Landcare Research
Manaaki Whenua

Quantifying Visual Preferences in Canterbury

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Why study landscape preferences in Canterbury?

- After Maori settlement, fires destroyed the scrub and beech forests and tussock grassland took over
- Early European settlers introduced exotic grasses, flowering plants, food crops, and trees that supplanted native vegetation
- Economic activities such as sheep, beef, and dairy farming; agricultural and horticultural production; electricity generation; and mining have further altered the landscape

Why study landscape preferences in Canterbury?

- In recent decades, Canterbury has seen particularly radical changes
- Dry ranges on which sheep and beef once grazed have increasingly been converted to irrigated pasture for dairy
- 83% of Cantabrians that we interviewed report having noticed *major changes* in the Canterbury landscape over the *last 3 years*

Why study landscape preferences in Canterbury?

- The underlying causes of changes to the visual landscape will not be discussed today
- Our fundamental question is:
  What would Cantabrians like to see in the landscape?

What would we like to see in the landscape?

Visual Preference Surveys

- Common in urban planning exercises

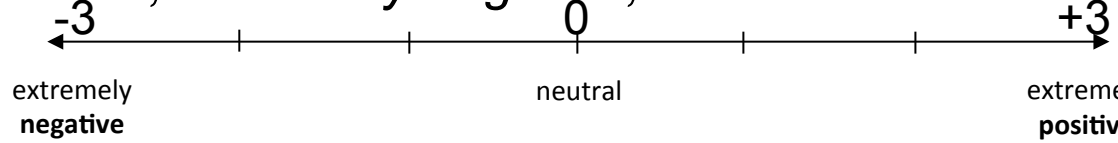
- Serious shortcomings:
  - Respondents react to covariates
  - Unobserved characteristics of respondents may influence results

What would we like to see in the landscape?

Visual Assessment Studies

Rate the image on a Likert scale:

Please indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.



- Regress score on image & respondent characteristics

$$Score = \beta_0 + \beta_1 \times bdg\_height + \beta_2 \times path\_width + \beta_3 \times pedestrians + \beta_4 \times placard + \beta_5 \times age + \beta_6 \times urbanite + \varepsilon$$

What would we like to see in the landscape?

Visual Assessment Studies

$$Score = \beta_0 + \beta_1 \times bdg\_height + \beta_2 \times path\_width + \beta_3 \times pedestrians + \beta_4 \times placard + \beta_5 \times age + \beta_6 \times urbanite + \varepsilon$$

β_1 = how much the score rises (or falls) if building height rises by 1 meter

If β_1 = 0.15, the score is predicted to rise by 0.15 pts for each additional meter
→ People prefer taller buildings

β_4 = how much the score rises (or falls) if a placard is shown

If β_4 = -0.32, the score is predicted to fall by 0.32 pts if there is a placard
→ People prefer not to have placards on the sidewalk

What would we like to see in the landscape?

Visual Assessment Studies

$$Score = \beta_0 + \beta_1 \times shelterbelt + \beta_2 \times cattle + \beta_3 \times irrigator + \beta_4 \times sheep + \beta_5 \times age + \beta_6 \times urbanite + \varepsilon$$

β_1 = how much the score rises (or falls) if a shelterbelt is shown

β_2 = how much the score rises (or falls) if cattle are shown

β_3 = how much the score rises (or falls) if an irrigator shown

β_4 = how much the score rises (or falls) if sheep are shown

β_5 = how much the score rises (or falls) if the respondent's age rises by 1 year

β_6 = how much the score rises (or falls) if the respondent is an urbanite

What would we like to see in the landscape?

Technical Note

$$Score = \beta_0 + \beta_1 \times shelterbelt + \beta_2 \times cattle + \beta_3 \times irrigator + \beta_4 \times sheep + \beta_5 \times age + \beta_6 \times urbanite + \varepsilon$$

OLS yields biased standard errors

→ Estimate the model using a cross-classified random effects model

Visual assessment study

- 1200 photos taken along 900km of Canterbury roads
- Photos selected for comparability; classified for content

Component	Categorisation
Roadside shelterbelt in image	yes, no
Shelterbelt origin	none, native, exotic
Shelterbelt species	none, poplar, gum, gorse, pine, macrocarpa, pittosporum, flax, mixed native trees
Distant shelterbelt	yes, no
Prominent individual trees	yes, no
Type of stock	none, sheep, beef cattle, dairy cows
Prominent horticulture	yes, no
Prominent irrigator	yes, no
Prominent silage bales	yes, no
Prominent green paddocks	yes, no
Prominent weeds	yes, no
Overgrown verge	yes, no
Prominent electric/telephone poles	yes, no
Prominent hills	yes, no

Survey

- Sample: 800 Canterbury households
  - Demographically and geographically representative
  - Sample pool derived from random digit dialling
- Mode: Internet
  - Not preferred option for most surveys
  - Ideally suited for image-intensive visual preference surveys

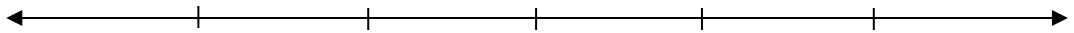
Survey

- Content:
  - Household demographics
  - Occupation
  - Perceptions of industrial sectors in Canterbury
  - Travel patterns
  - Outdoor activities
  - 43 images in the visual assessment study
- Incentive:
  - $10 donated to charity of respondent's choice

- ☐ Christchurch Earthquake Appeal
- ☐ National Heart Foundation
- ☐ Southern Stars Charitable Trust
- ☐ SPCA Canterbury
- ☐ CanTeen
- ☐ NSAD
- ☐ Red Cross of NZ
- ☐ Trees Canterbury

Please indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.

7 pt Likert scale



extremely **negative**

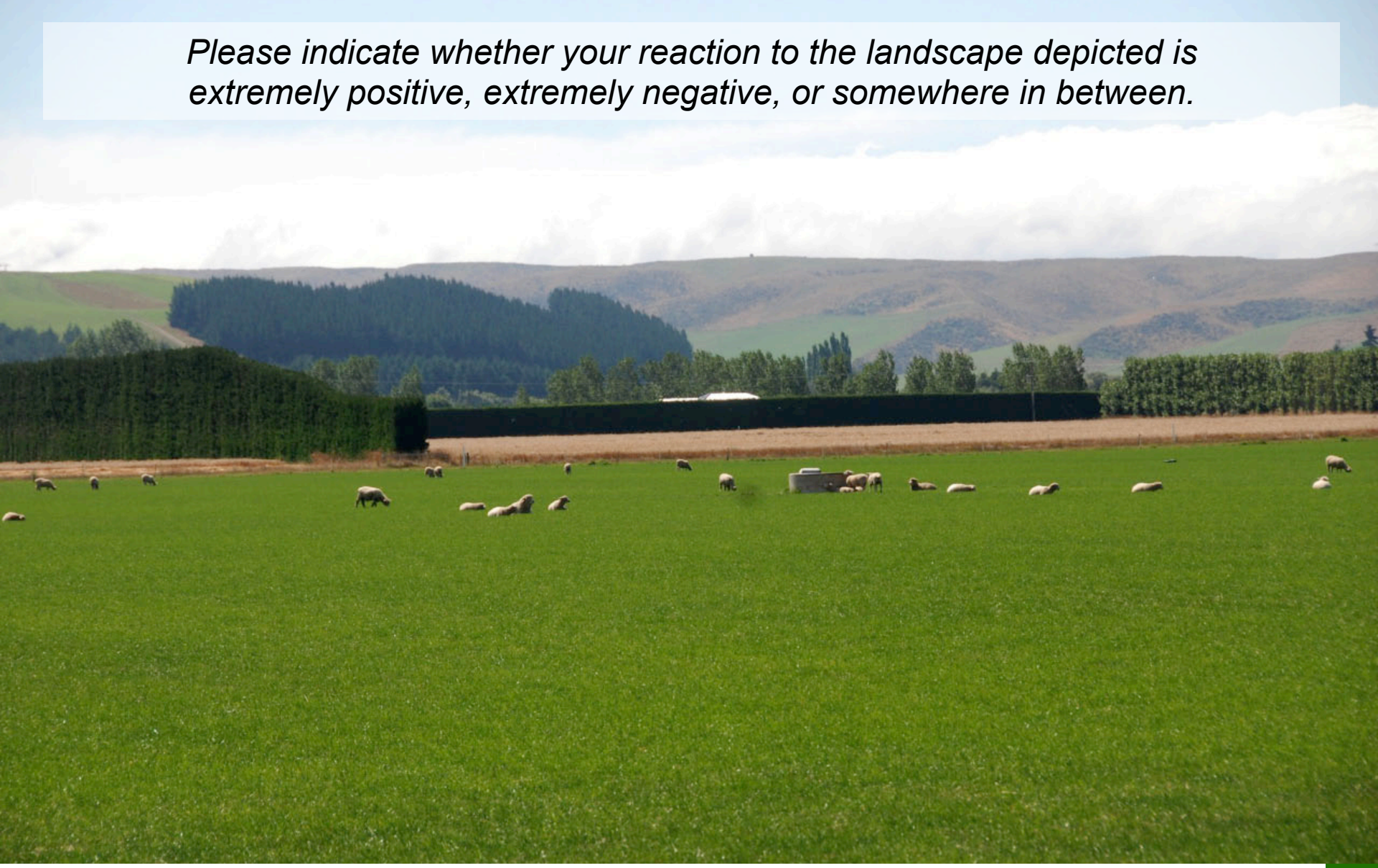
neutral

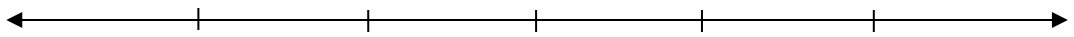
extremely **positive**

Please indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.

extremely **negative** | neutral | extremely **positive**

Please indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.



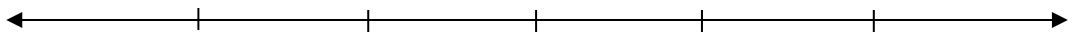


extremely **negative**

neutral

extremely **positive**

Please indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.



extremely **negative**

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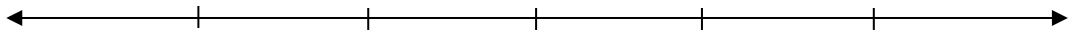
Please indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.



extremely **negative**

neutral

extremely **positive**

Results 1:
Visual preference survey

Most favoured images

Results 1:
Visual preference survey

Least favoured images

Results 2: Visual assessment study

Score is measured on a 7 point scale

1. Shelterbelts (whether near or far) and sheep increase scores the most

2. Irrigators, dairy cows, and silage decrease scores the most

3. Demographics of respondents don't matter very much

		rural		urban	
variable	unit	estimate	std err	estimate	std err
Shelterbelt in image	dummy	0.73***	(0.051)	0.62***	(0.035)
Distant shelterbelt	dummy	0.34***	(0.038)	0.36***	(0.026)
Individual trees	dummy	0.19***	(0.037)	0.14***	(0.025)
Sheep	dummy	0.62***	(0.056)	0.46***	(0.038)
Beef cattle	dummy	-0.0032	(0.056)	-0.089**	(0.038)
Dairy cows	dummy	-0.34***	(0.044)	-0.28***	(0.030)
Horticulture	dummy	0.38***	(0.038)	0.25***	(0.026)
Irrigator	dummy	-0.91***	(0.050)	-0.86***	(0.034)
Silage bales	dummy	-0.33***	(0.050)	-0.33***	(0.034)
Weeds	dummy	-0.15***	(0.030)	-0.14***	(0.020)
Electric/telephone poles	dummy	-0.035	(0.031)	-0.037*	(0.021)
Hills	dummy	0.11***	(0.032)	0.074***	(0.022)
Male	dummy	-0.0087	(0.080)	0.036	(0.063)
Age	years	0.0081**	(0.0033)	0.00021	(0.0025)
White	dummy	-0.056	(0.13)	-0.15	(0.095)
Māori	dummy	-0.10	(0.26)	-0.31*	(0.16)
Canterbury residency	years	-0.00019	(0.0024)	0.0016	(0.0020)
Farm family	dummy	0.095	(0.11)	0.039	(0.16)
Outdoors activities	dummy	0.025	(0.13)	-0.046	(0.074)
Constant		-0.082	(0.25)	0.41***	(0.15)
Number of groups		244		494	
Obs per group		38		38	

Notes: Maximum likelihood model estimated using cross-classified random effects. Standard errors reported in parentheses. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Results 2: Visual assessment study

Score is measured on a 7 point scale

Interesting result

Want to understand it better

Strategy:
Run the same model, but look at shelterbelts more closely

		rural		urban	
variable	unit	estimate	std err	estimate	std err
Shelterbelt in image	dummy	0.73***	(0.051)	0.62***	(0.035)
Distant shelterbelt	dummy	0.34***	(0.038)	0.36***	(0.026)
Individual tr[illegible]s	dummy	0.19***	(0.037)	0.14***	(0.025)
Sheep	dummy	0.62***	(0.056)	0.46***	(0.038)
Beef catt[illegible]	dummy	-0.0032	(0.056)	-0.089**	(0.038)
Dairy cov[illegible]	dummy	-0.34***	(0.044)	-0.28***	(0.030)
Horticultu[illegible]	dummy	0.38***	(0.038)	0.25***	(0.026)
Irrigator	dummy	-0.91***	(0.050)	-0.86***	(0.034)
[illegible]	dummy	-0.33***	(0.050)	-0.33***	(0.034)
[illegible]	dummy	-0.15***	(0.030)	-0.14***	(0.020)
Electric/telephone poles	dummy	-0.035	(0.031)	-0.037*	(0.021)
Hills	dummy	0.11***	(0.032)	0.074***	(0.022)
Male	dummy	-0.0087	(0.080)	0.036	(0.063)
Age	years	0.0081**	(0.0033)	0.00021	(0.0025)
White	dummy	-0.056	(0.13)	-0.15	(0.095)
Māori	dummy	-0.10	(0.26)	-0.31*	(0.16)
Canterbury residency	years	-0.00019	(0.0024)	0.0016	(0.0020)
Farm family	dummy	0.095	(0.11)	0.039	(0.16)
Outdoors activities	dummy	0.025	(0.13)	-0.046	(0.074)
Constant		-0.082	(0.25)	0.41***	(0.15)
Number of groups		244		494	
Obs per group		38		38	

Notes: Maximum likelihood model estimated using cross-classified random effects. Standard errors reported in parentheses. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Results 2: Visual assessment study

	rural		urban	
variable	estimate	std err	estimate	std err
Exotic shelterbelt	0.34***	(0.045)	0.24***	(0.031)
Native shelterbelt	0.69***	(0.052)	0.53***	(0.035)
Number of groups	244		494	
Obs per group	38		38	

Notes: Maximum likelihood model estimated using cross-classified random effects. Standard errors reported in parentheses.
*** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Everything in the model is the same except that we now look at *types* of shelterbelts

1. Native shelterbelts are preferred to exotic shelterbelts
2. Both are preferred to no shelterbelts

Results 2: Visual assessment study

1. Gums, poplars, and mixed native shelterbelts are viewed very favourably

2. Gorse is the only shelterbelt that leaves a negative visual impression

3. Pine is viewed less favourably than other shelter belt types

	rural		urban	
variable	estimate	std err	estimate	std err
Poplar shelterbelt	1.11***	(0.089)	1.08***	(0.061)
Gum shelterbelt	1.26***	(0.089)	1.14***	(0.061)
Gorse shelterbelt	-0.53***	(0.10)	-0.35***	(0.065)
Pine shelterbelt	0.35***	(0.066)	0.27***	(0.045)
Macrocarpa shelterbelt	0.88***	(0.089)	0.69***	(0.061)
Pittosporum shelterbelt	0.71***	(0.089)	0.42***	(0.061)
Flax shelterbelt	0.62***	(0.089)	0.64***	(0.061)
Mixed native shelterbelt	1.21***	(0.075)	1.07***	(0.051)
Number of groups	244		494	
Obs per group	38		38	

Notes: Maximum likelihood model estimated using cross-classified random effects. Standard errors reported in parentheses. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

The shelterbelt shown in this image is comprised of mixed native plantings, including pittosporum (kohuhu), cabbage tree (to kouka), caprosma (karama), and ribbonwood (houhere). The biodiversity index of this shelterbelt is **very high**.

How does this knowledge affect your perception of this image?

[] less attractive
[] no change
[] more attractive

The shelterbelt shown in this image is comprised of poplar, a tree that was introduced to New Zealand in the 1830s. Its biodiversity index is **low**.

How does this knowledge affect your perception of this image?

[] less attractive
[] no change
[] more attractive

The shelterbelt shown in this image is comprised of flax, a native bush. Its biodiversity index is **high**.

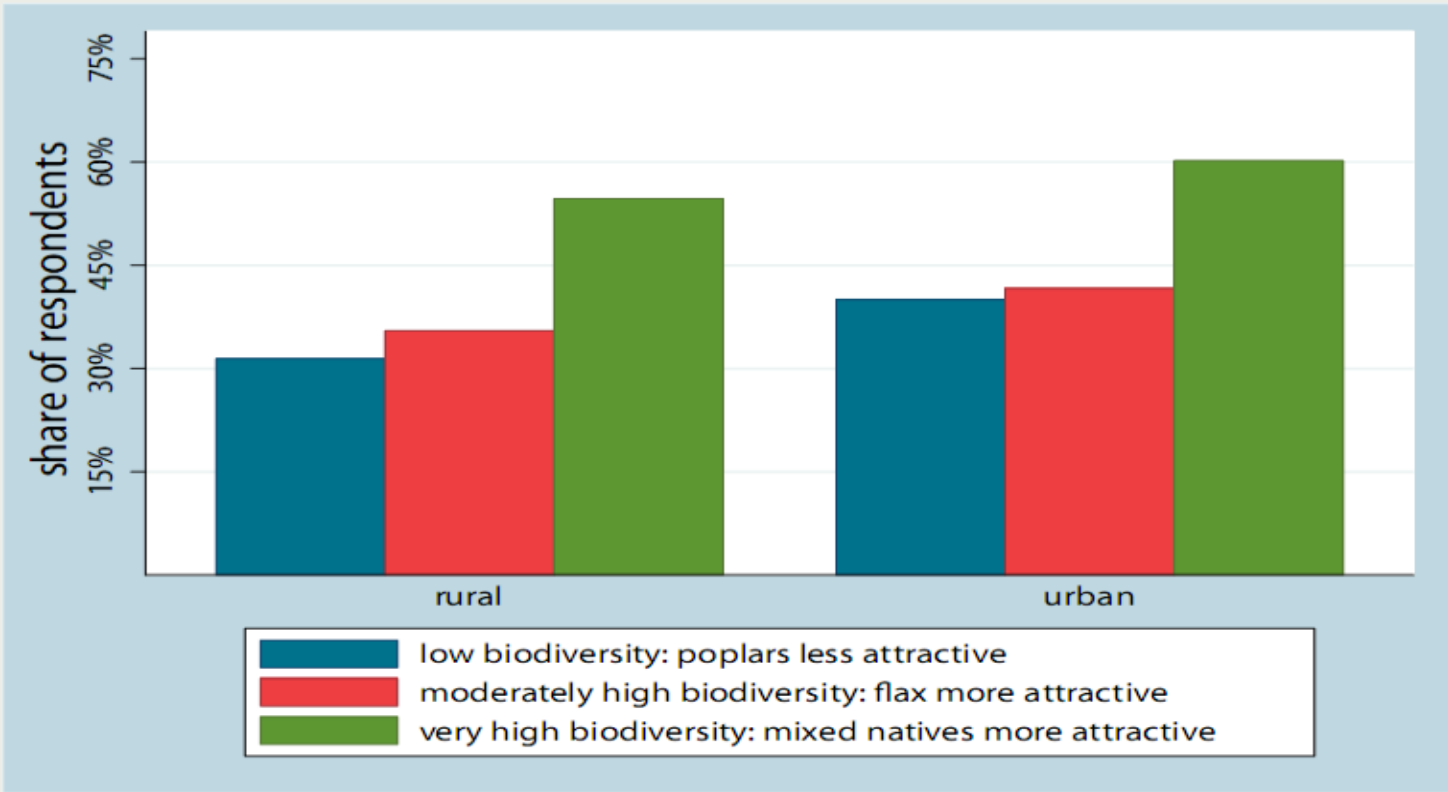
How does this knowledge affect your perception of this image?

[] less attractive
[] no change
[] more attractive

Results 3: Biodiversity

How does this additional information affect your perception of this image?

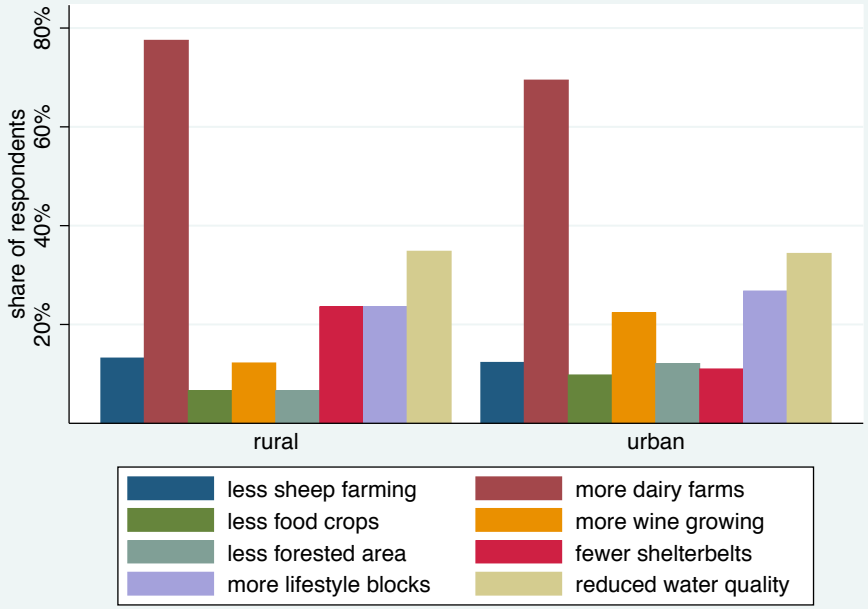
[] less attractive
[] no change
[] more attractive



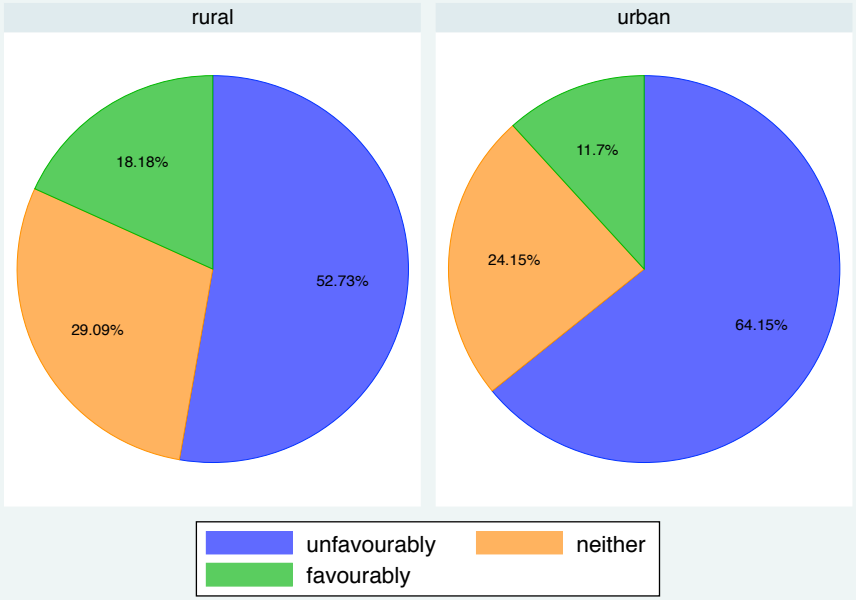
1. Subjective evaluation of the attractiveness of shelterbelts is influenced by knowledge about biodiversity

Interesting sub-result: Visual changes in the landscape

- 83% of respondents report that dairy conversion is 1st or 2nd most significant visual changes in the landscape



Rural and urban agree that dairy conversion is a significant visual change in the landscape

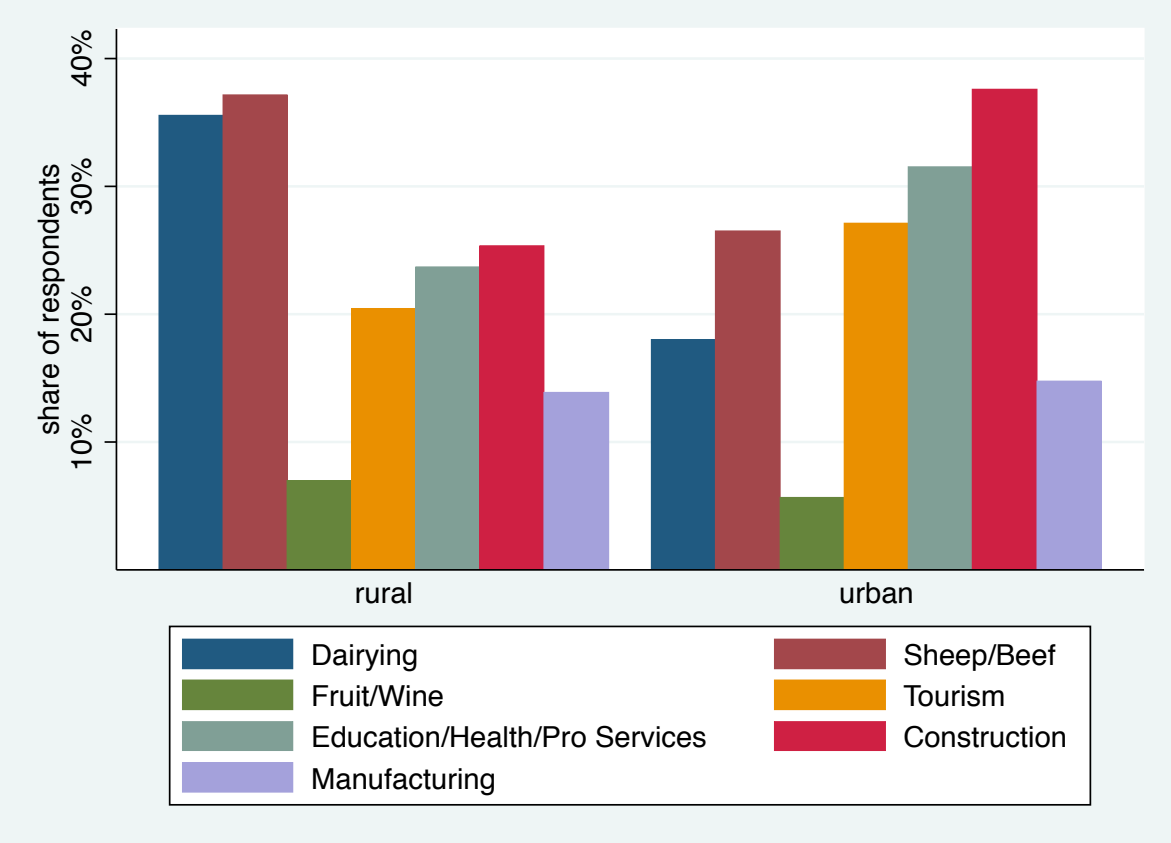


Dairy conversion largely viewed unfavourably among respondents

Interesting sub-result: Visual changes in the landscape

Sheep/beef and dairy identified as most important sectors among rural respondents

Construction and professional services identified as most imp. sectors among urban respondents



Interesting sub-result: Visual changes in the landscape

1. Respondents who believe that dairy is important for the economy are 27% less likely to view dairy conversion unfavourably

Who views visual impacts of dairy conversion negatively?

		rural		urban	
Variable	unit	dy/dx	z	dy/dx	z
Believes that dairy is important for economy	dummy	-0.26***	(0.00)	-0.28***	(-0.00)
Male	dummy	-0.059	(-0.39)	-0.026	(-0.59)
Age	years	-0.0040	(-0.14)	0.0062**	(0.00)
Pakeha	dummy	0.009	(0.94)	0.033	(0.65)
M ori	dummy	-0.11	(-0.54)	0.08	(0.52)
Canterbury residency	years	0.0021	(0.32)	0.0004	(0.80)
Farm family	dummy	-0.078	(-0.36)	-0.022	(-0.88)
Outdoors activities	dummy	-0.18	(-0.13)	0.12	(2.50)
N		244		494	

Notes: Estimated with a probit model. Marginal effects reported. z-statistics presented in parentheses using heteroskedasticity-robust standard errors. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level.

Summary

- Canterbury residents have noticed numerous visual changes in the landscape
  - Dairy conversion is viewed unfavourably, but less so by people who consider it to be economically important
- There is strong consistency among rural and urban New Zealanders:
  - People dislike seeing irrigators, silage bales, and dairy cows
  - Conversely, people like seeing shelterbelts and sheep
- Native shelterbelts are preferred to exotic shelterbelts, but both are preferred to the absence of shelterbelts
- Given sufficient information, people prefer biodiversity

Policy

- There are at least 2 cost-effective means of improving the visual landscape of Canterbury:
  - Encourage landowners to plant shelterbelts
  - Stop removing existing shelterbelts for irrigators
- Good news for biodiversity policy:
  - There is a general preference for mixed native shelterbelts
  - Interplanting natives and exotics can further enhance biodiversity
- Expect more from New Zealand science
  - We can do better than choosing A or B
  - You should demand it