

Cultural Services of a Small River in Canterbury



**Lincoln
University**
Te Whare Wānaka o Aoraki
CHRISTCHURCH • NEW ZEALAND



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New Zealand's specialist land-based university

Land Use and
Management



Waterway
Attributes

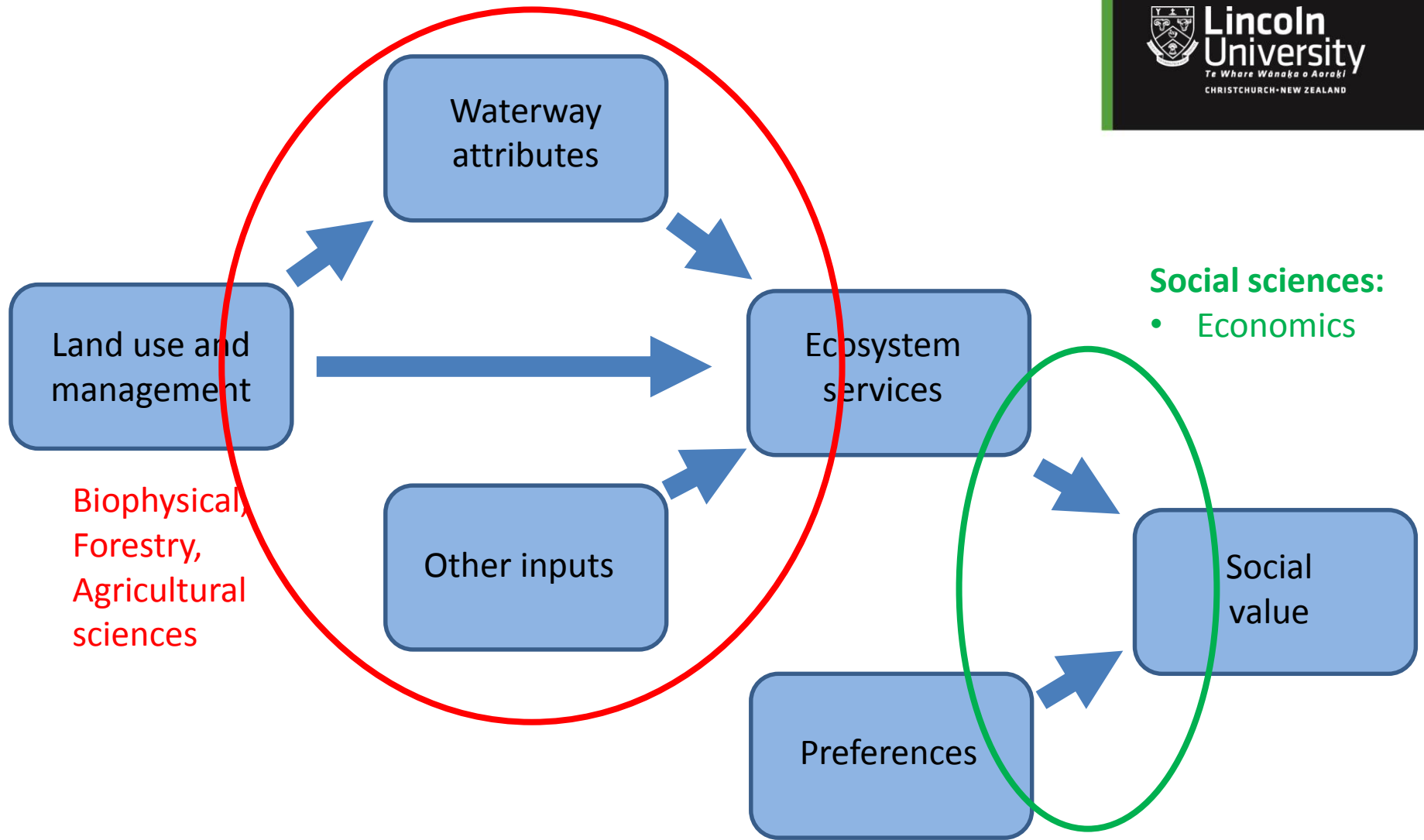


Social
Value

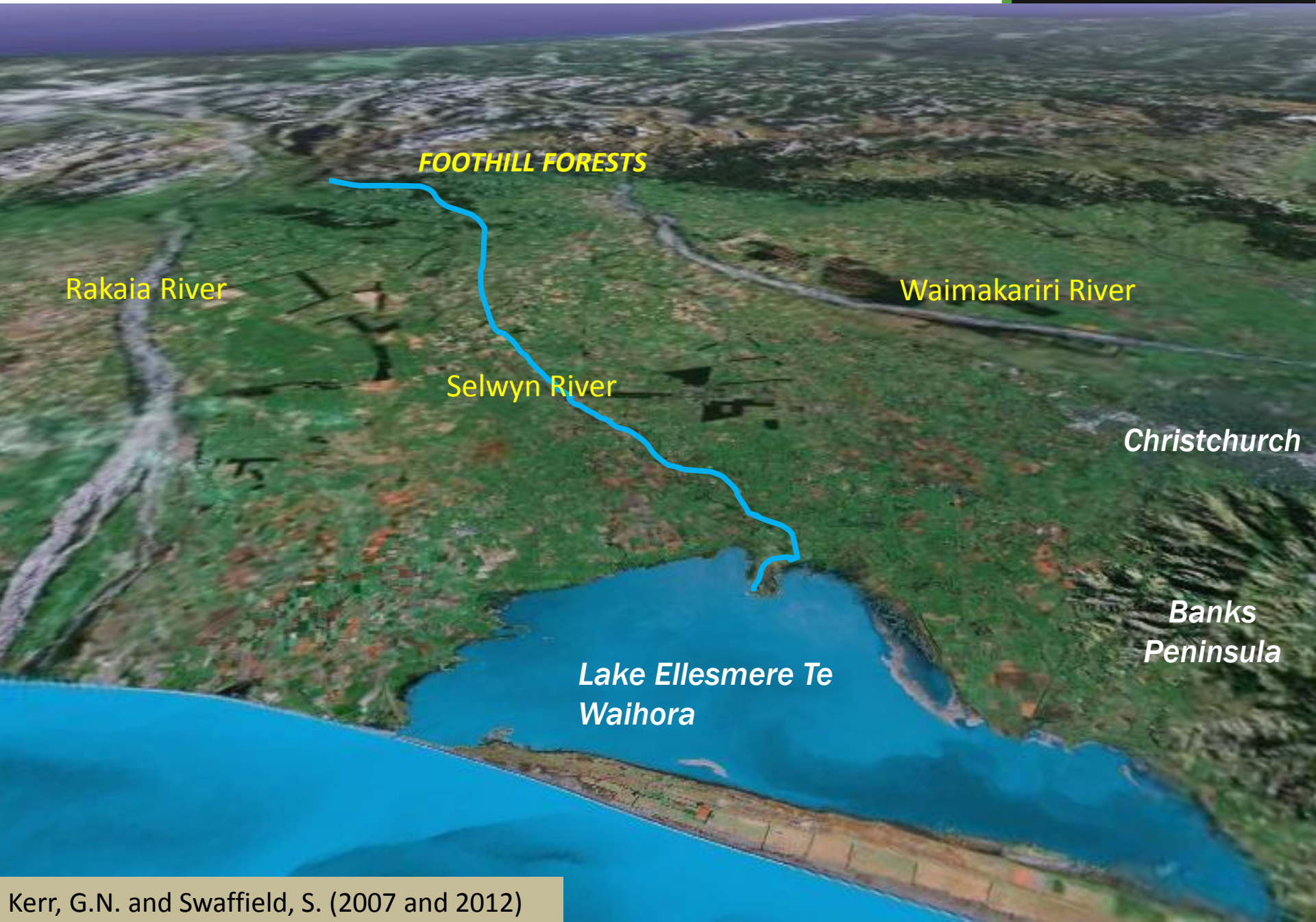
Public perceptions

Hughey, Kerr & Cullen (2013)

- Fresh waters are the worst condition of all environments
 - Consistent since 2000
- Rivers and lakes worst managed
- Native bush/forests 2nd best managed (after NPs)
 - Plantation forests not assessed
- Only 6% think forestry is one of the 3 main causes of harm to fresh waters



SELWYN RIVER CASE STUDY AREA



FOOTHILL FORESTS

Rakaia River

Waimakariri River

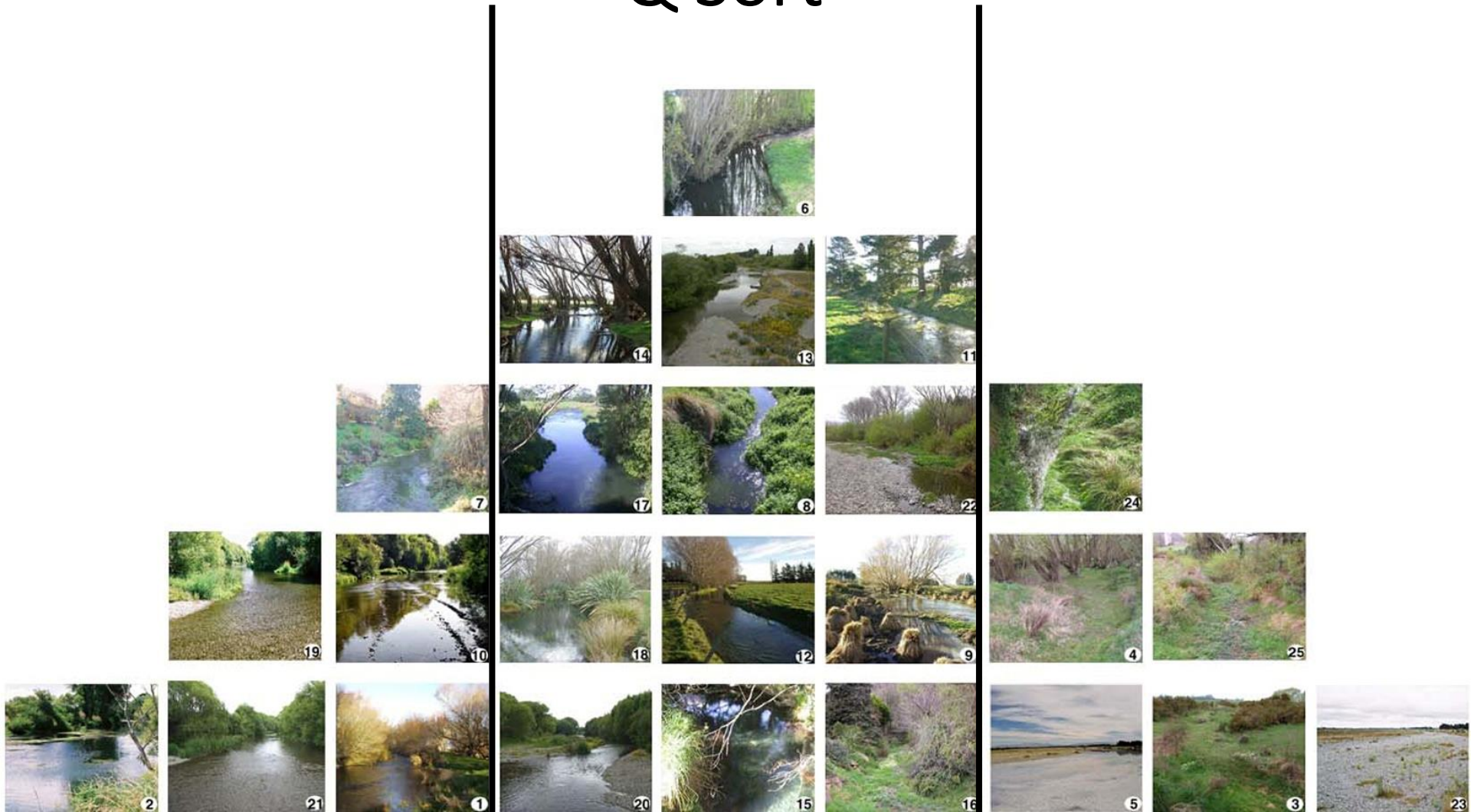
Selwyn River

Christchurch

Banks Peninsula

Lake Ellesmere Te Waihora

Q Sort




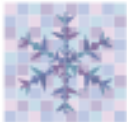



Highest Amenity

Lowest Amenity

NZ freshwater studies consistently identify the same salient attributes

- Safety
 - Health
 - Recreation
 - Algal blooms
- Flow
- Water clarity
- Ecological integrity
 - Habitat
 - Fish abundance
- Riparian vegetation
- Aesthetics
- Channel form

CHOICE 1

		Base
Summer flows (Average days) 	No Flow	27 days
	Low Flow	75 days
	Moderate Flow	10 days
Winter flows (Average days) 	No Flow	15 days
	Low Flow	65 days
	Moderate Flow	110 days
Water clarity (except during floods)		
Water pollution		
Riverbank vegetation is mostly ...	 Shade trees	
Change in local employment		None
Extra cost to your household each year		None

Selwyn River: Relative importance

Item valued	Group A	Group B
Safe to swim	100	100
Avoid a summer no flow day (base = moderate flow)	0.30	7.7
Avoid a winter no flow day (base = moderate flow)	0.66	5.8
Avoid a summer low flow day (base = moderate flow)	0.86	1.58
Avoid a winter low flow day (base = moderate flow)	0.07	1.45
Clear water	44	54
Natives (base = shade trees)	22	7.6
Gorse (base = shade trees)	-46	-90
Grass (base = shade trees)	27*	26
Jobs	0.16	2.9

Selwyn River: Dollar values

Item valued	Group A	Group B
Safe to swim	\$174	\$106
Avoid a summer no flow day (base = moderate flow)	\$0.48	\$7.84
Avoid a winter no flow day (base = moderate flow)	\$1.15	\$5.94
Avoid a summer low flow day (base = moderate flow)	\$1.47	\$1.60
Avoid a winter low flow day (base = moderate flow)	\$0.11	\$1.45
Clear water	\$77	\$55
Natives (base = shade trees)	\$38	\$8
Gorse (base = shade trees)	-\$80	-\$90
Grass (base = shade trees)	\$48	\$26
Jobs	\$0.26	\$2.93

Forests?

- Few forest-related studies
 - Rivas Palma, Kerr & Sharp, Yao et al.
 - Recreation (but not water-based)
- Some identification of effects
 - River flows
 - Water quality
 - Flora & fauna

Hawkes Bay Plantation Forestry

Rivas Palma (2008)



Forestry effects on waterways	Value of change in Ecosystem Services over a 28 year forestry rotation (undiscounted) for Hawkes Bay residents
Sediment reduction	\$2,600 ha ⁻¹
Algae reduction	\$3,120 ha ⁻¹
Flow reduction	-\$200 ha ⁻¹
Total for these items	\$5,520 ha⁻¹

Note: Confidence intervals are large and should be considered before applying these values

Planted forests: Giant Kokopu

Yao et al. (2014)

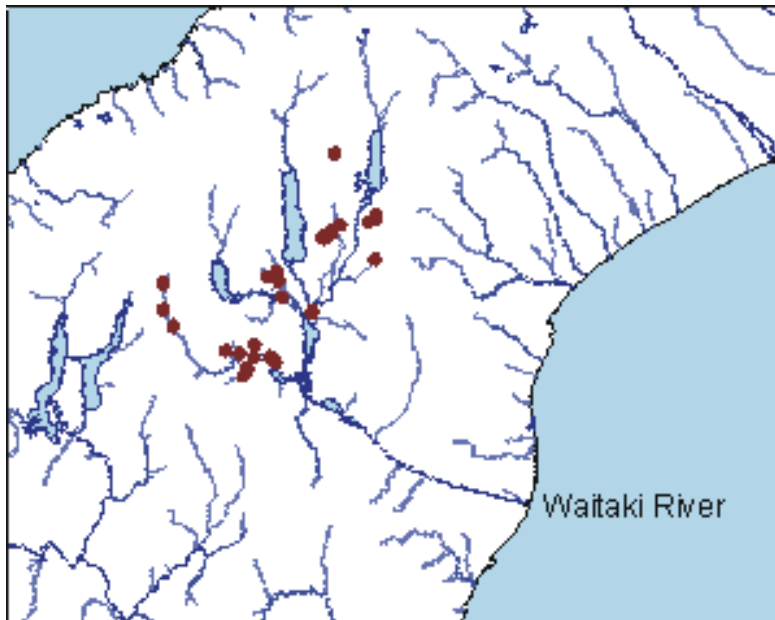
- Base: Giant Kokopu (*Galaxias argenteus*) in 10% of suitable streams in NZ planted forests
- Increase to 30% of suitable streams
- WTP per NZ resident, per year for 5 years
 - Mean \$8.37
 - Median \$6.25
 - 90% ci \$4 ~ \$22



Wilding Trees & Endangered Species

Kerr & Sharp (2007)

Bignose galaxias (*Galaxias macronasus*)
habitat threatened by wilding
pines: Avoiding extinction valued at
about \$130m for South Island residents



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Note: Confidence interval is large and should be considered before applying this value

Conclusions?

- Few studies have valued forest impacts on ES
- Non-forest waterway impacts are frequently valued
- Need to connect: activity \Rightarrow effect \Rightarrow value
- Values can be very large
 - Particularly preservation values
- Important attributes include
 - water clarity, water quality, vegetation, aesthetic, fauna and flora
- There is a lot we don't know
 - But there is strong evidence that forest management can impact highly valued ecosystem services that may be external to forest managers' consideration

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Selected results from some NZ freshwater studies

APPENDIX

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North Shore streams (\$ household⁻¹ year⁻¹)

Kerr, G.N. & Sharp, B.M.H. (2008)



Stream type	Attribute (one stream)	Class A	Class B	Weighted
Natural	Clear water (vs murky)	\$22	\$118	\$79
	Number of native fish species	\$5	\$20	\$14
	Fish habitat (km)	\$0	\$7	\$4
	Vegetation: Moderate (base = little/none)	\$6	\$67	\$42
	Vegetation: Plenty (base = little/none)	\$1	\$58	\$35
Degraded	Clear water (vs murky)	\$24	\$77	\$56
	Number of native fish species	-\$6	\$20	\$10
	Fish habitat (km)	\$5	\$22	\$15
	Vegetation: Moderate (base = little/none)	\$0	\$112	\$66
	Vegetation: Plenty (base = little/none)	-\$1	\$45	\$26
	Channel	\$9	\$110	\$69

Significant @ 95% confidence level

Note: Some confidence intervals are large and should be considered before applying these values

Waikato catchment (\$ household⁻¹ year⁻¹)

Marsh (2012)

Attribute (one catchment)	Level	Mean
Suitability for swimming base = 50% chance of health warnings for 1-2 weeks	20%	\$39
	10%	\$190
	2%	\$141
Water clarity base = 1 metre of underwater visibility	1.5 metres	\$19
	2 metres	\$28
	4 metres	\$82
Ecological health base = less than 40% of readings are excellent	50%	\$51
	60%	\$1
	80%	\$136

Note: Confidence intervals are large and should be considered before applying these values

Natural Character

Bell et al. (2012)



- Matakītaki, Takaka & Waimea rivers
- Also assessed
 - Native fish & fishing, suitability for swimming, suitability for boating
- Natural character
 - Highly modified, mixed vegetation, mostly natural, all native species
 - \$ household⁻¹ year⁻¹ for 5 years

		5%	Mean WTP	95%
Matakītaki From mainly natural to ...	Mixed vegetation	-76	-152	-210
	Highly modified	-112	-198	-398
Takaka From Highly modified to ...	Mixed vegetation	28	57	\$85
	Mainly natural	80	100	129
	Native species	96	189	296
Waimea From highly modified to ...	Mixed vegetation	64	85	118
	Mainly natural	22	135	281
	Native species	-26	159	344

Selwyn WTP estimates

Data: Latent class model results in S&R paper.xlsx

		WTP: Class 1									
		SUM1	SUM2	WIN1	WIN2	CLEAR	SWIM	GRASS	NATIVE	GORSE	JOBS
Krinsky & Expected	Min	-\$0.48	-\$1.47	-\$1.15	\$0.11	\$76.98	\$174.38	\$47.66	\$38.13	-\$79.75	\$0.26
	Max	-\$5.96	-\$4.01	-\$6.36	-\$2.18	\$23.68	\$90.24	-\$42.29	-\$31.46	-\$442.76	-\$1.01
	Median	\$5.23	\$1.31	\$0.62	\$1.10	\$328.46	\$543.52	\$94.25	\$116.74	\$13.48	\$2.26
	Mean	-\$0.51	-\$1.48	-\$1.13	\$0.12	\$75.80	\$172.13	\$48.18	\$38.40	-\$77.64	\$0.27
	lower 2.5	-\$0.48	-\$1.47	-\$1.23	\$0.10	\$81.16	\$181.46	\$46.29	\$37.41	-\$87.54	\$0.29
	upper 2.5	-\$2.67	-\$2.66	-\$3.10	-\$0.51	\$44.42	\$125.54	\$6.58	\$6.45	-\$212.59	-\$0.35
	Significai	\$1.88	-\$0.19	-\$0.07	\$0.62	\$147.14	\$290.20	\$77.27	\$64.14	-\$16.75	\$1.07
	K&R SD	NS	**	**	NS	**	**	**	**	**	NS
	Delta	\$1.14	\$0.63	\$0.77	\$0.29	\$27.26	\$44.47	\$17.51	\$14.54	\$51.45	\$0.37
	Delta SD	\$1.05	\$0.57	\$0.66	\$0.26	\$22.19	\$35.54	\$16.16	\$13.27	\$42.42	\$0.34
Delta low	-\$2.53	-\$2.59	-\$2.43	-\$0.39	\$33.49	\$104.72	\$15.99	\$12.12	-\$162.90	-\$0.40	
Delta high	\$1.58	-\$0.35	\$0.14	\$0.62	\$120.46	\$244.03	\$79.33	\$64.13	\$3.39	\$0.93	
Significai	NS	**	NS	NS	**	**	**	**	NS	NS	
Exp/SD	-0.45	-2.57	-1.75	0.44	3.47	4.91	2.95	2.87	-1.88	0.77	
		WTP: Class 2									
		SUM1	SUM2	WIN1	WIN2	CLEAR	SWIM	GRASS	NATIVE	GORSE	JOBS
Krinsky & Expected	Min	-\$7.84	-\$1.60	-\$5.94	-\$1.45	\$54.55	\$105.55	-\$26.44	\$7.92	-\$90.47	\$2.93
	Max	-\$113.95	-\$18.87	-\$55.43	-\$11.26	-\$929.98	-\$1,002.82	-\$334.29	-\$296.64	-\$1,316.37	-\$33.58
	Median	\$98.61	\$44.88	\$62.35	\$17.27	\$509.09	\$910.66	\$186.92	\$302.19	\$1,642.99	\$23.17
	Mean	-\$7.91	-\$1.66	-\$5.98	-\$1.48	\$54.66	\$105.43	-\$26.81	\$8.28	-\$91.16	\$2.91
	lower 2.5	-\$8.99	-\$1.80	-\$6.73	-\$1.65	\$61.42	\$119.15	-\$30.41	\$7.07	-\$107.85	\$3.26
	upper 2.5	-\$21.49	-\$5.69	-\$14.40	-\$4.22	\$14.56	\$55.80	-\$117.71	-\$70.93	-\$308.70	\$1.63
	Significai	-\$3.42	\$0.92	-\$3.19	-\$0.18	\$151.22	\$254.73	\$37.74	\$81.37	-\$17.98	\$7.07
	K&R SD	**	NS	**	**	**	**	NS	NS	**	**
	Delta	\$5.85	\$2.03	\$3.83	\$1.14	\$44.73	\$64.50	\$41.48	\$39.42	\$89.50	\$1.76
	Delta SD	\$3.13	\$1.34	\$2.00	\$0.77	\$26.25	\$35.02	\$31.14	\$30.39	\$49.33	\$0.93
Delta low	-\$13.98	-\$4.24	-\$9.85	-\$2.96	\$3.10	\$36.91	-\$87.48	-\$51.65	-\$187.16	\$1.11	
Delta high	-\$1.71	\$1.03	-\$2.03	\$0.05	\$106.00	\$174.20	\$34.60	\$67.49	\$6.22	\$4.75	
Significai	**	NS	**	NS	**	**	NS	NS	NS	**	
Exp/SD	-2.51	-1.19	-2.98	-1.90	2.08	3.01	-0.85	0.26	-1.83	3.15	

New