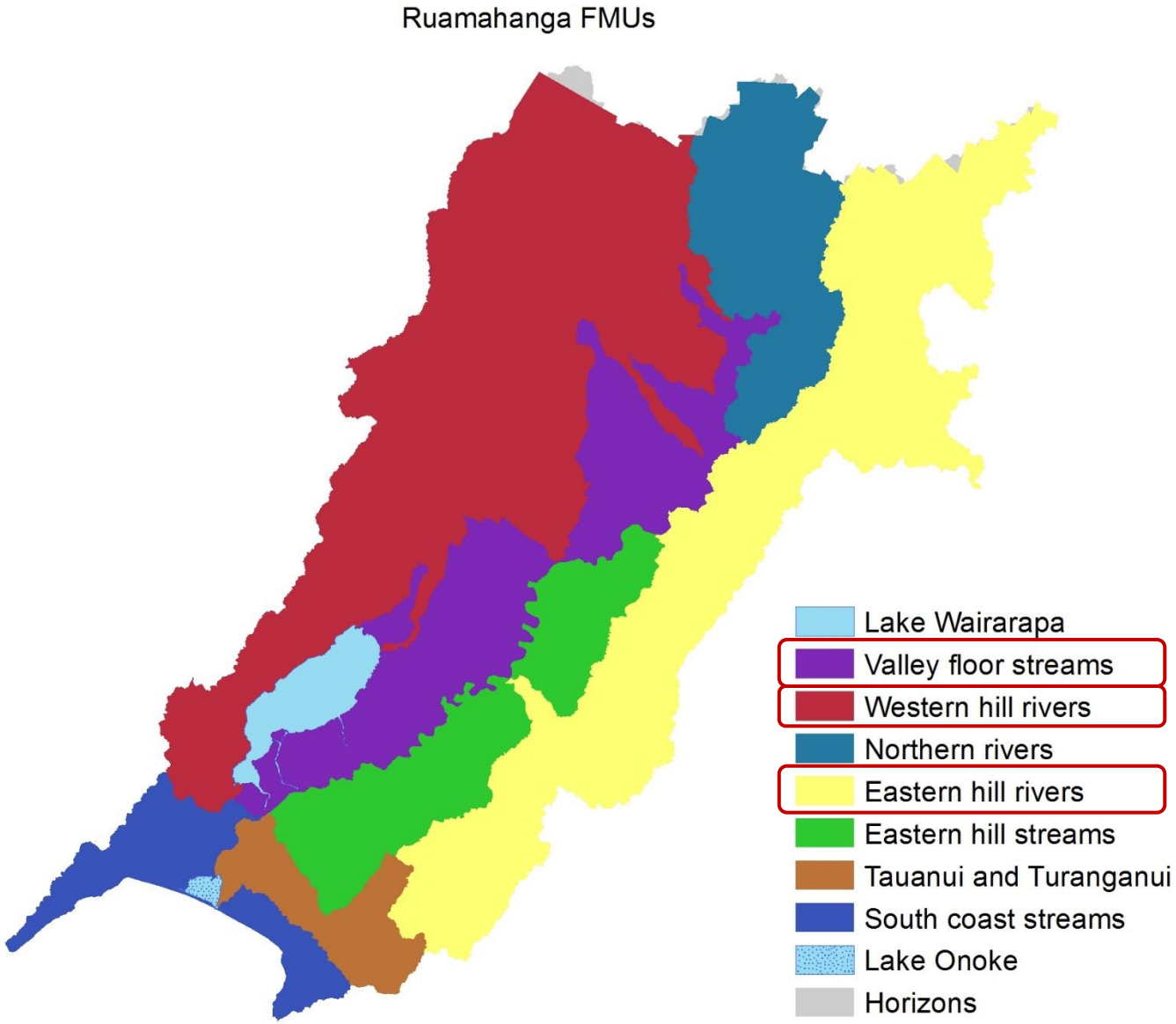
Sediment & On-farm Mitigation

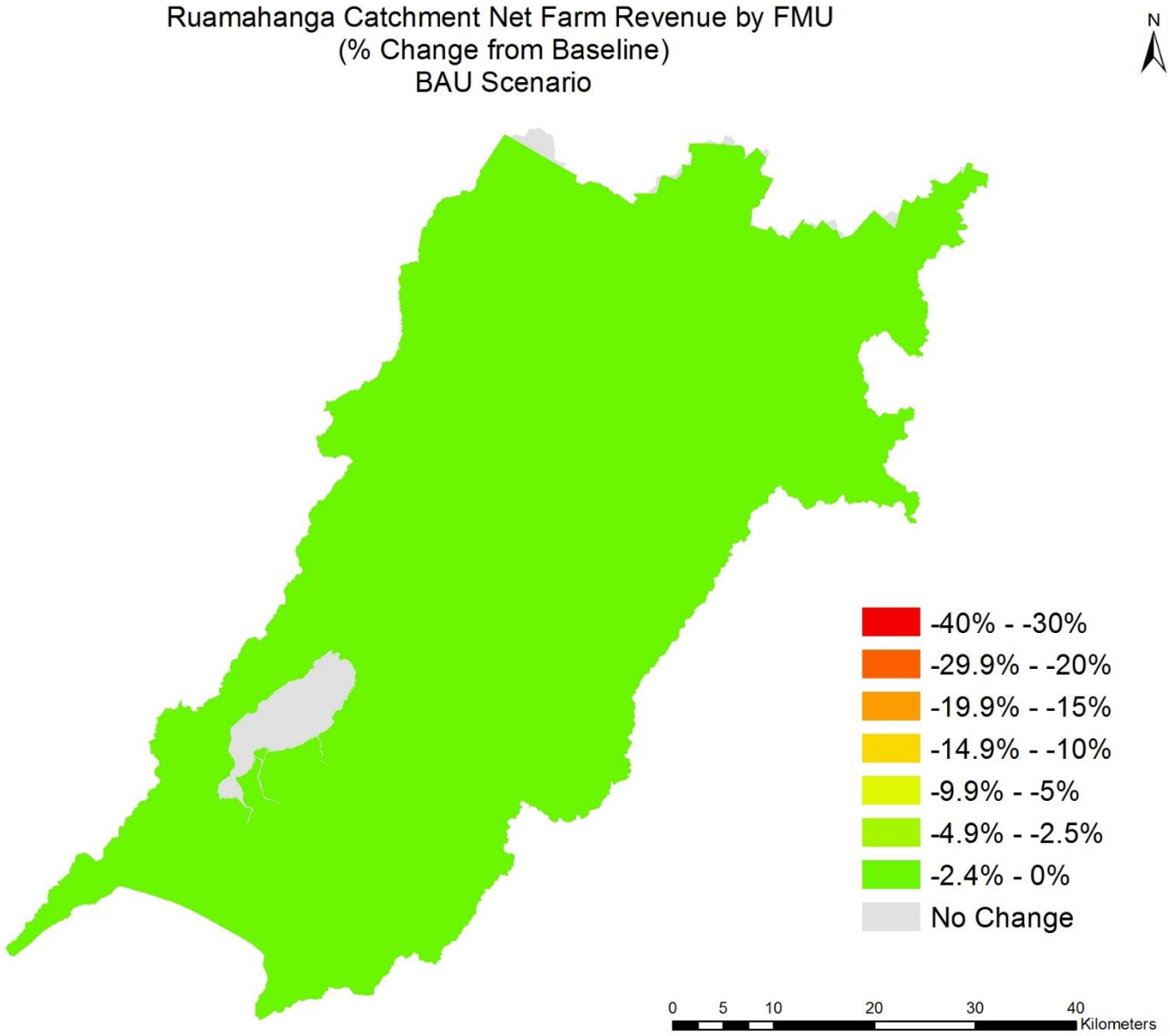


FMU-level Net Revenues

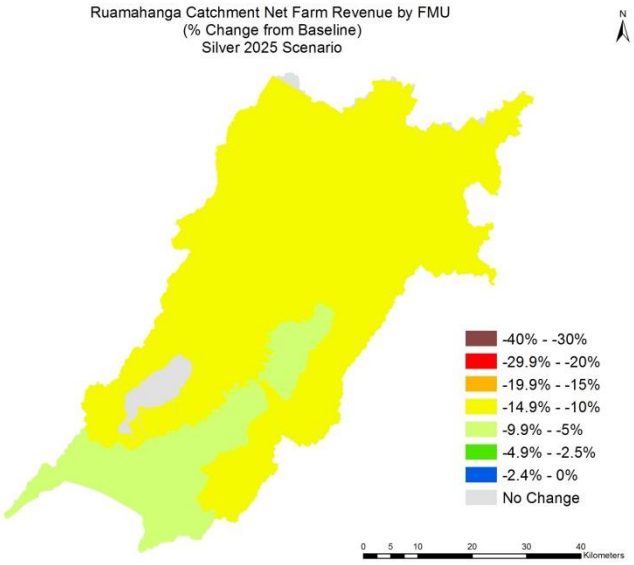
FMU	Base Net Revenue (mil $)	BAU	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
		% Change from baseline						
Eastern Hill streams	$17.8	0%	-7%	-16%	-17%	-14%	-19%	-19%
Eastern hill rivers	$43.5	-1%	-11%	-29%	-33%	-25%	-35%	-35%
Valley floor streams	$44.3	-1%	-11%	-13%	-13%	-13%	-14%	-14%
Main stem Ruamāhanga R.	$19.2	-1%	-9%	-13%	-13%	-12%	-15%	-15%
Lake Onoke	$10.0	-1%	-10%	-21%	-20%	-18%	-22%	-22%
Western hill rivers	$39.1	-1%	-12%	-21%	-23%	-20%	-25%	-25%
Northern rivers	$18.4	0%	-13%	-31%	-34%	-28%	-36%	-36%
Not Specified	$0.3	-1%	-12%	-48%	-37%	-15%	-39%	-39%
Entire Catchment	$192.5	-1%	-11%	-21%	-22%	-19%	-24%	-24%

The 3 FMU with biggest net revenue impacts from sediment & on-farm mitigation options

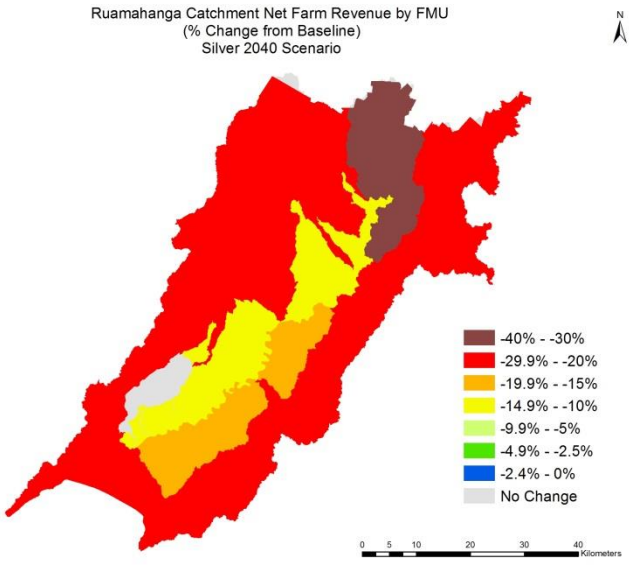

Ruamahanga FMUs
Lake Wairarapa
Valley floor streams
Western hill rivers
Northern rivers
Eastern hill rivers
Eastern hill streams
Tauanui and Turanganui
South coast streams
Lake Onoke
Horizons


Ruamahanga Catchment Net Farm Revenue by FMU
(% Change from Baseline)
BAU Scenario
N
-40% - -30%
-29.9% - -20%
-19.9% - -15%
-14.9% - -10%
-9.9% - -5%
-4.9% - -2.5%
-2.4% - 0%
No Change
0 5 10 20 30 40
Kilometers

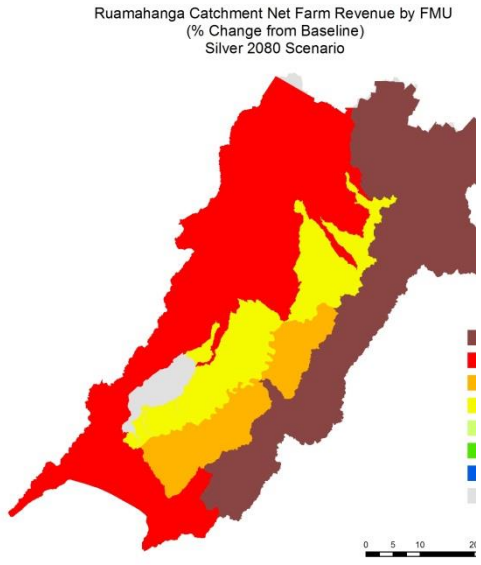
Sediment & on-farm mitigation options – Silver Scenario



- Space planting
- Stock exclusion
- Tier 1 mit. options

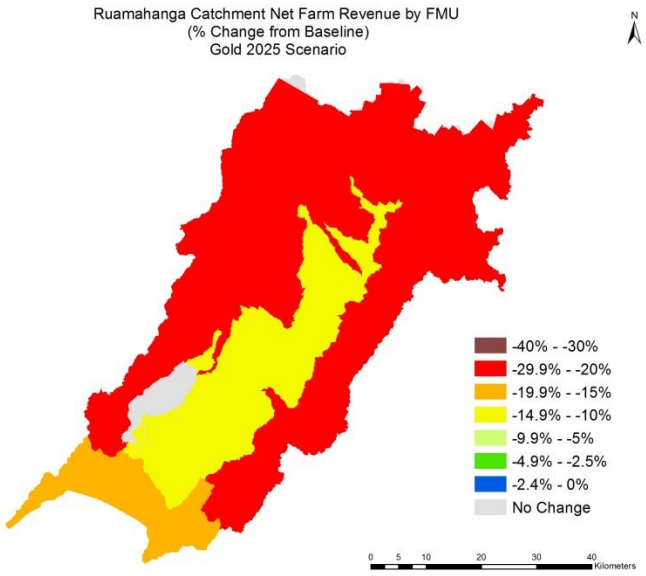


- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 2 mit. options

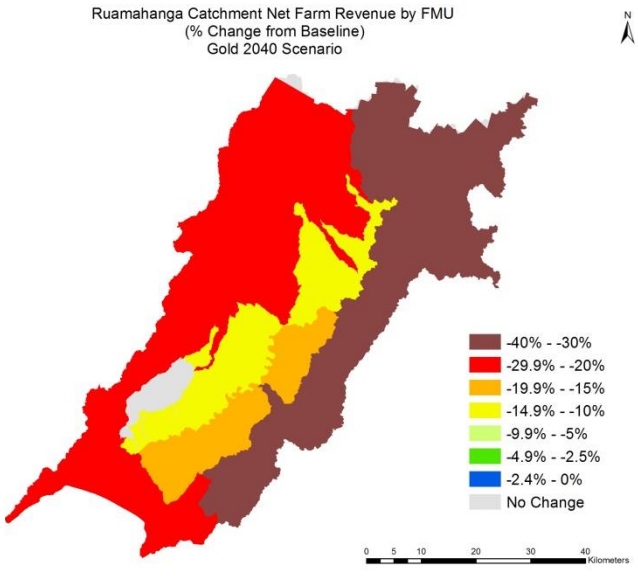


- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 3 mit. options

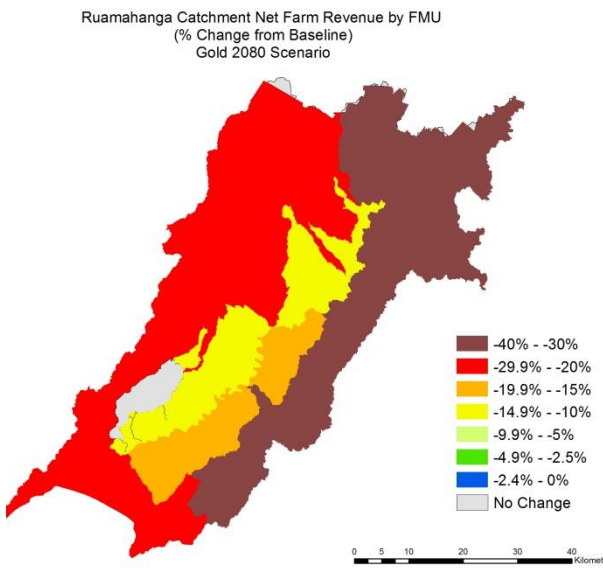
Sediment & on-farm mitigation options – Gold Scenario



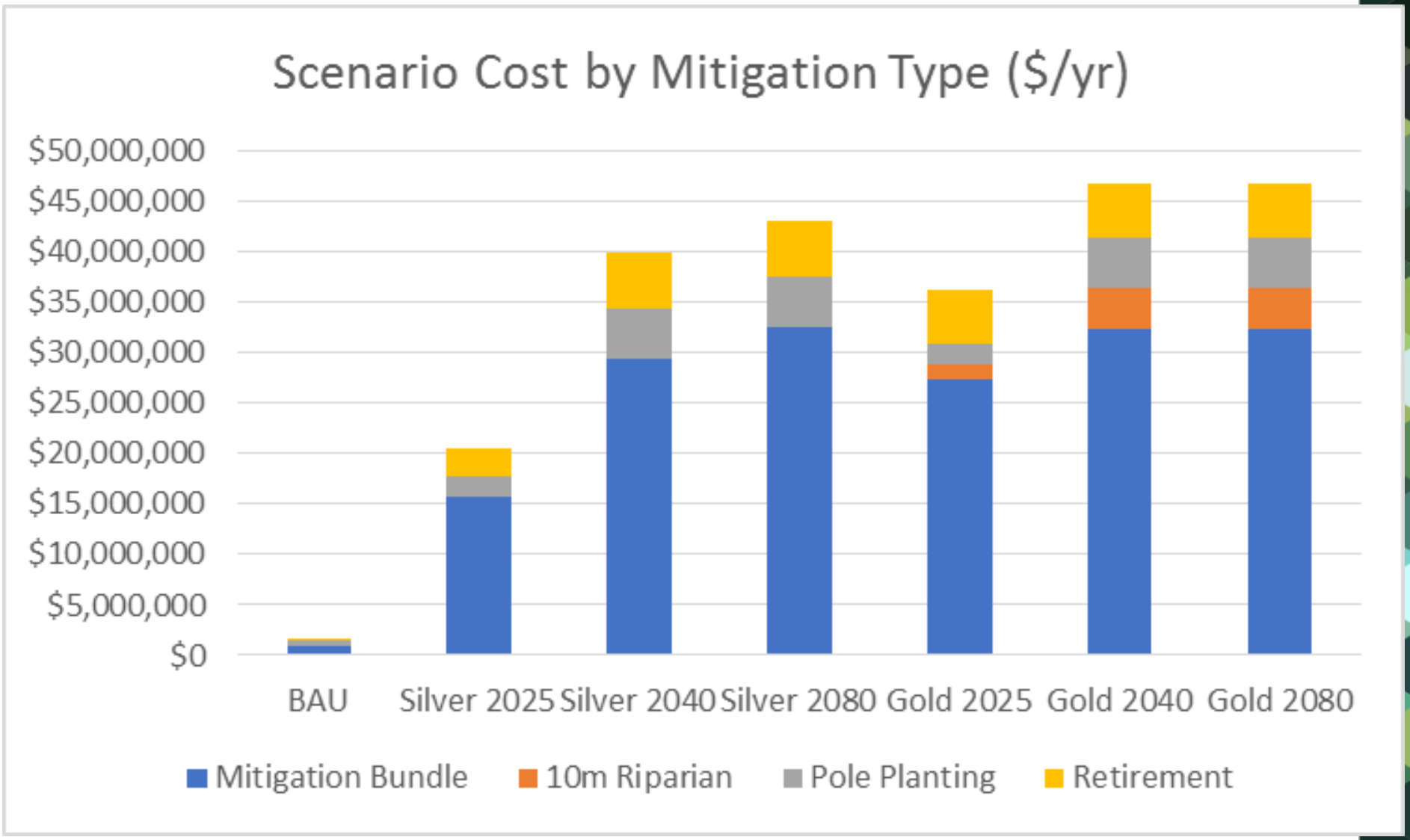
- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 2 mit. options

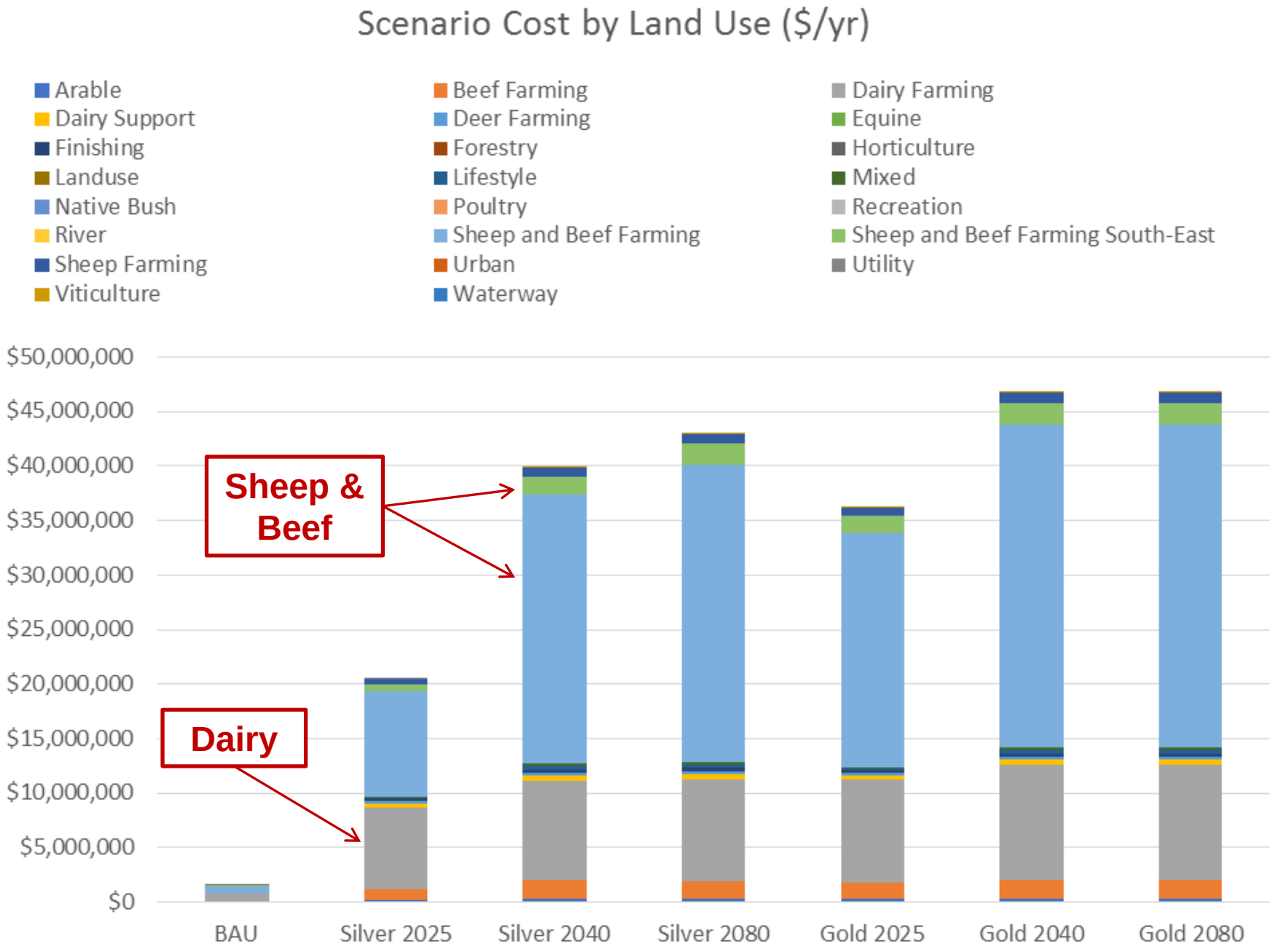


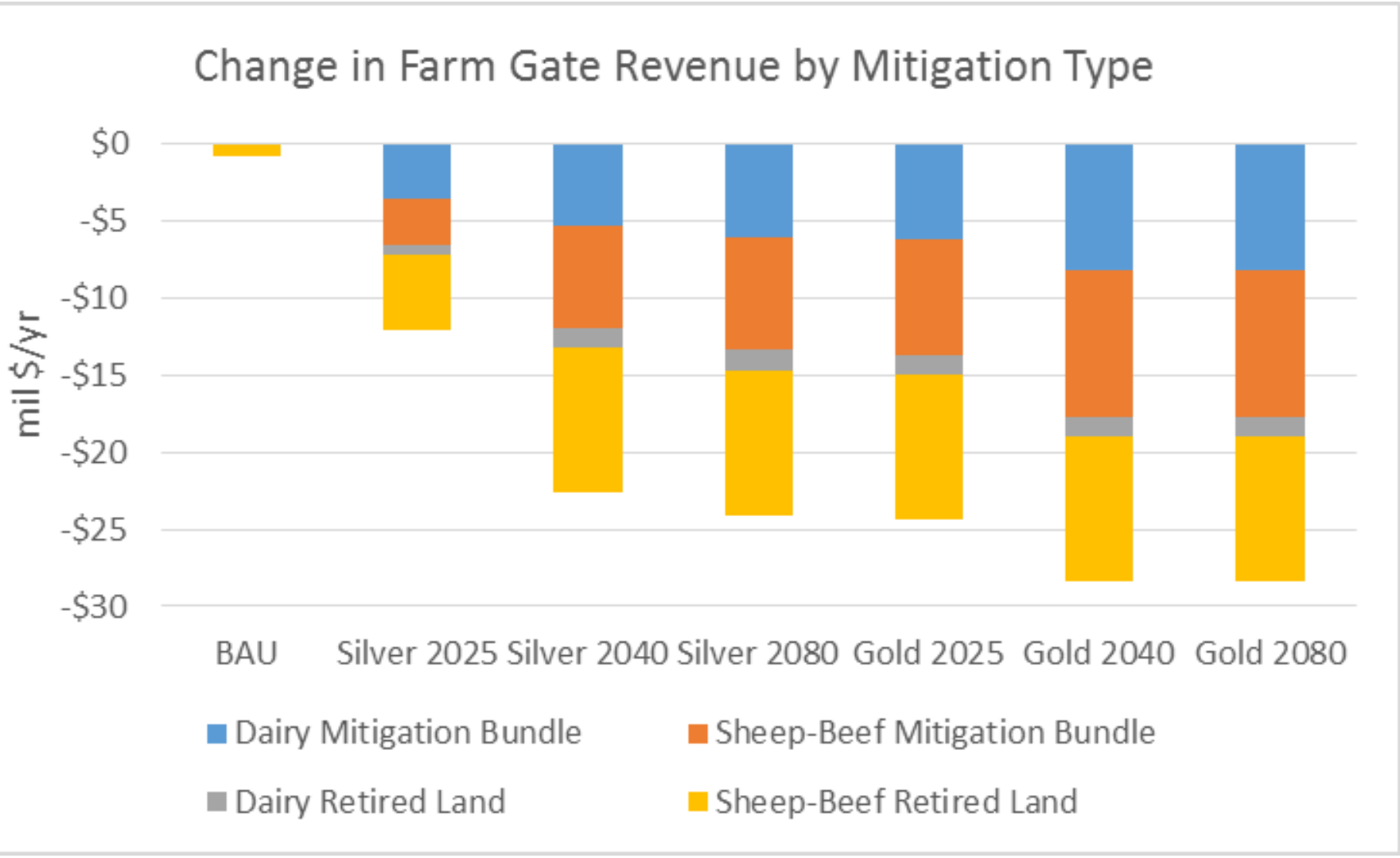
- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options



- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options


Scenario Cost by Mitigation Type ($/yr)
$50,000,000
$45,000,000
$40,000,000
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
BAU
Silver 2025
Silver 2040
Silver 2080
Gold 2025
Gold 2040
Gold 2080
Mitigation Bundle
10m Riparian
Pole Planting
Retirement


Scenario Cost by Land Use ($/yr)
Arable
Beef Farming
Dairy Farming
Dairy Support
Deer Farming
Equine
Finishing
Forestry
Horticulture
Landuse
Lifestyle
Mixed
Native Bush
Poultry
Recreation
River
Sheep and Beef Farming
Sheep and Beef Farming South-East
Sheep Farming
Urban
Utility
Viticulture
Waterway
$50,000,000
$45,000,000
$40,000,000
$35,000,000
$30,000,000
$25,000,000
$20,000,000
$15,000,000
$10,000,000
$5,000,000
$0
Sheep & Beef
Dairy
BAU
Silver 2025
Silver 2040
Silver 2080
Gold 2025
Gold 2040
Gold 2080

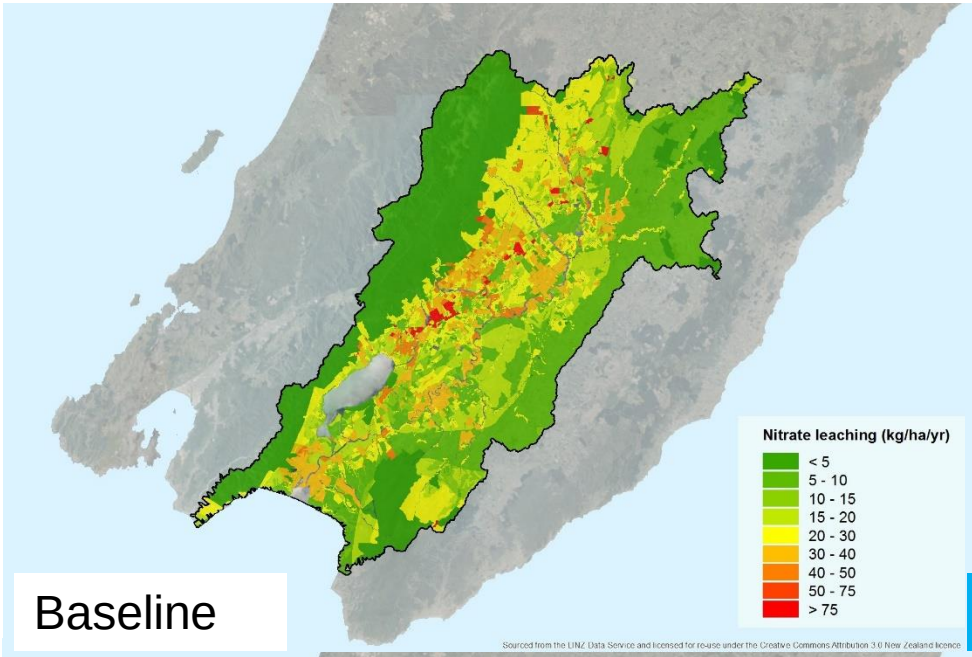

Change in Farm Gate Revenue by Mitigation Type
$0
-$5
-$10
-$15
-$20
-$25
-$30
mil $/yr
BAU
Silver 2025
Silver 2040
Silver 2080
Gold 2025
Gold 2040
Gold 2080
Dairy Mitigation Bundle
Sheep-Beef Mitigation Bundle
Dairy Retired Land
Sheep-Beef Retired Land

Environmental Impacts

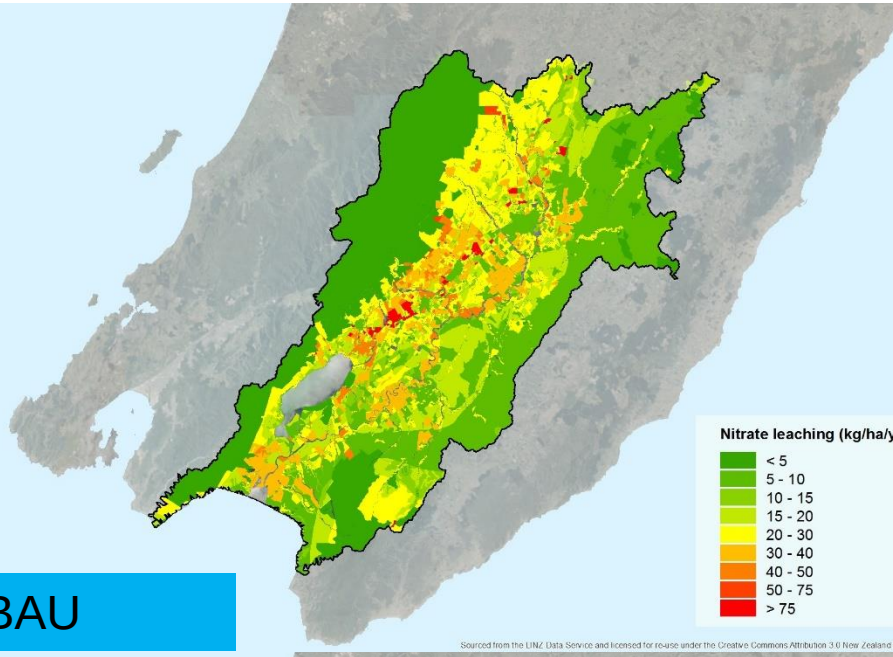
	BAU 2040	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Environmental parameters (% change)								
Sediment loss	-9.3%	-15.3%	N/A	-26.9%	-36.8%	N/A	-30.1%	-32.9%
N losses	0%	0%	-8.1%	-8.7%	-8.7%	-9.0%	-9.1%	-9.1%
P losses	0%	0%	-18.1%	-43.4%	-52.1%	-32.4%	-52.6%	-52.6%

- Scenarios have little impact on N losses
- More substantial impacts on sediment & P losses

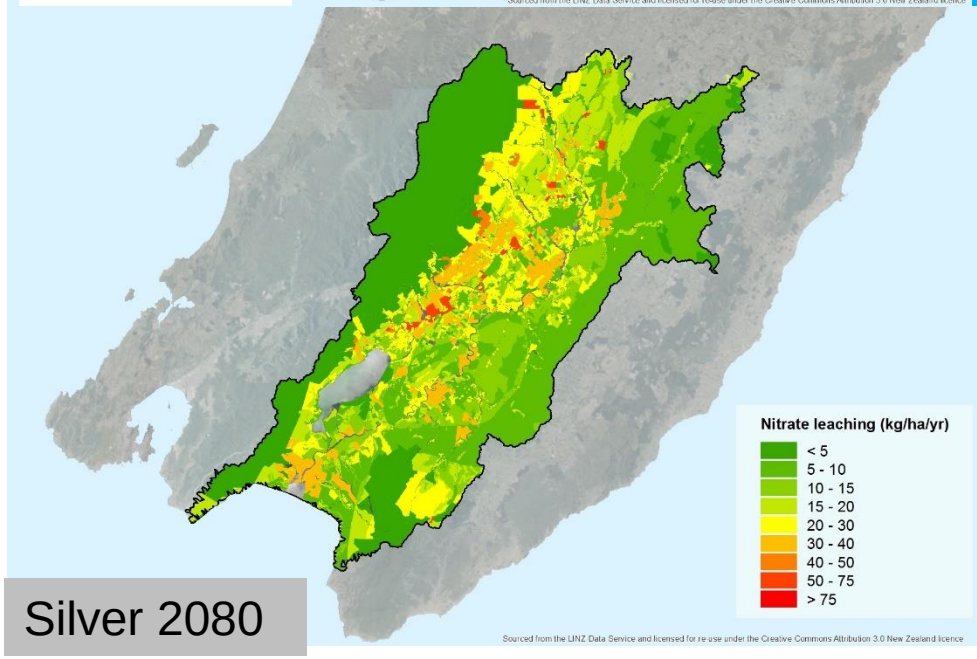
Nitrate Leaching



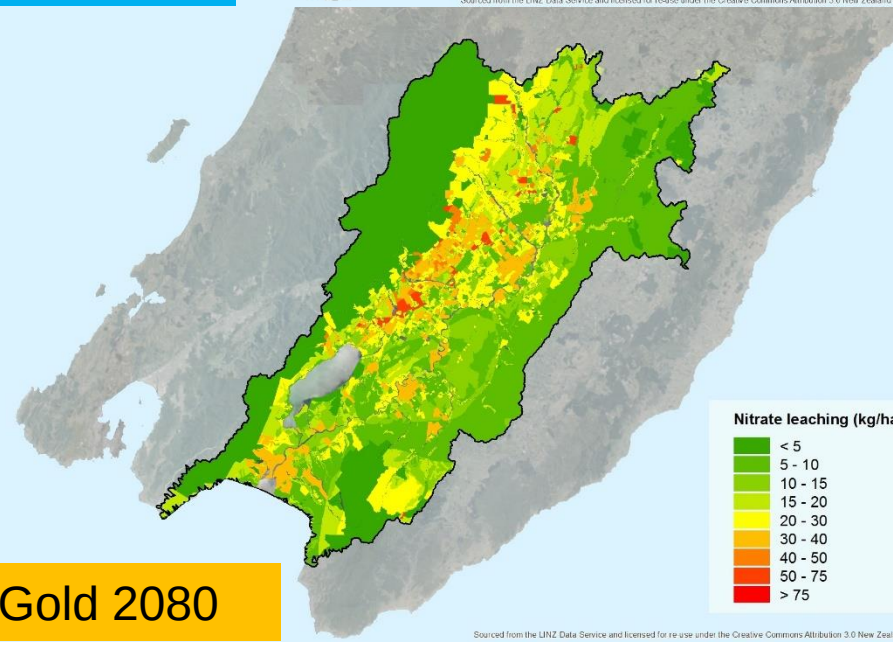
Baseline



BAU

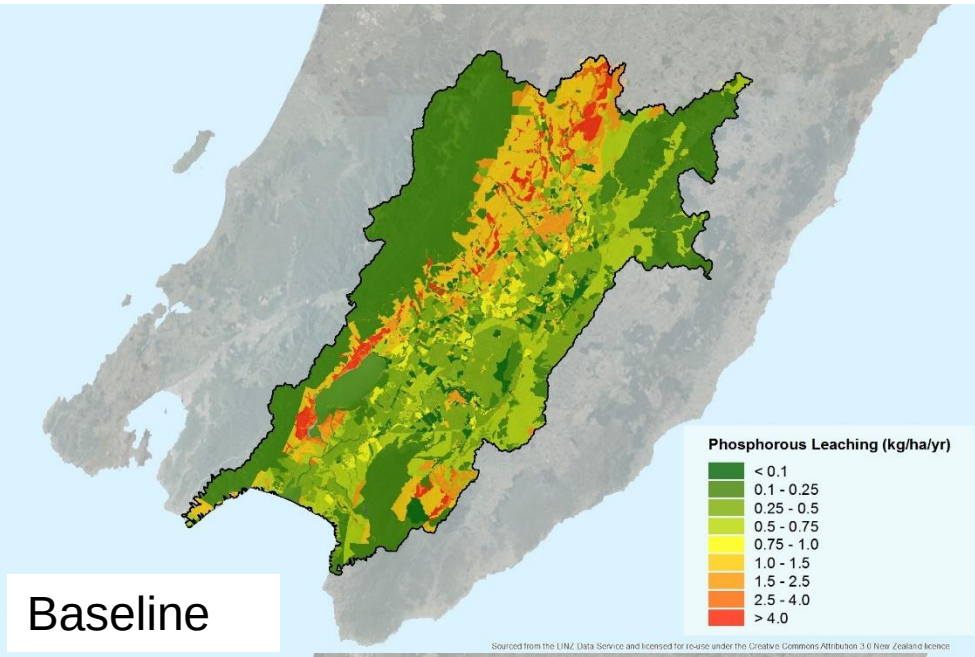


Silver 2080

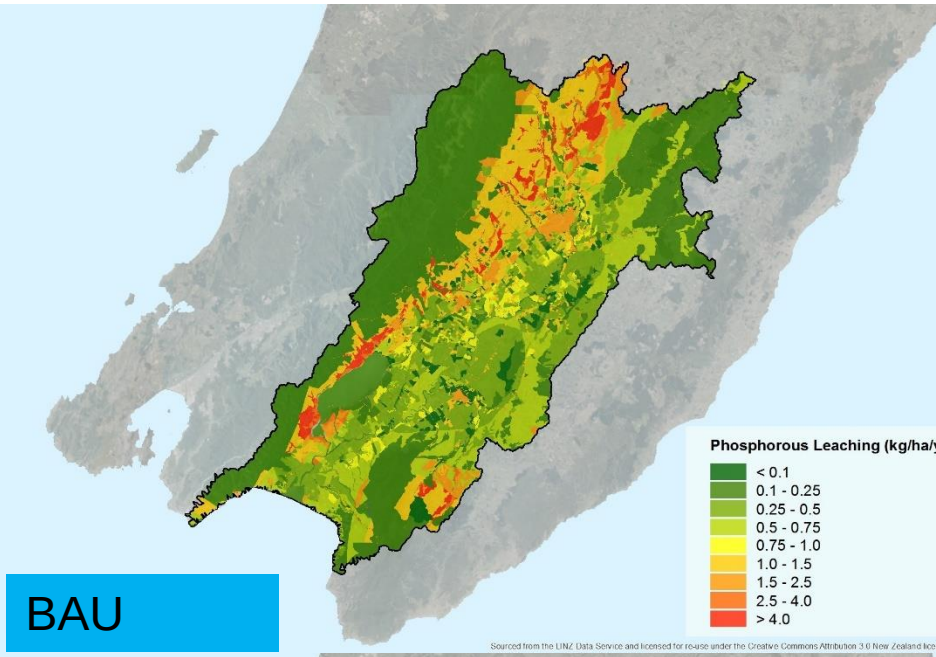


Gold 2080

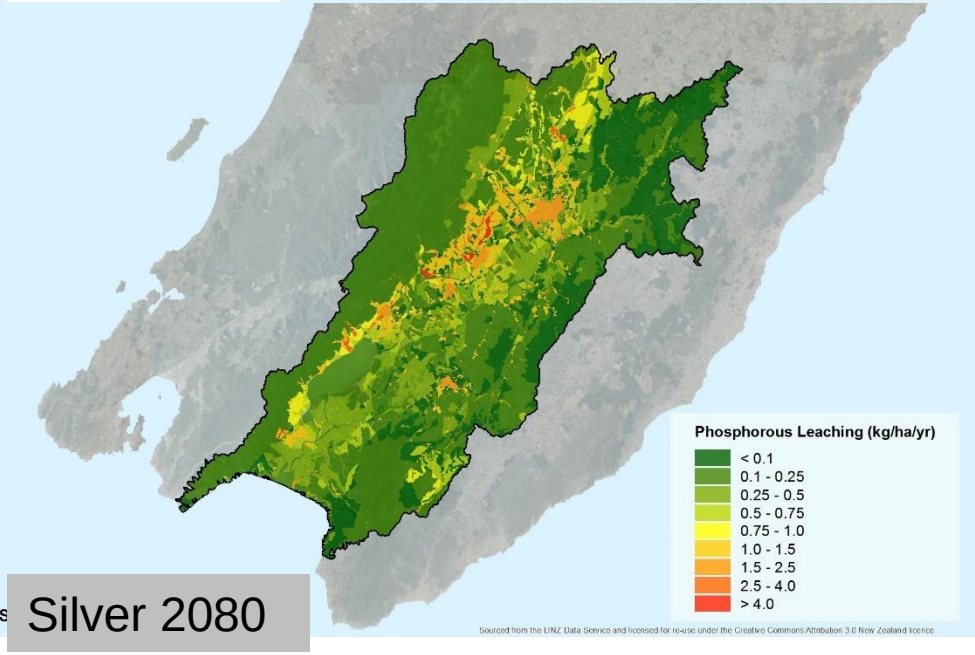
P Loss



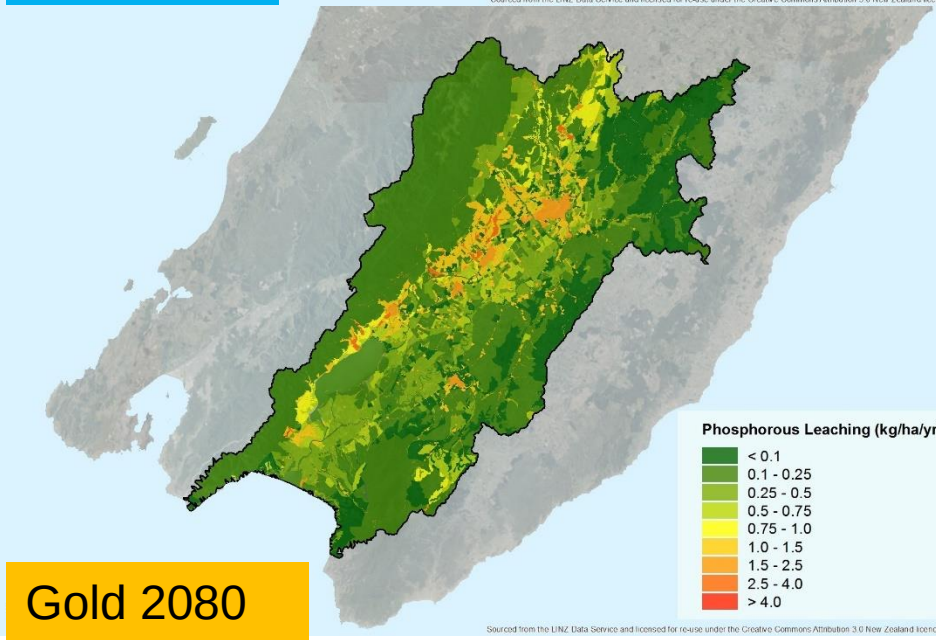
Baseline



BAU

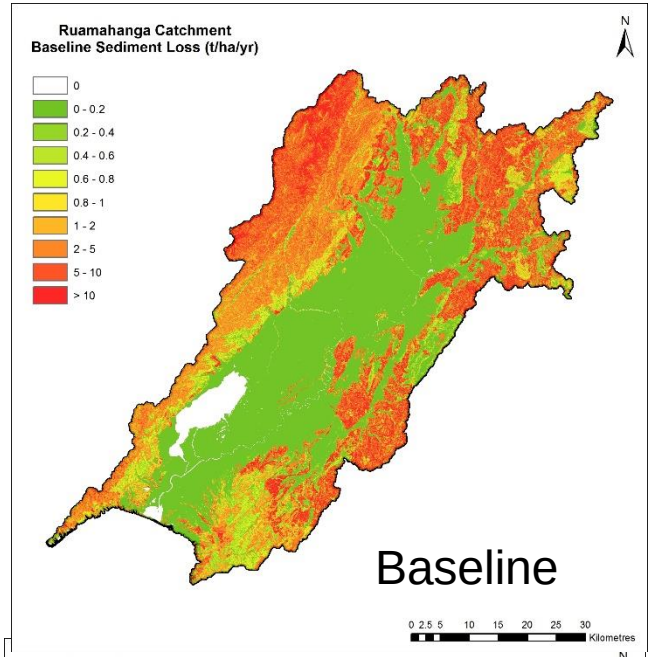


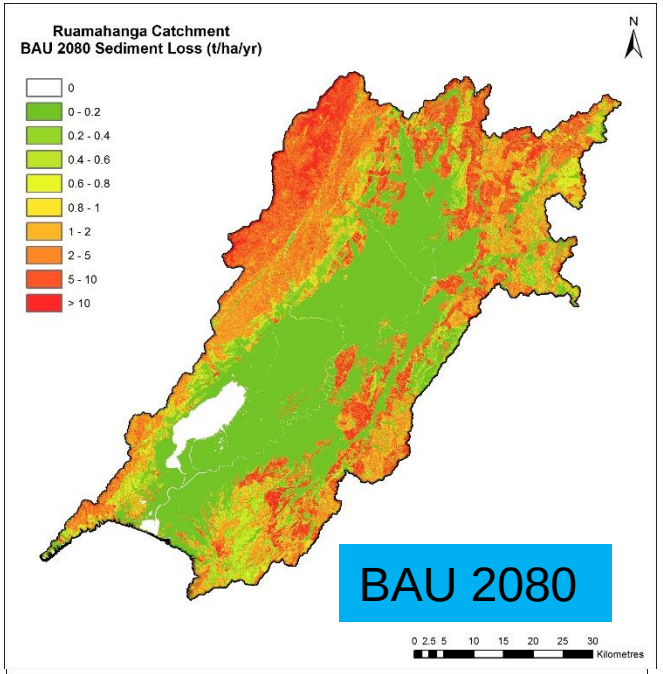
Silver 2080

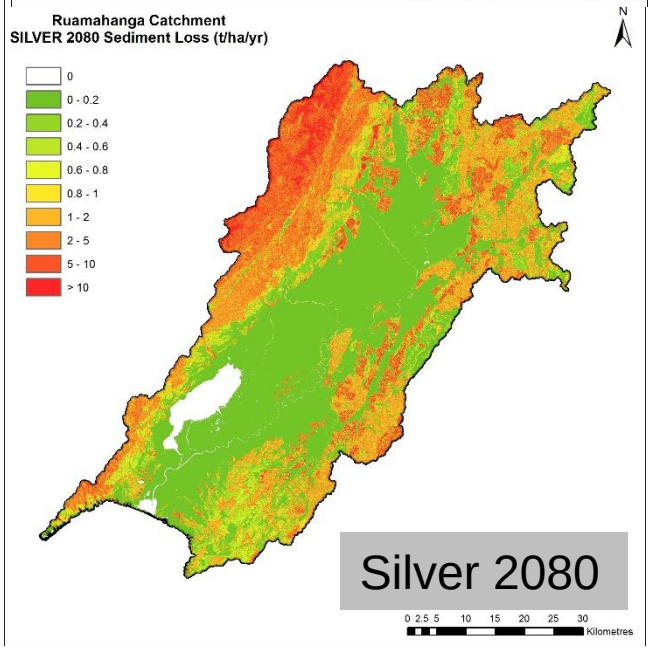


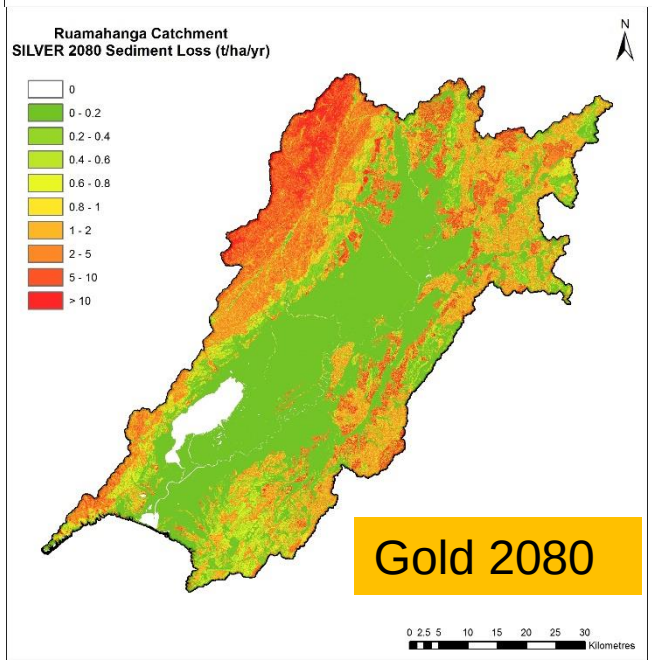
Gold 2080

Sediment Loss

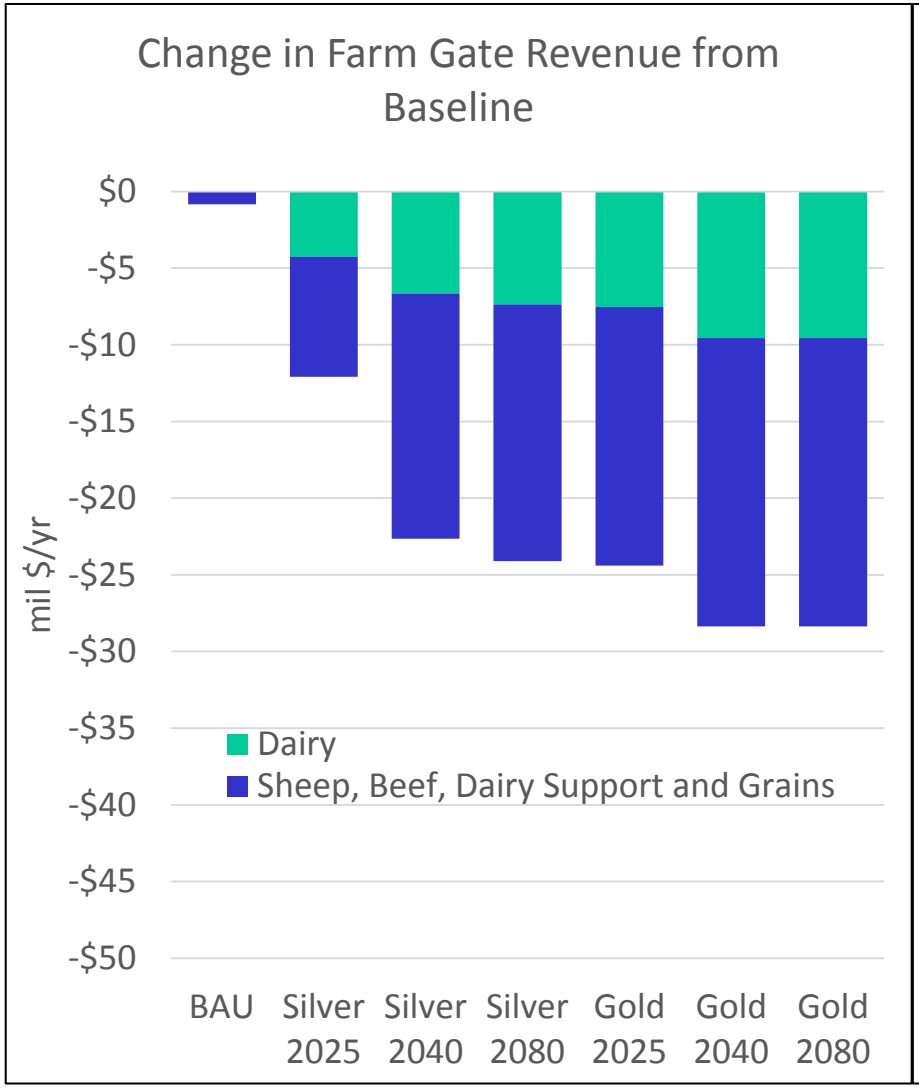


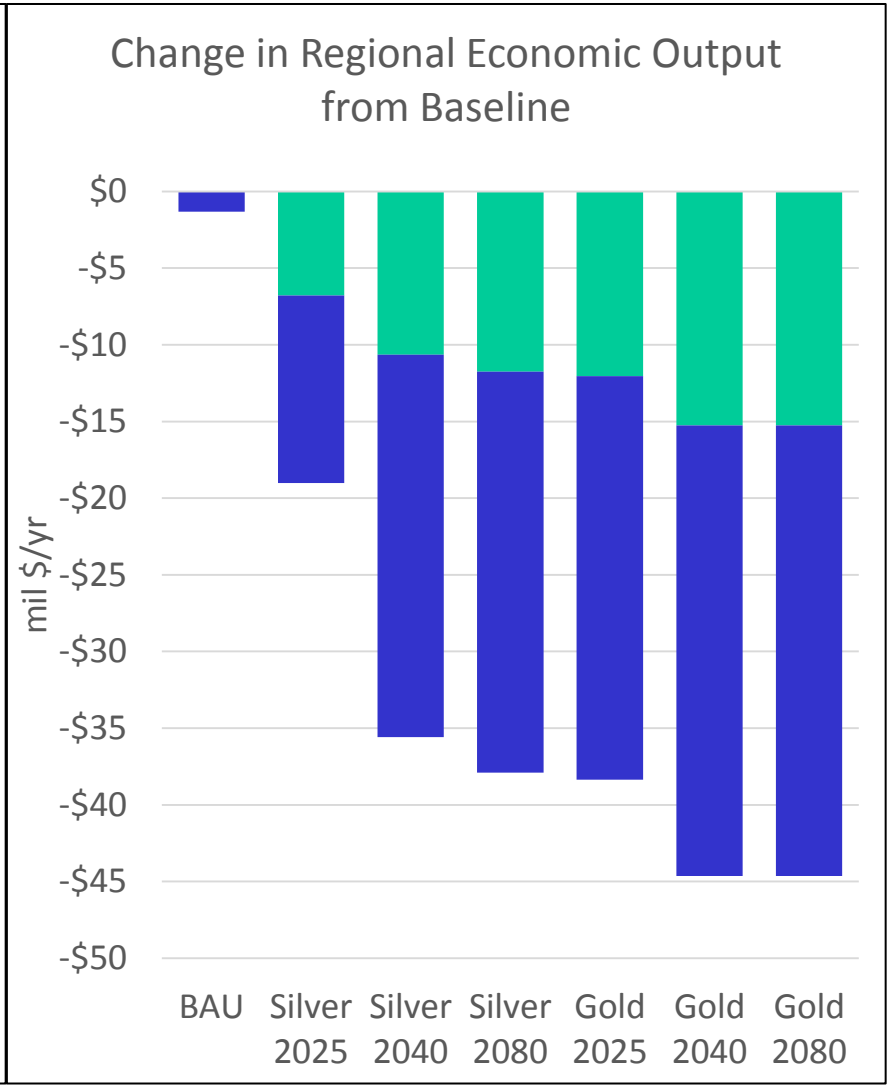




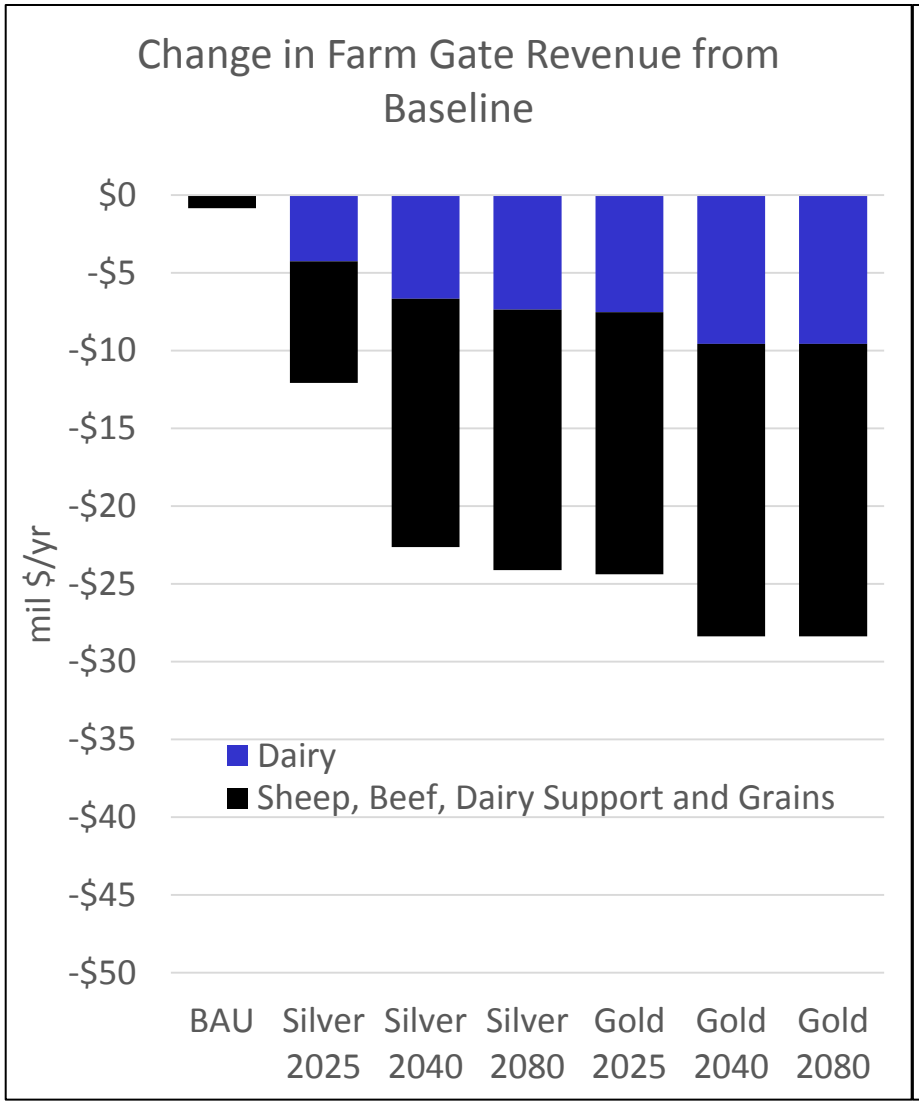


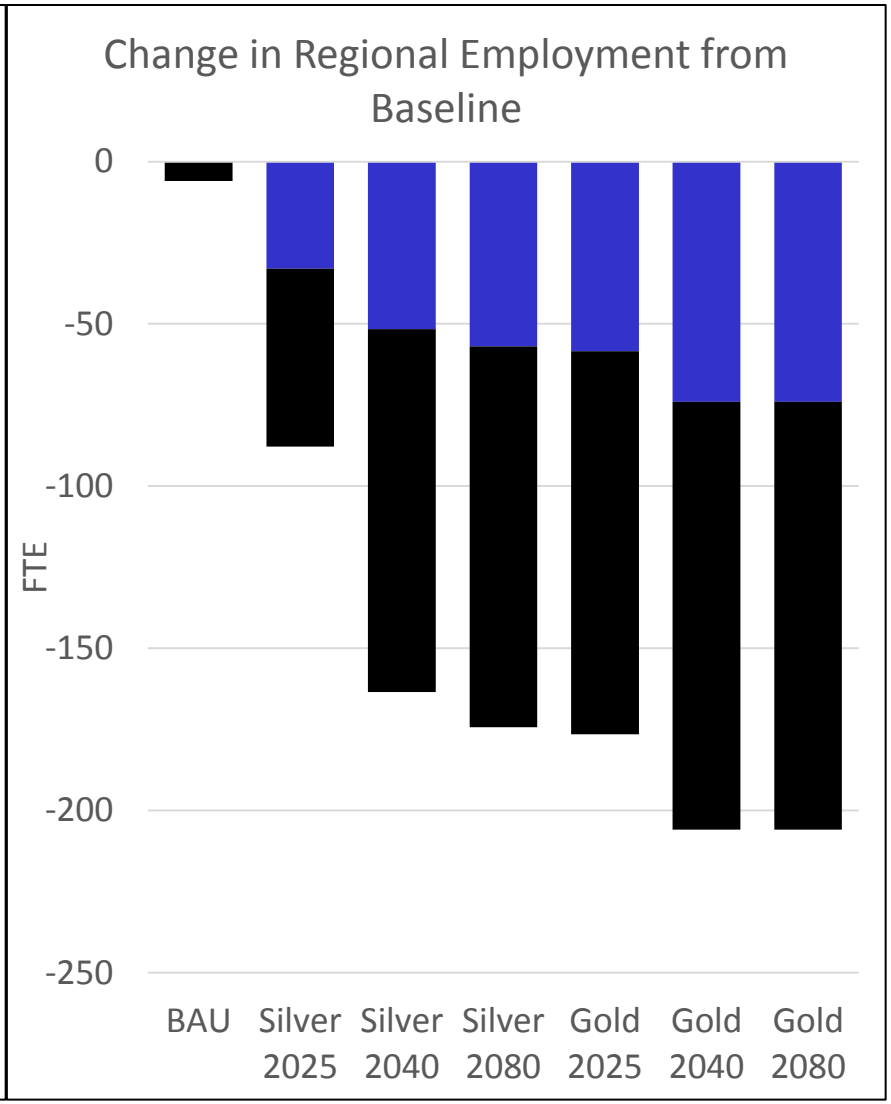
Regional Economic Impacts – Economic Output



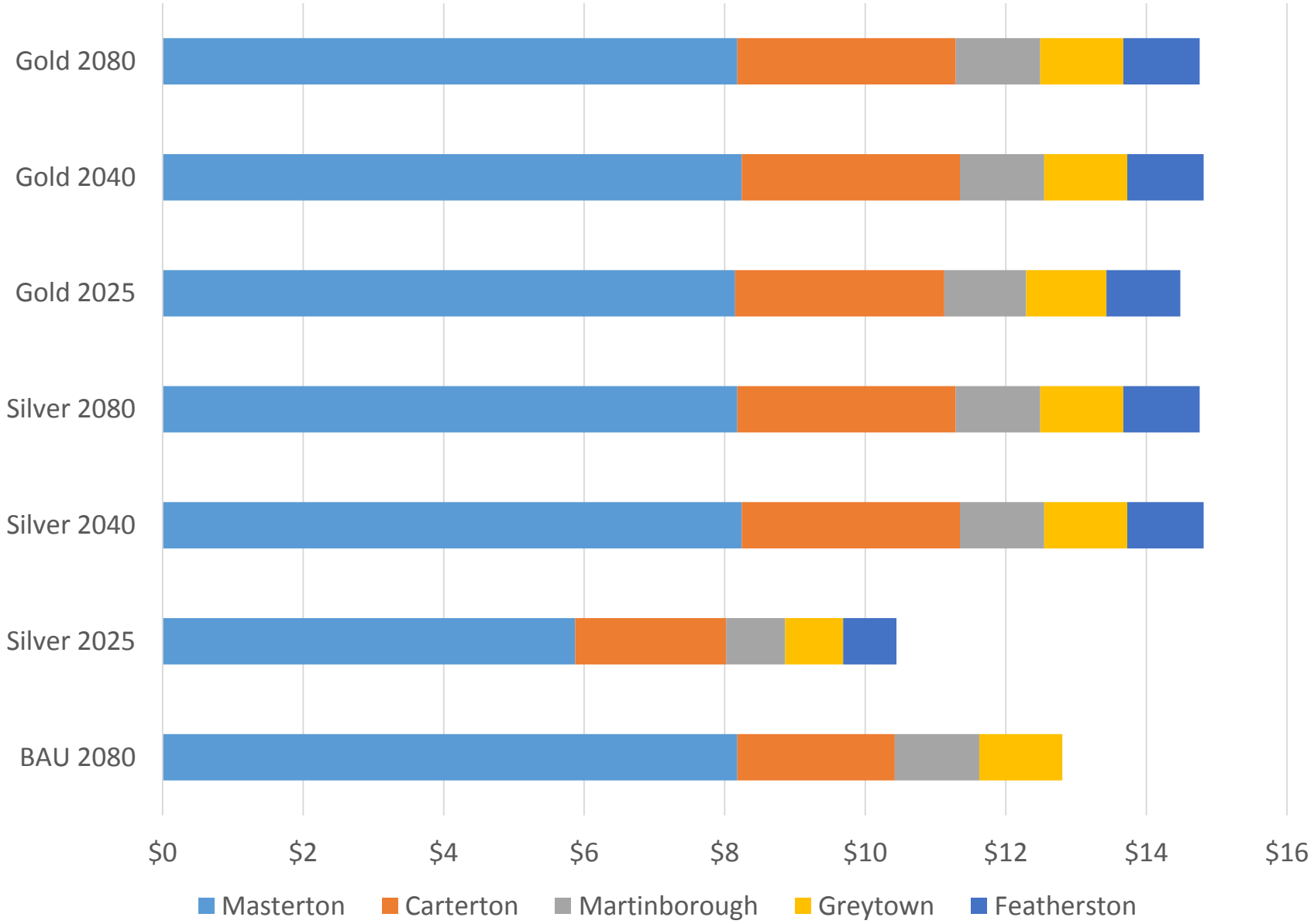


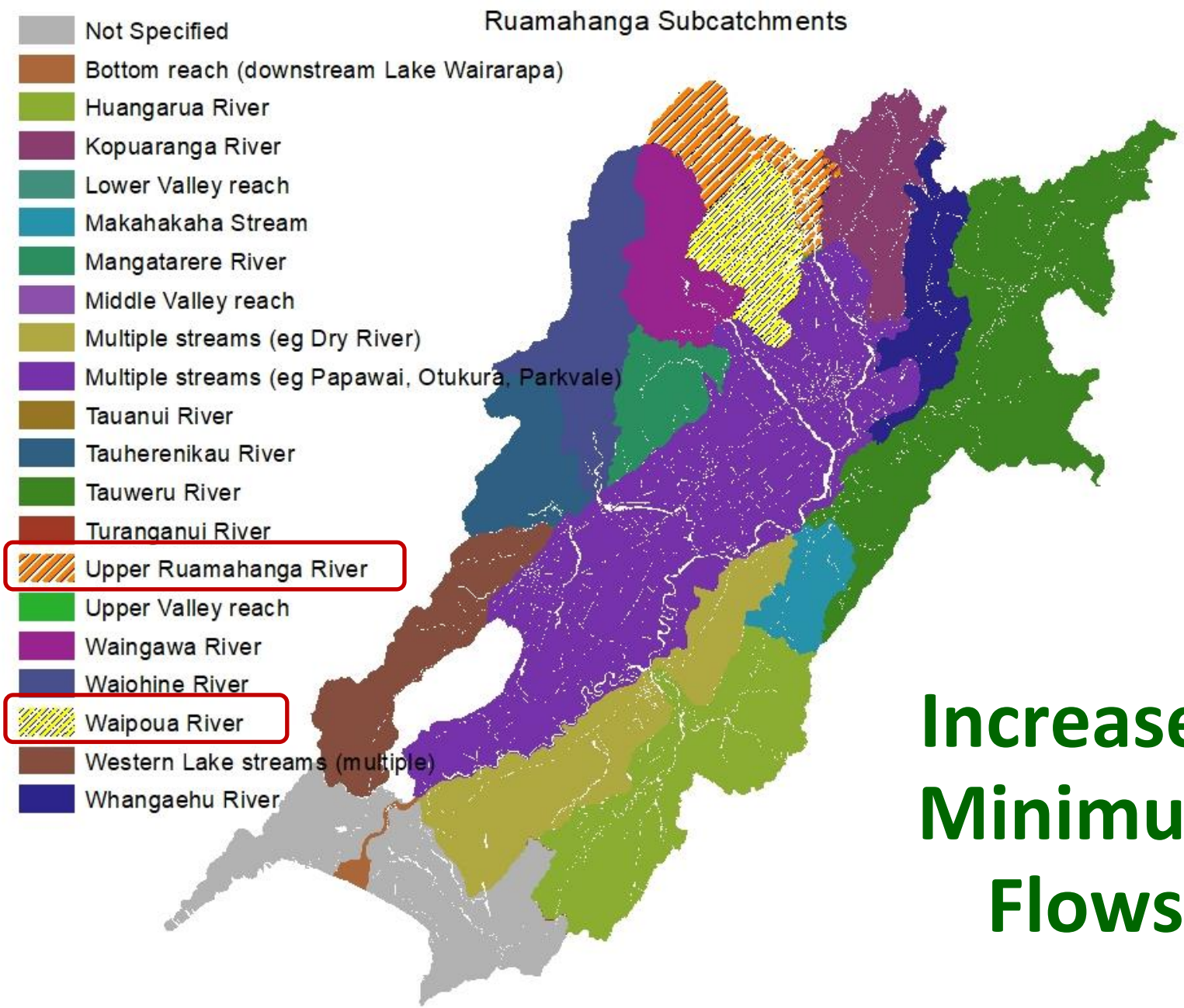
Regional Economic Impacts - Employment





Wastewater Treatment Plant Mitigation Cost (million $/yr)





Increased Minimum Flows

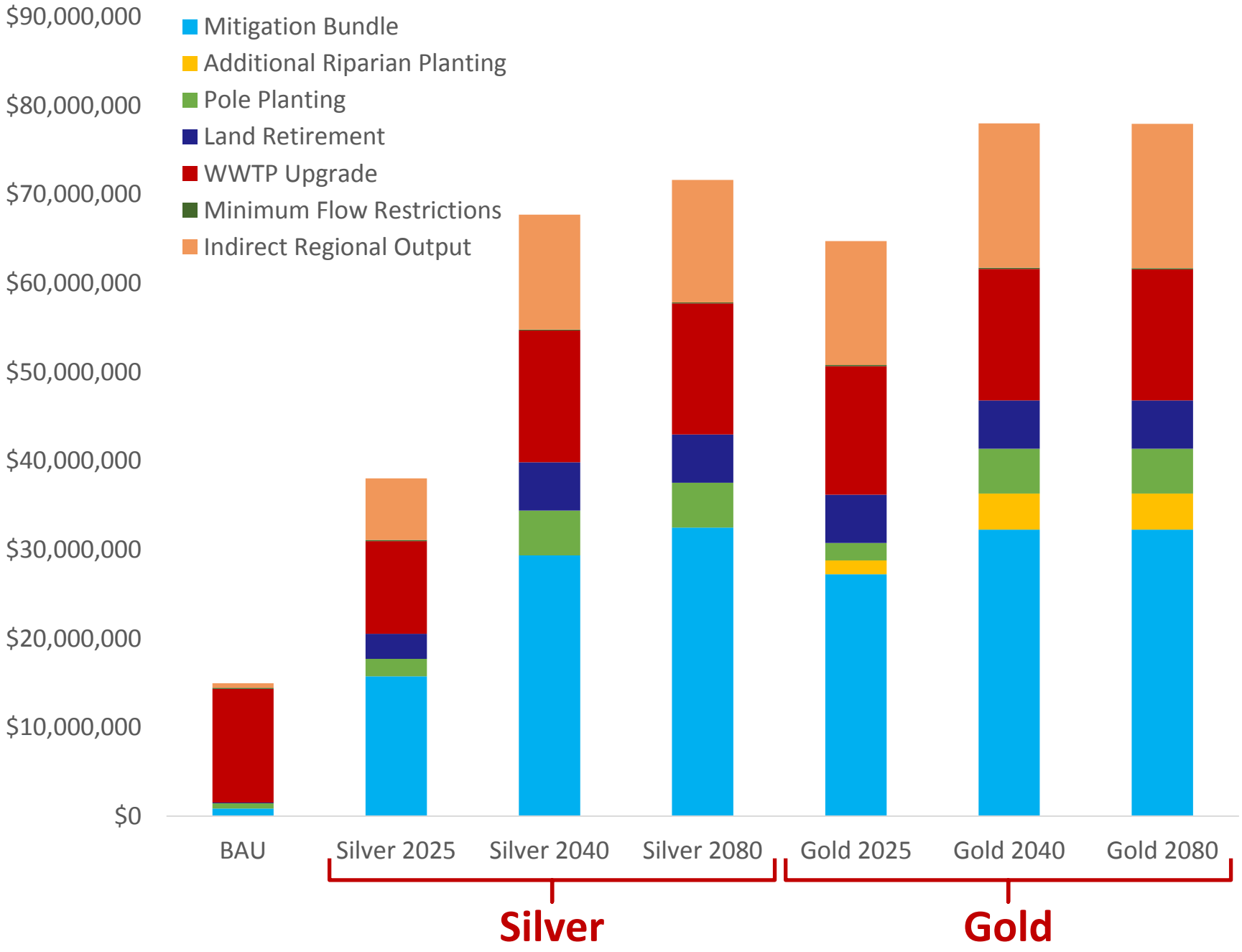
Increased Minimum Flows Regional Economic Impacts ($/yr)

Reliability	Waipoua (104 ha)		Upper Ruamahanga (861 ha)	
	Now	*Future*	*Now*	*Future*
Change in Regional Economic Output from Baseline - Most Intensive Systems Irrigated				
Average Annual Reliability	-$12,315	-$16,879	-$70,785	-$115,449
Average Summer Reliability	-$21,442	-$29,048	-$97,583	-$186,913
90th Percentile Summer Reliability	-$43,786	-$53,145	-$160,114	-$347,705
Change in Regional Economic Output from Baseline - Average System Irrigated				
Average Annual Reliability	-$8,140	-$11,557	-$28,096	-$45,824
Average Summer Reliability	-$14,974	-$20,668	-$38,733	-$74,189
90th Percentile Summer Reliability	-$31,584	-$37,503	-$63,552	-$138,010

Increased Minimum Flows
Regional Employment Impacts

Reliability	Waipoua (104 ha)		Upper Ruamahanga (861 ha)	
	Now	*Future*	*Now*	*Future*
Change in Regional Employment from Baseline (FTE) – Average Systems Irrigated				
Average Annual Reliability	-0.1	-0.1	-0.5	-0.8
Average Summer Reliability	-0.1	-0.2	-0.7	-1.3
90th Percentile Summer Reliability	-0.3	-0.4	-1.1	-2.4
Change in Regional Employment from Baseline (FTE) – Average System Irrigated				
Average Annual Reliability	-0.1	-0.1	-0.2	-0.3
Average Summer Reliability	-0.1	-0.1	-0.3	-0.5
90th Percentile Summer Reliability	-0.2	-0.3	-0.4	-1.0

Total Scenario Costs, by Component ($/yr)



Contact Details

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END

Spare slides below if needed during question time

Increased Minimum Flows Change in Revenue ($/yr)

Reliability	Waipoua		Ruamahanga [upper]	
	Now	*Future*	*Now*	*Future*
Dairy (Total Revenue Change)				
Average Annual Reliability	$0	$0	$0	$0
Average Summer Reliability	$0	$0	$0	$0
90th Percentile Summer Reliability	$0	$0	$0	$0
Arable (Total Revenue Change)				
Average Annual Reliability	-$3,456	-$5,163	$0	$0
Average Summer Reliability	-$6,869	-$9,713	$0	$0
90th Percentile Summer Reliability	-$15,098	-$17,441	$0	$0
Sheep, Beef & Dairy Support (Total Revenue Change)				
Average Annual Reliability	-$1,762	-$2,245	-$18,010	-$29,374
Average Summer Reliability	-$2,729	-$3,535	-$24,829	-$47,557
90th Percentile Summer Reliability	-$5,148	-$6,599	-$40,738	-$88,468
All Land Uses (Total Revenue Change)				
Average Annual Reliability	-$5,218	-$7,408	-$18,010	-$29,374
Average Summer Reliability	-$9,598	-$13,249	-$24,829	-$47,557
90th Percentile Summer Reliability	-$20,246	-$24,040	-$40,738	-$88,468

Key Model Outputs

NZFARM
NEW ZEALAND FOREST AND AGRICULTURE REGIONAL MODEL

$$$ **Net Revenue** (from on-farm production)

Food (meat, milk, fruit, etc.)

Raw materials (timber, pulp, wool, silage, etc.)

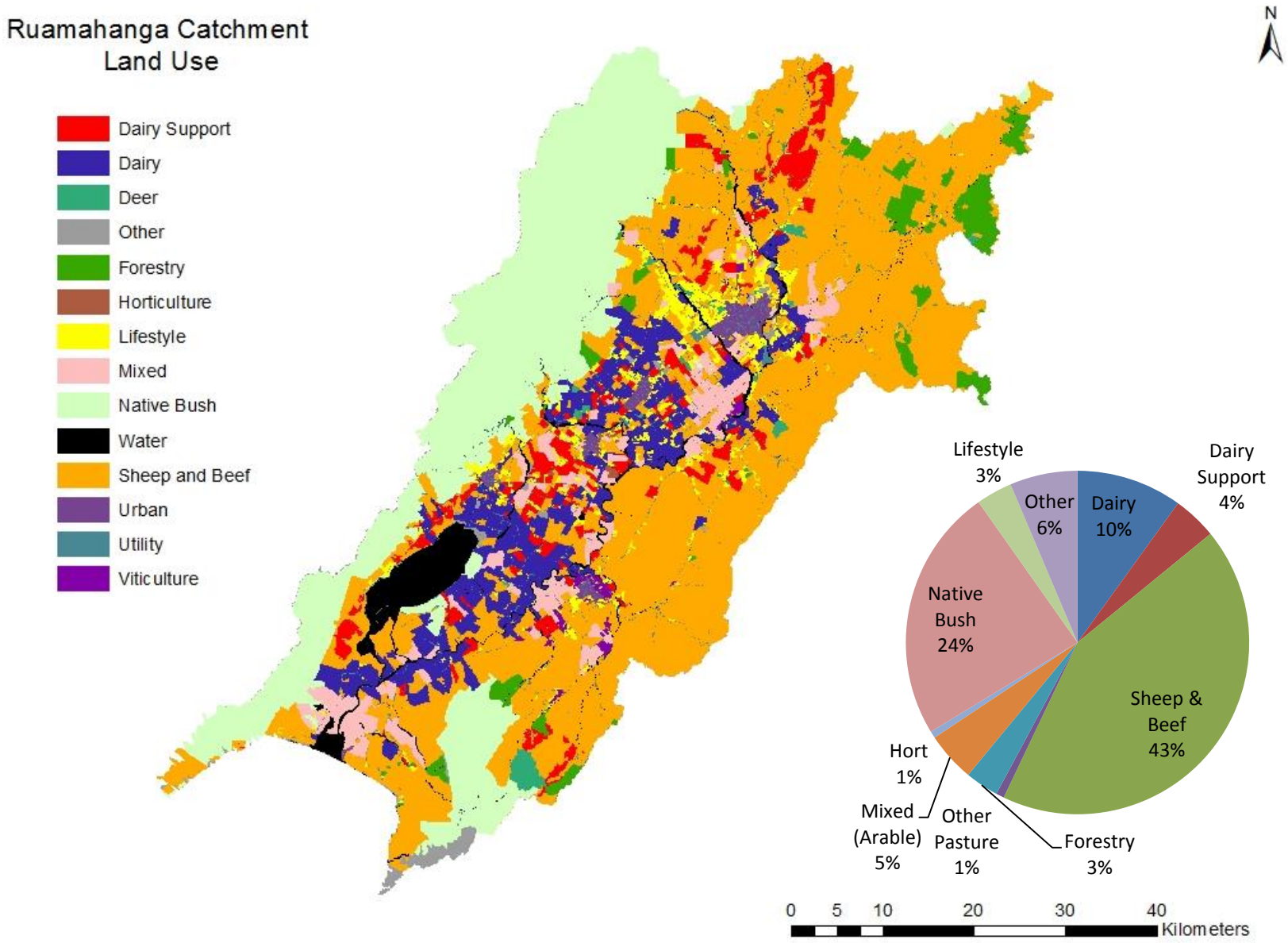
Freshwater (N, P, *E.coli*, irrigated area)

Erosion and Prevention (soil loss/retain by land use)

Carbon Sequestration (exotic and native forest, grassland, etc.)

Outputs will vary subject to:

- Contaminant load target(s)
- Policy mechanism
- Mitigation cost & effectiveness


Ruamahanga Catchment
Land Use
Dairy Support
Dairy
Deer
Other
Forestry
Horticulture
Lifestyle
Mixed
Native Bush
Water
Sheep and Beef
Urban
Utility
Viticulture
N
Lifestyle 3%
Dairy Support 4%
Other 6%
Dairy 10%
Native Bush 24%
Sheep & Beef 43%
Hort 1%
Mixed (Arable) 5%
Other Pasture 1%
Forestry 3%
0 5 10 20 30 40
Kilometers

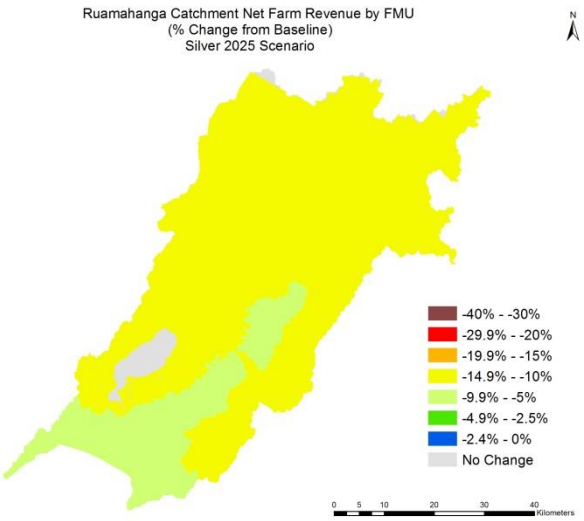
Regional Impacts

Land Use	BAU	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Change Farm Gate Revenue from Baseline (Mil $/yr)							
Dairy	$0.00	-$4.25	-$6.67	-$7.36	-$7.54	-$9.56	-$9.56
Sheep, Beef, Dairy Support & Grains	-$0.84	-$7.82	-$15.97	-$16.75	-$16.85	-$18.81	-$18.81
Total	-$0.85	-$12.08	-$22.64	-$24.11	-$24.39	-$28.37	-$28.37
Change in Regional Economic Output from Baseline (Mil $/yr)							
Dairy	-$0.01	-$6.80	-$10.65	-$11.75	-$12.04	-$15.27	-$15.27
Sheep, Beef, Dairy Support & Grains	-$1.32	-$12.21	-$24.93	-$26.16	-$26.31	-$29.38	-$29.38
Total	-$1.32	-$19.01	-$35.58	-$37.91	-$38.36	-$44.64	-$44.64
Change in Regional Employment from Baseline (FTE)							
Dairy	0.0	-33.0	-51.6	-56.9	-58.4	-74.0	-74.0
Sheep, Beef, Dairy Support & Grains	-5.9	-54.8	-111.9	-117.5	-118.1	-132.0	-132.0
Total	-5.9	-87.8	-163.5	-174.4	-176.5	-206.0	-206.0

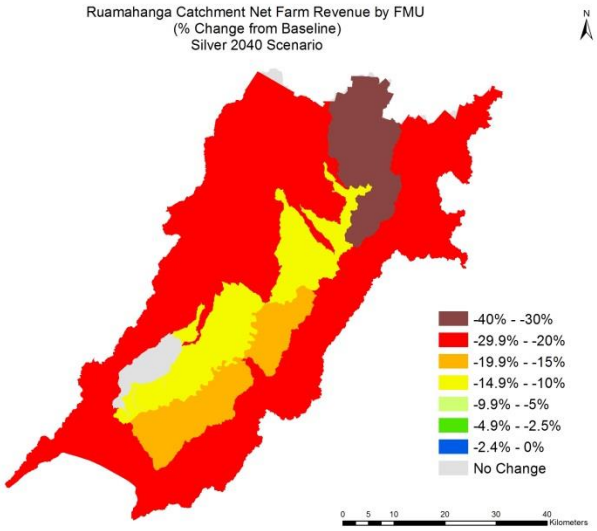
Annualised WWTP Upgrade Costs ('000$/yr)

District	BAU 2080	Silver 2025	Silver 2040	Silver 2080	Gold 2025	Gold 2040	Gold 2080
Masterton	8,178	5,873	8,241	8,178	8,146	8,241	8,178
Carterton	2,243	2,149	3,105	3,111	2,980	3,105	3,111
Martinborough	1,202	839	1,202	1,202	1,164	1,202	1,202
Greytown	1,181	824	1,181	1,181	1,143	1,181	1,181
Featherston	0	758	1,086	1,086	1,051	1,086	1,086
Total	**12,805**	**10,443**	**14,816**	**14,758**	**14,483**	**14,816**	**14,758**

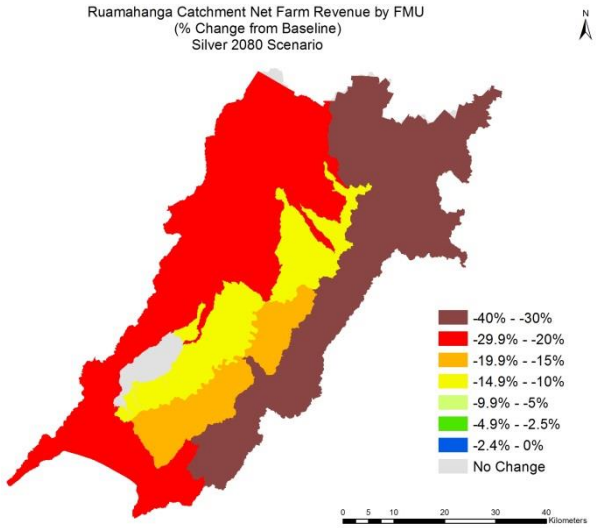
- Space planting
- Stock exclusion
- Tier 1 mit. options

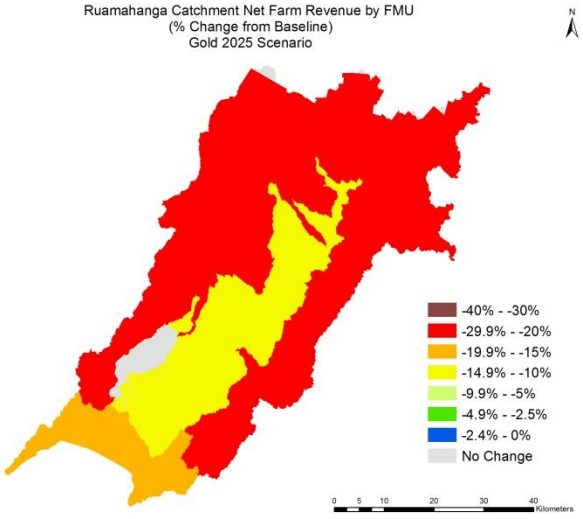


- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 2 mit. Options

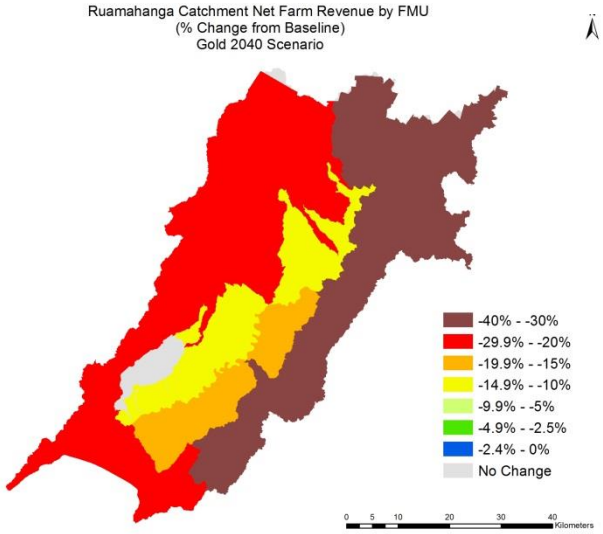


- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 3 mit. Options

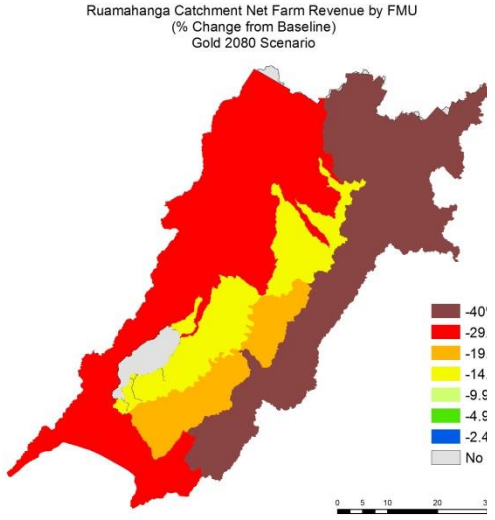




- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 2 mit. options

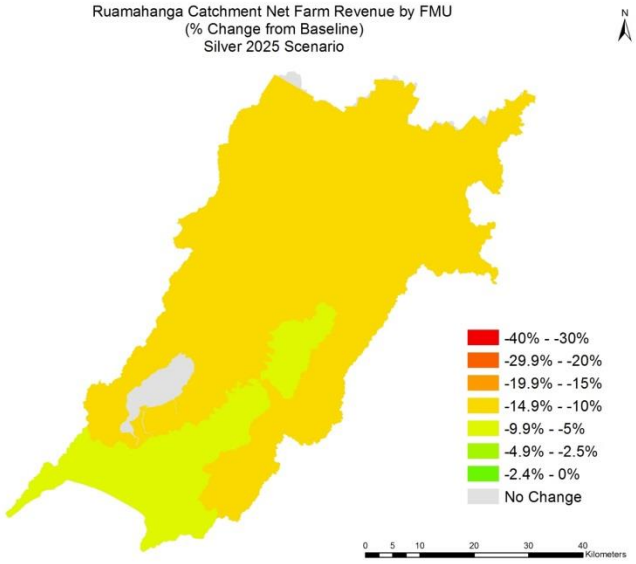


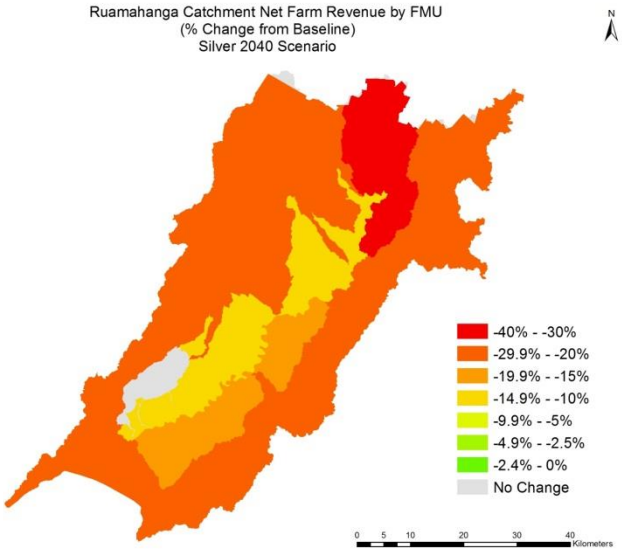
- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options

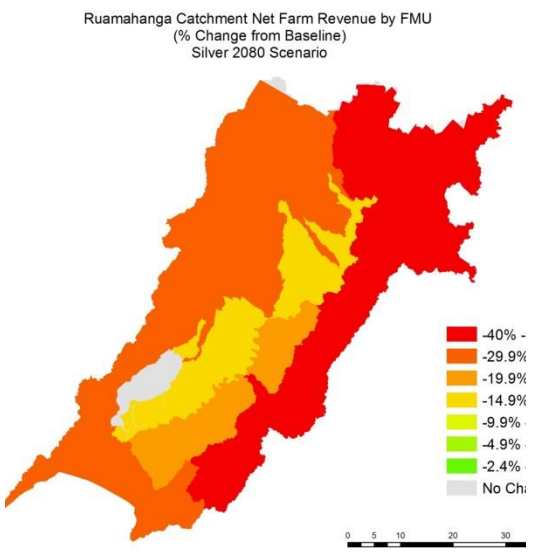


- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options

Sediment & on-farm mitigation options – Silver Scenario





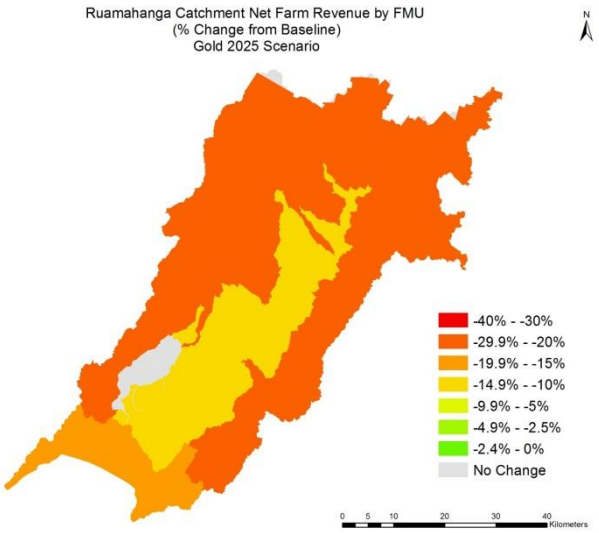


- Space planting
- Stock exclusion
- Tier 1 mit. options

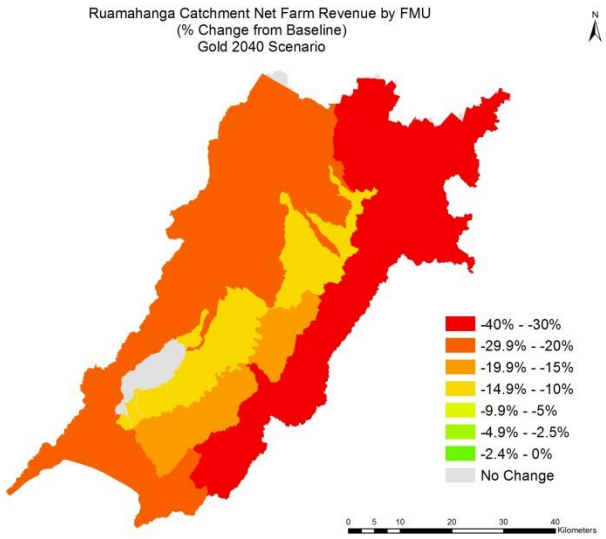
- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 2 mit. options

- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 3 mit. options

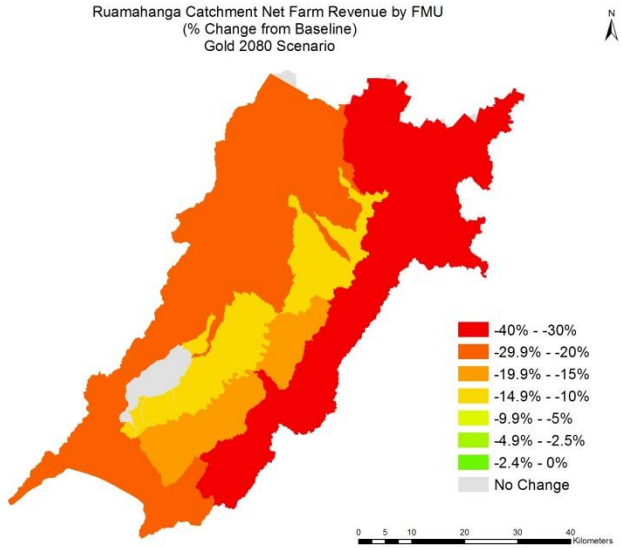
Sediment & on-farm mitigation options – Gold Scenario



- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 2 mit. options

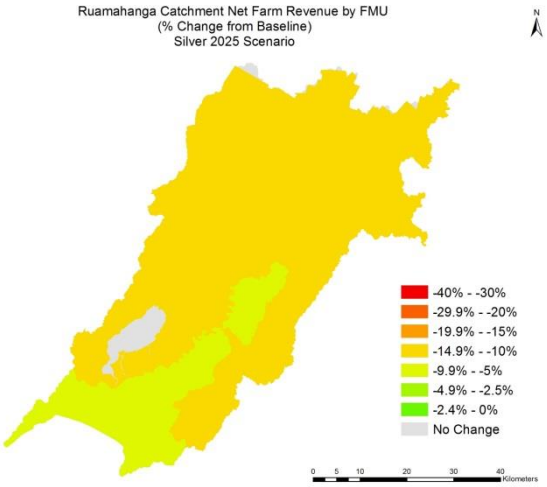


- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options

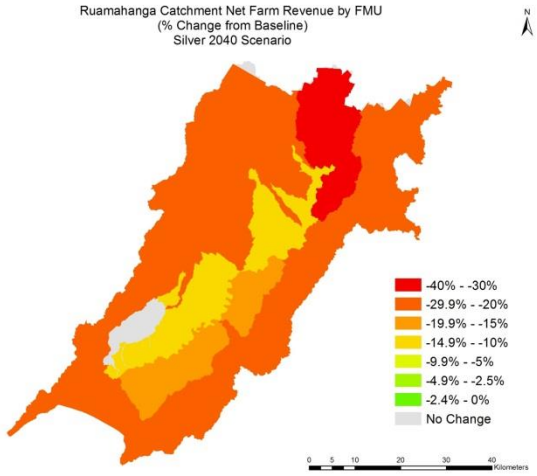


- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options

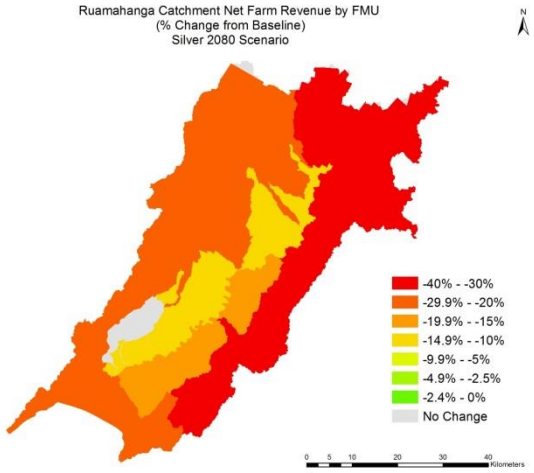
- Space planting
- Stock exclusion
- Tier 1 mit. options

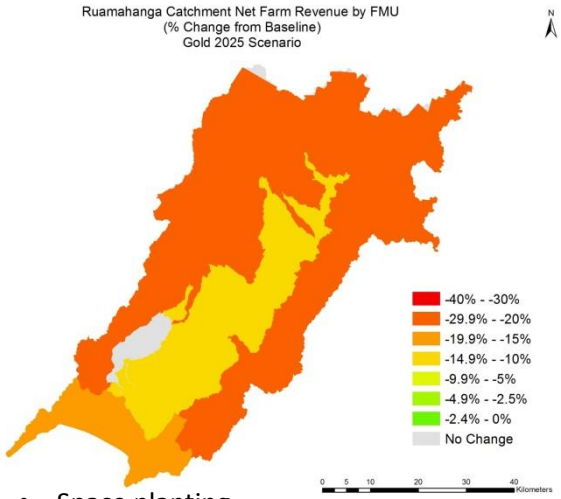


- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 2 mit. Options

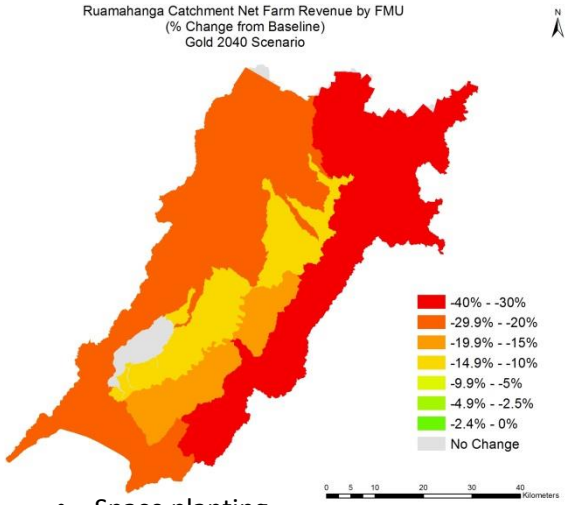


- Space planting
- Stock exclusion
- Retire steep slopes
- Tier 3 mit. Options

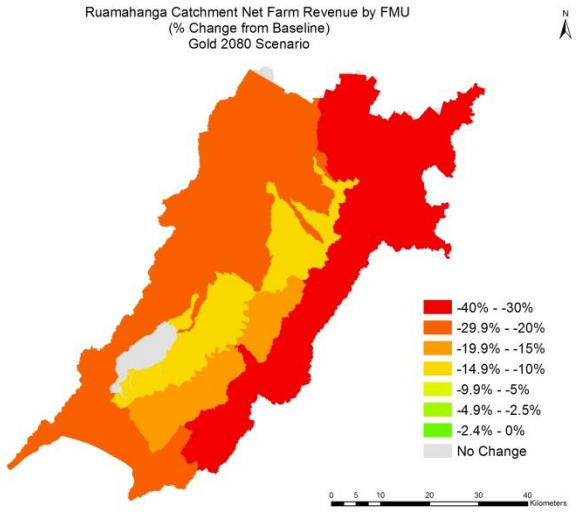




- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 2 mit. options



- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options



- Space planting
- Stock exclusion
- Retire steep slopes
- Riparian planting (+5m)
- Tier 3 mit. options