Visual landscape preferences in the Canterbury Region
Landscape preferences in the Canterbury Region

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May 2012
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Summary

Objectives

The research identifies whether Canterbury residents have noticed visual changes to the rural landscape in recent years, what changes they are particularly concerned about, and whether primary producers can adopt practices to mitigate those visual changes.

Methods

The research method comprises of a qualitative assessment of two focus groups, one with rural residents and one with urban residents, and a quantitative assessment of an online survey of 740 Canterbury residents. The survey includes a series of closed-ended, multiple-choice questions and a visual assessment study comprised of 43 photographic images of different rural landscape features across the Canterbury region.

Results

Changes to the visual landscape and how changes are perceived

- The majority of Cantabrians have noticed visual changes to the rural landscape. The majority of those who noted those changes view them unfavourably (64.15% of urban residents and 53.73% rural residents).
- Dairy conversion is noted as a particularly prominent change to the rural landscape of Canterbury. Residents who believe that dairy farming is one of the two most important sectors for the Canterbury economy are less likely to perceive the visual impacts of dairy farming negatively.

Visual landscape features that Cantabrians particularly like or dislike

- There is strong consistency among rural and urban Cantabrians regarding the rural landscape features that they particularly like or dislike.
- Cantabrians particularly dislike seeing dairy cows, irrigators, silage bales, and overgrown road verges. Conversely, Cantabrians particularly like seeing shelterbelts and individual trees. Native shelterbelts are preferred to exotic shelterbelts, but both are preferred to having no shelterbelts. Cantabrians also like seeing hills and mountains, horticulture, and sheep. Importantly, people appear to value visual diversity in the landscape.
- People’s dislike of visual features of dairying is not influenced only by visual aesthetics. For example, some associate irrigators with regional water issues, conflating visual impacts of dairy conversion with non-visual impacts. Therefore, even if measures are taken to improve the visual aesthetics of dairy farms, some people are still likely to hold negative views on dairy conversion.
- Cantabrians do not consistently prefer historic landscape features to new ones. Gorse hedgerows, which were once common in parts of Canterbury, are consistently disliked by residents.
Biodiversity matters to people, at least for choosing shelterbelts. Native shelterbelts were even more strongly preferred when survey respondents were informed that these have high biodiversity values, and exotic shelterbelts were less preferred when survey respondents were informed that these have low biodiversity values.

Conclusion and Recommendations

The findings provide evidence of widespread support from Cantabrians for planting native shelterbelts with high biodiversity value on productive land because native shelterbelts will help mitigate changes to the visual landscape and will increase the biodiversity values of productive land in Canterbury. Based on the above results, the following land management approaches are recommended:

1. **Maintain existing shelterbelts** except where trees need to be removed to increase road safety or to create windows for views. Internal shelterbelts within paddocks should be maintained wherever possible, particularly on riparian margins.

2. **Increase the biodiversity value of existing exotic shelterbelts** by under- or inter-planting with native plant species.

3. **Establish new shelterbelts with high biodiversity values.** In order to provide visual diversity and increase biodiversity, new shelterbelts along roadsides should comprise a mix of plant species and a high percentage of those plants (at least 25%) should be New Zealand native. It is preferable to use locally sourced natural indigenous species rather than cultivars or hybrids that may have no nectar or fruit for wildlife. Recognized pest species should be excluded.

4. **Publicly promote on-farm planting programmes that increase rural biodiversity** as biodiversity is important to Cantabrians; however, many people are unaware that mixed native shelterbelts provide greater biodiversity value than monoculture exotic shelterbelts.
1 Introduction

The Canterbury landscape has undergone profound changes since the arrival of Māori settlers in the 13th century; fires destroyed much of the scrub and beech forests that originally covered the area, and tussock grassland slowly took over. European settlers then introduced exotic grasses, flowering plants, food crops, and trees that gradually supplanted much of the native vegetation. The landscape has been further altered by economic activities such as sheep, beef, and dairy farming; wheat, barley, and wine production; electricity generation; and mining.

This research examines which visual aspects of the rural landscape in Canterbury are of particular importance to regional residents, the degree to which residents have noticed visual changes in the rural landscape, and their perceptions of those changes. The research also examines people’s responses to shelterbelts and the extent to which their preferences for different shelterbelt types are influenced by their relative biodiversity value. The research was funded by DairyNZ and was carried out between February and May 2012.

1.1 Objectives

The key objective of the research was to identify ways to mitigate negative visual changes to Canterbury’s rural landscape. To meet this objective, we sought to answer the following key research questions:

- What visual changes to the rural landscape have Canterbury residents noticed over the past few years?
- How do people feel about those changes?
- Which visual aspects of the rural Canterbury landscape are especially important to urban and rural residents? Does natural screening in the form of shelterbelts reduce any negative visual impact of changes in Canterbury’s rural economy?
- If so, what types of shelterbelts do Canterbury residents prefer, both aesthetically and in terms of biodiversity value?

2 Methods

The research method comprises the qualitative assessment of two focus groups held in Canterbury and the quantitative assessment of an online survey of 740 Canterbury residents.

2.1 Qualitative approach

Two focus groups were held: one consisting of eight urban residents from Christchurch, the other of eight residents from a rural township in which dairy farming is well established. The focus groups discussed open ended research questions, including:

1. Which features or types of landscapes do you most like when you are driving down rural roads in Canterbury? Why is that?
2. Which features or types of landscapes do you least like driving down rural roads in Canterbury? Why is that?

3. Have you noticed any significant visual changes to the landscape in rural Canterbury over the last few years? What are they?

4. How do you feel about those changes? Why?

Each person was given the opportunity to answer each question and the facilitator stressed that there were no right or wrong answers. Group discussion was encouraged, and both discussions were lively.

After trialling a paper version of the survey questions, participants provided feedback on survey content. To contribute to the content analysis of the visual assessment study as described in Section 2.2, participants were then shown a number of images of Canterbury landscapes and asked to describe key features in each scene. The focus groups were recorded and data assessed drawing on framework analysis (Krueger 1994) to identify and interpret common themes emerging from the two discussions.

2.2 Quantitative approach

Visual preference surveys are a common tool used to inform planning decisions. Following the protocol developed by Anton Nelessen (1994), respondents subjectively evaluate a series of images. Each image is categorized by type, and means and standard deviations are calculated for each category in order to report which images – and hence which design features – are preferred, on average. This methodology has been championed by the new urbanist and smart growth movements, which have shown that the public prefers small town and village scenes to contemporary suburban scenes (Nelessen 1994; Maliza & Exline 2000; Kaplan et al. 2004), and has been used to justify changes in long-range planning and zoning ordinances (e.g., Envision Utah 2000; Seattle Department of Transportation 2001). However, without additional analysis, it is unclear whether expressed preferences differ in a statistical sense, whether features of images that are unaccounted for confound interpretation, and to which features of scenes viewers respond. Indeed, in the absence of such considerations, comparing means across scenes to inform planning may lead to costly wrong decisions (Herzog et al. 1982).

Visual assessment studies, by contrast, undertake critical analyses of image components, allowing inferential statistics to test the strength and significance of differences across images while accounting for correlations over which planners have little control (Ewing et al. 2003). These studies have been used by progressive landscape architects, environmental psychologists, and urban planners to gauge public preference in a variety of contexts (e.g., Dunn 1976; Arthur 1977; Kaplan & Kaplan 1989; Nasar 1998; Sanoff 1991; Stamps 2000; Stamps & Nasar 1997).

Best practice in visual assessment studies entails conducting a visual preference study in which respondents view between 5 and 100 images (Schroeder 1984), often including several unevaluated “decoy images” at the beginning to allow for learning and calibration (Herzog 1985, 1989). Photographs are generally used, and efforts are made to ensure both the comparability (e.g., consistently using colour photographs shot under similar lighting conditions).
conditions) and visual accuracy (e.g., by using wide-angle lenses) of image (Zube et al. 1976; Shuttleworth 1980). Results have been shown to be consistent when respondents rate images, rank images, or choose between paired images (Zube et al. 1976; Im 1984; Stamps 1997); with larger numbers of images, however, rating images on a Likert scale ranging from least preferred to most preferred is most efficient and feasible (Zube et al. 1985). Finally, multivariate regression is used to explain differences in image content in a statistical sense (e.g., Lien & Buhyoff 1986; Ewing 2001; Herzog & Leverich 2003; Arriaza et al. 2004).

Ordinary least squares (OLS) is the regression approach used in the vast majority of visual assessment studies. However, OLS assumes that each observation is independent; if this assumption is violated, e.g., if the subjective evaluation of images is clustered by location, then OLS point estimates will be inefficient and their associated standard errors will be biased toward zero. Hierarchical modelling overcomes this limitation by introducing a “nesting” structure. For example, images in the present study are nested within respondents since each respondent evaluates the same set of images, and respondents are nested within images since each image is evaluated by the same set of respondents (Ewing et al. 2005). The cross-classified random effects form of hierarchical modelling is the preferred means of studying image effects while controlling for respondent effects and vice-versa (Raudenbush & Byrk 2002; Ewing et al. 2005; Rabe-Hesketh & Skrondal 2008).

To ensure images used in the visual assessment study were consistent in terms of angle, perspective, lighting, and exposure, one photographer drove over 800km of rural roads throughout Canterbury, concentrating on areas that had established and new areas of dairy farming, and photographed approximately 1200 scenes. These 1200 scenes were categorised by geography, land use, and image content, and 43 images were selected for the study based on these characteristics as well as comparability of photographic attributes. For example, the following four images (Image 1) were selected to represent diverse land use and image content while sharing similar angle, perspective, lighting, and exposure.

Image 1 Images of diverse land-use and image content.
The following four images similarly depict different types of shelterbelts (Image 2).

![Images of different types of shelterbelts.](image2)

Image 2 Images of different types of shelterbelts.

The exposure, contrast, saturation, and temperature of each of the 48 images were then checked by an independent consultant to ensure comparability and to reduce concerns about bias stemming from photo warmth and quality (Stamps 1993).

As previously mentioned, images were presented to each focus group, and focus group participants were asked to identify key features of each scene. A team of three researchers from Landcare Research then categorised the content of each of the 43 images according to the 14 features identified in the focus groups using the Estimate-Talk-Estimate technique (Gustafson et al. 1973) to derive consensus. These features are listed in Table 1.

Table 1 Image components of the photos used in the visual assessment survey

<table>
<thead>
<tr>
<th>Component</th>
<th>Categorisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadside shelterbelt in image</td>
<td>yes, no</td>
</tr>
<tr>
<td>Shelterbelt origin</td>
<td>none, native, exotic</td>
</tr>
<tr>
<td>Shelterbelt species</td>
<td>none, poplar, gum, gorse, pine, macrocarpa, pittosporum, flax, mixed native trees</td>
</tr>
<tr>
<td>Shelterbelt shape</td>
<td>none, trimmed, untrimmed</td>
</tr>
<tr>
<td>Shelterbelt height</td>
<td>none, short, tall</td>
</tr>
<tr>
<td>Distant shelterbelt</td>
<td>yes, no</td>
</tr>
<tr>
<td>Prominent individual trees</td>
<td>yes, no</td>
</tr>
<tr>
<td>Type of stock</td>
<td>none, sheep, beef cattle, dairy cows</td>
</tr>
</tbody>
</table>
These features and categories were subsequently used as explanatory variables in the visual assessment study. While individual landowners have little or no influence over the last two variables, they were included because the presence of telephone and electricity poles and variation in topography may affect the aesthetic quality (and hence viewers’ perceptions) of images of Canterbury’s landscape.

2.3 Focus group data

Two eight-person focus groups were held, one in an urban centre (Christchurch) and one in a rural town. UMR recruited participants on behalf of Landcare Research, drawing on Christchurch members of their national SayIt survey group and recruiting participants for the rural town through cold calling over the telephone. All participants were offered standard industry incentives.

Each focus group included a mix of genders. The age of the urban group participants ranged from 29 to 58 years with the majority of participants in their 40s. The ages of rural participants were evenly dispersed from 27 to 79 years. All but one of the urban participants had lived in the Canterbury region for over 24 years while the rural participants had lived in Canterbury for between 3.5 and 49 years. Most participants in both groups defined themselves as NZ Pakeha, two participants in the urban group self-identified as Māori, and one person in the rural group self-identified as Asian. All participants had noticed visual changes to the rural landscape over the last three years.

None of the urban participants were currently employed in the farming sector, although one participant had worked with clients from the rural agricultural sector in the past, and one came from a Canterbury farming background. In contrast, some members of the rural group were employed or had immediate family employed in farming, although more people were employed in off-farm sectors. One rural participant noted that an immediate family was engaged in dairying.

2.4 Survey Data

A survey was administered to 800 residents of Canterbury via the Internet in March 2012. The Canterbury population was stratified by urban/rural residence for sampling. Within each stratum, potential respondents were selected at random from a population of individuals who...
agreed to participate in online survey research and who were at least 18 years old. Importantly, this population was recruited via telephone and other non-Internet sources, reducing the potential sample selection biases inherent in online surveys (Cuddeback et al. 2004). Consistent with the population distribution of Canterbury, 67% of the sample was drawn from urban centres. To encourage a high response rate, $10 was donated to a charity designated by the respondent at the end of the survey.

Designed with reference to the recent qualitative research literature on landscape values in Canterbury (e.g., Clemens & Swaffield 2009), the survey covered demographic information, occupations of household members, hobbies and activities, travel in the Canterbury region, perceptions about the importance of various industrial sectors for Canterbury’s economic future, perceptions of different rural land use changes, and a visual preference component in which respondents evaluated the 43 images described above. A final section assessed the impact of information regarding biodiversity on the subjective evaluation of several shelterbelt options. Apart from the visual preference component, the entire survey comprised closed-ended, multiple-choice questions. This format was chosen to facilitate efficiency and comparability of survey responses and is standard in quantitative survey research (Marsden & Wright 2010). For the visual preference component of the survey, respondents were asked to evaluate the landscape depicted on a 7-point Likert scale that ranged from extremely unappealing (low scores) to extremely appealing (high scores). Five decoy images were included at the beginning to allow for learning and calibration; after these images were shown, images appeared in random order to circumvent biases arising from viewing order. The survey was extensively tested for understanding prior to administration.

Of the 800 responses, 60 (7.5%) were eliminated due to inconsistency and/or poor quality (e.g., spending too little time on each component), leaving an effective sample of 740. The responses that were omitted did not follow systematic patterns, e.g., no demographic group was disproportionately represented in the rejected surveys. Moreover, the results shown below are substantively the same if the entire sample of 800 is used instead.

Summary statistics for the sample are presented in Table 2. The mean age of survey respondents was 50.3, while the youngest and oldest respondents were 19 and 88, respectively. The average age of adult residents in Canterbury in 2006 was 48.3 (Statistics New Zealand 2006), although there is some evidence that earthquake-induced migration disproportionately affected young people (Lafferty 2011). Hence, the age structure of our sample reflects that of the Canterbury population. The mean duration of residence in Canterbury is 31 years. Half of the sample is male, as expected, although just 4.5% of the respondents identify themselves as being Māori, approximately 2.5 percentage points lower than the Canterbury population in general. Although we had hoped to have a proportional Māori sample, lower than average participation rates in surveys among Māori are common in New Zealand research (e.g., Fink et al. 2011).

<table>
<thead>
<tr>
<th>Table 2 Summary statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Age</td>
</tr>
</tbody>
</table>
### Landscape preferences in the Canterbury Region

<table>
<thead>
<tr>
<th></th>
<th>dummy</th>
<th>0.83</th>
<th>0.38</th>
<th>0.86</th>
<th>0.35</th>
<th>0.82</th>
<th>0.39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakeha</td>
<td>dummy</td>
<td>0.045</td>
<td>0.21</td>
<td>0.033</td>
<td>0.18</td>
<td>0.051</td>
<td>0.22</td>
</tr>
<tr>
<td>Māori</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other ethnicity</td>
<td>dummy</td>
<td>0.11</td>
<td>0.32</td>
<td>0.11</td>
<td>0.31</td>
<td>0.12</td>
<td>0.32</td>
</tr>
<tr>
<td>Christchurch</td>
<td>years</td>
<td>31.15</td>
<td>19.20</td>
<td>31</td>
<td>19.65</td>
<td>31.28</td>
<td>18.98</td>
</tr>
<tr>
<td>Farm household</td>
<td>dummy</td>
<td>0.081</td>
<td>0.27</td>
<td>0.17</td>
<td>0.38</td>
<td>0.036</td>
<td>0.19</td>
</tr>
<tr>
<td>Outdoors activities</td>
<td>dummy</td>
<td>0.81</td>
<td>0.39</td>
<td>0.89</td>
<td>0.31</td>
<td>0.77</td>
<td>0.42</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>740</td>
<td>245</td>
<td>495</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Rural-urban differences: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Gender, age, residency, and ethnicity are statistically indistinguishable for the rural and urban portions of the sample. In contrast, rural respondents are more than twice as likely as urban respondents to be employed in the farming sector themselves or to have immediate family members who are employed in that sector, a difference that is statistically significant at the 1% level. Rural respondents are also significantly more likely to participate in outdoors activities such as hiking/tramping, camping, hunting, bird watching, and boating at least once per year. For these reasons and because rural and urban people may hold differing views on Canterbury’s rural landscape, we split the sample into urban and rural subsamples in the analysis. This approach is consistent with having held separate focus groups in rural and urban locations in Canterbury.

Figure 1 depicts where survey respondents lived and travelled to frequently with the region. Unsurprisingly, urban people are statistically more likely to travel in the Christchurch area (difference significant at the 5% level) while rural people are more likely to frequent Ashburton, Gerladine/Rangitata, Kiaroi/Waiuku Beach, Mt Hutt/Mt Sommers, Methven, Oxford/Eyrewell Forest, Rakaia/Leeston/Southbridge, Rangiora/Ashley Forest, Timaru/Temuka, Waimate, and Waipara. Rural and urban respondents are equally likely to live and/or frequently travel in other parts of the province.

Figure 2 shows where in Canterbury survey respondents travel at least occasionally. Again, the urban subsample is statistically more likely to travel in and to Christchurch as well as the Akaroa/Banks Peninsula area. The rural subsample is significantly more likely to travel in the following areas at least occasionally: Ashburton, Fairlie/Mt Cook/Twizel, Geraldine/Rangitata, Kiapiai/Waiuku Beach, Mt Hutt/Mt Sommers, Methven, Oxford/Eyrewell Forest, Rakaia/Leeston/Southbridge, Rangiora/Ashley Forest, Timaru/Temuka, and Waimate.
Figure 1  Areas in which Canterbury residents live and/or frequently travel.

Figure 2  Areas in which Canterbury residents travel occasionally or more.
3 Results

The analytical component of this report is comprised of four parts. In the first part, we use survey data to identify the economic areas that are considered most important for the Canterbury economy. In the second part, we discuss noted changes in Canterbury’s visual landscape, focusing particularly on changes associated with dairy conversion because it is the most noted visual change and whether those changes are perceived favourably or unfavourably. We then assess how travel patterns and perceptions of the importance of dairy farming for Canterbury’s economy impact on these views. In the third part, we identify the images that were most and least favoured by respondents in the visual preference survey and evaluate them to quantify the contribution of each component in the visual assessment study using a cross-clustered random effects model. The fourth and final part identifies whether preferences for various types of shelterbelts change when respondents learn the biodiversity value of each option.

3.1 Industrial sectors and the Canterbury economy

Survey results indicate that rural residents are 96% more likely than urban residents to identify dairy as being one of the two most important sectors for Canterbury’s economy (a difference that is statistically significant at the 1% level) (Figure 3). Similarly, rural residents are more 40% more likely than urban residents to identify raising livestock (i.e., sheep, beef cattle, and deer) as being one of the two most important sectors for Canterbury’s economy (significant at the 1% level). In contrast, urban residents are 33% more likely than rural residents to identify tourism and 32% more likely than rural residents to identify education, health, and professional services as being among the two most important sectors for Canterbury’s economy, respectively (significant at the 5% level). Urban residents are also 48% more likely than rural residents to identify construction as being one of the two most important sectors for New Zealand’s economy (significant at the 1% level). However, urban and rural residents are equally likely to identify fruit/wine production and manufacturing as being among the two most important sectors for Canterbury’s economy. Survey forms completed by focus group participants also demonstrated a rural/urban split over the relative economic importance of dairy farming.

The survey also collected data on the perceived importance of wholesale/retail trade; other livestock production; forestry, fishing, and hunting; government and safety; and legal, scientific, and technical services. However, none of these areas was identified as being important for Canterbury’s economy by at least 5% of survey respondents.
3.2 Changes to the visual landscape and how they are perceived

83% of survey respondents who lived in Canterbury for more than 3 years noted changes in the rural Canterbury landscape in recent years. Among them, 71% identified dairy conversion as being either the largest or the second-largest change (Figure 4), with similar reporting among rural and urban residents. The next most commonly noted visual change in the Canterbury landscape is reduced water quality, which approximately 38% of respondents reported; as with dairy conversion, reduced water quality was noted by similar shares of rural and urban residents. More lifestyle blocks and less sheep farming were the third and fourth most reported visual changes, respectively.

While the survey included a specific list of changes from which respondents could choose, the two focus groups were each asked an open-ended question about what visual changes they had noticed in the rural landscape over last few years. The members of the rural focus group consistently identified the following significant landscape changes: removal of trees and shelterbelts; the conversion of beef and sheep farms and forestry blocks into dairy farms and lifestyle blocks; and dairy conversion. The urban focus group mentioned a broader range of visual changes, including increased subdivisions, rural roads improvements, and the removal of forestry blocks as well as dairy conversion. The urban focus group did not identify the removal of hedges and shelterbelts as consistently as the rural focus group, reflecting the survey results in Figure 4.

Figure 3 Industrial sectors that are considered most important for the Canterbury economy.
As shown in Figure 5, rural survey respondents who reported dairy conversion as one of the two largest visual changes in Canterbury are 55% more likely than their urban counterparts to view those changes favourably (significant at the 5% level). Urban residents who reported dairy conversion as one of the two largest visual changes in Canterbury are 22% more likely than their rural counterparts to view those changes unfavourably (significant at the 10% level). That is, rural people are significantly more likely to view dairy conversion positively and significantly less likely to view it negatively.

A probit model was used to identify characteristics of respondents who hold a negative view of the visual impact of dairy conversion (defined as both identifying dairy conversion as being among the two most notable changes to the Canterbury landscape and reporting that they view these changes negatively), with particular attention paid to travel patterns and perceptions about the importance of dairying for the Canterbury economy. Marginal effects and heteroskedasticity-robust standard errors are reported in Table 3.

Rural residents who live and/or frequently travel in the Ashburton area are 14% less likely than rural people who do not live or travel in this area to hold negative views of the landscape changes associated with dairy conversion, ceteris paribus. However, other travel patterns (including occasional travel to the Ashburton area) do not significantly affect rural residents’ perceptions about the visual impact of dairy conversion. For urban residents, however, travel patterns do impact on the perception of dairy conversion. Specifically, urban residents who frequently travel to Akaroa/Banks Peninsula, Ashburton, and Kaikoura/Cheviot are about 20% more likely to report that dairy conversion has had negative visual impacts. Urban residents who frequently travel to Culverdon/Hammer Springs/Lewis Pass, Rakaia/Leeston/Southbridge, and Waimate are about 18% less likely to say that dairy conversion has had negative visual impacts. Urban residents who occasionally (or more frequently) travel to Arthur’s Pass, Geraldine/Rangitata, and Waipara are about 13% more
likely to say that dairy conversion has had negative visual impacts. Urban residents who travel in other areas are statistically neither more nor less likely to hold negative views of the visual perceptions of dairy conversion.

Figure 5 Views on the visual changes associated with dairy, among those who identify dairy as one of two largest changes.

The relationships between travel patterns and views held on dairying suggest that people might either notice and/or dislike dairying in some areas of Canterbury more than others. This suggestion appears to be supported by the views expressed during the urban focus group, in which it was generally agreed that participants disliked seeing the large number of pivot irrigators when driving south from Christchurch to Otago (via Ashburton, for which the views of dairying are quite negative, see Table 3). However, the perception of irrigation in other locations was more mixed in the focus groups. For example, one urban focus group participant did not like seeing irrigation on the Canterbury plains but did prefer irrigated paddocks in the Mackenzie country because s/he felt that irrigation was ‘bringing the land back to life’. The same person did not consider the traditional brown-hued Mackenzie country as a natural landscape but rather as a landscape modified by decades of intensive sheep farming. In contrast, another participant in the urban focus group felt strongly that irrigation should not occur in the Mackenzie country and other dry locations as s/he felt that irrigation in these areas was stressing the land beyond its natural capacity. The idea that some areas in Canterbury were more suited for intensified farming than others also came up in discussions about green and brown pastures, with several participants saying that while they preferred green grass, they found it unnatural in certain parts of Canterbury.

Removal of trees (both forestry blocks and shelterbelts) was viewed negatively by both focus groups because they felt these changes reduced the visual diversity and amenity of the landscape. However the rural focus group additionally associated the loss of shelterbelts with
reduced animal welfare. One rural participant also associated the loss of shelterbelts with increased soil erosion.

Table 3 indicates that people who believe that dairy is one of the two most important sectors for the Canterbury economy are about 27% less likely to perceive the visual impacts of dairy conversion negatively, *ceteris paribus*. This result is statistically significant at the 1% level, and the magnitude of the impact is similar for rural and urban residents. Gender, ethnicity, or occupation doesn’t affect the likelihood that survey respondents view the visual impacts of dairy conversion negatively, but urban residents who regularly participate in outdoors activities are 12% more likely than urban residents who do not participate in outdoors activities to view the visual impacts of dairy conversion negatively, *ceteris paribus*. 
Table 3  Determinants of negative view of visual impact of dairy conversion

<table>
<thead>
<tr>
<th>Variable</th>
<th>unit</th>
<th>dy/dx</th>
<th>std err</th>
<th>dy/dx</th>
<th>std err</th>
<th>dy/dx</th>
<th>std err</th>
<th>dy/dx</th>
<th>std err</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akaroa area/Banks Peninsula</td>
<td>dummy</td>
<td>0.10</td>
<td>(0.37)</td>
<td>0.16**</td>
<td>(0.03)</td>
<td>0.04</td>
<td>(0.64)</td>
<td>-0.006</td>
<td>(0.93)</td>
</tr>
<tr>
<td>Arthur’s Pass area</td>
<td>dummy</td>
<td>0.28</td>
<td>(0.16)</td>
<td>0.16</td>
<td>(0.25)</td>
<td>0.021</td>
<td>(0.81)</td>
<td>0.10*</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Ashburton area</td>
<td>dummy</td>
<td>-0.14*</td>
<td>(0.09)</td>
<td>0.22***</td>
<td>(0.01)</td>
<td>-0.010</td>
<td>(0.93)</td>
<td>-0.029</td>
<td>(0.68)</td>
</tr>
<tr>
<td>Christchurch City</td>
<td>dummy</td>
<td>0.034</td>
<td>(0.67)</td>
<td>-0.038</td>
<td>(0.71)</td>
<td>0.19</td>
<td>(0.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culverdon/Hanmer Springs/Lewis Pass area</td>
<td>dummy</td>
<td>0.093</td>
<td>(0.48)</td>
<td>-0.18*</td>
<td>(0.09)</td>
<td>-0.006</td>
<td>(1.00)</td>
<td>-0.15*</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Fairlie/Mt Cook/Twizel area</td>
<td>dummy</td>
<td>0.035</td>
<td>(0.77)</td>
<td>0.20*</td>
<td>(0.08)</td>
<td>0.087</td>
<td>(0.38)</td>
<td>0.065</td>
<td>(0.30)</td>
</tr>
<tr>
<td>Geraldine/Rangitata/Pleasant Valley area</td>
<td>dummy</td>
<td>0.0074</td>
<td>(0.95)</td>
<td>-0.0395</td>
<td>(0.72)</td>
<td>0.031</td>
<td>(0.77)</td>
<td>0.14**</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Kaiapoi/Waikuku Beach area</td>
<td>dummy</td>
<td>-0.0068</td>
<td>(0.95)</td>
<td>-0.0866</td>
<td>(0.16)</td>
<td>0.024</td>
<td>(0.78)</td>
<td>-0.066</td>
<td>(0.31)</td>
</tr>
<tr>
<td>Kaikoura/Chieviot area</td>
<td>dummy</td>
<td>-0.10</td>
<td>(0.43)</td>
<td>0.23**</td>
<td>(0.02)</td>
<td>-0.055</td>
<td>(0.56)</td>
<td>-0.084</td>
<td>(0.17)</td>
</tr>
<tr>
<td>Mt Hutt/Mt Sommers/Methven area</td>
<td>dummy</td>
<td>0.052</td>
<td>(0.62)</td>
<td>-0.034</td>
<td>(0.78)</td>
<td>0.044</td>
<td>(0.58)</td>
<td>0.03</td>
<td>(0.60)</td>
</tr>
<tr>
<td>Oxford/Eyrewell Forest area</td>
<td>dummy</td>
<td>0.10</td>
<td>(0.45)</td>
<td>0.04</td>
<td>(0.76)</td>
<td>0.018</td>
<td>(0.82)</td>
<td>0.079</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Rakaia/Leeston/Southbridge area</td>
<td>dummy</td>
<td>0.063</td>
<td>(0.52)</td>
<td>-0.15*</td>
<td>(0.06)</td>
<td>-0.13</td>
<td>(0.16)</td>
<td>-0.054</td>
<td>(0.36)</td>
</tr>
<tr>
<td>Rangiora/Ashley Forest area</td>
<td>dummy</td>
<td>-0.078</td>
<td>(0.44)</td>
<td>0.002</td>
<td>(0.98)</td>
<td>-0.087</td>
<td>(0.37)</td>
<td>0.090</td>
<td>(0.14)</td>
</tr>
<tr>
<td>Sheffield/Coalgate/Darfield/Kirwee area</td>
<td>dummy</td>
<td>0.027</td>
<td>(0.80)</td>
<td>-0.095</td>
<td>(0.27)</td>
<td>0.084</td>
<td>(0.30)</td>
<td>-0.066</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Timaru/Temuka area</td>
<td>dummy</td>
<td>0.13</td>
<td>(0.23)</td>
<td>-0.07</td>
<td>(0.43)</td>
<td>-0.006</td>
<td>(0.96)</td>
<td>0.034</td>
<td>(0.57)</td>
</tr>
<tr>
<td>Waimate area</td>
<td>dummy</td>
<td>-0.015</td>
<td>(0.90)</td>
<td>-0.22***</td>
<td>(0.01)</td>
<td>0.039</td>
<td>(0.61)</td>
<td>-0.079</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Waipara area</td>
<td>dummy</td>
<td>-0.11</td>
<td>(0.39)</td>
<td>-0.01</td>
<td>(0.92)</td>
<td>-0.089</td>
<td>(0.32)</td>
<td>0.15***</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Believes that dairy is important for economy</td>
<td>dummy</td>
<td>0.26***</td>
<td>(0.00)</td>
<td>-0.28***</td>
<td>(0.00)</td>
<td>-0.25***</td>
<td>(0.00)</td>
<td>-0.29***</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

Page 15
<table>
<thead>
<tr>
<th></th>
<th>dummy</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>dummy</td>
<td>-0.059</td>
<td>(0.39)</td>
<td>-0.026</td>
<td>(0.59)</td>
<td>-0.035</td>
</tr>
<tr>
<td>Age</td>
<td>years</td>
<td>-0.0040</td>
<td>(0.14)</td>
<td>0.0062***</td>
<td>(0.00)</td>
<td>0.0046*</td>
</tr>
<tr>
<td>Pakeha</td>
<td>dummy</td>
<td>0.009</td>
<td>(0.94)</td>
<td>0.033</td>
<td>(0.65)</td>
<td>0.029</td>
</tr>
<tr>
<td>Māori</td>
<td>dummy</td>
<td>-0.11</td>
<td>(0.54)</td>
<td>0.08</td>
<td>(0.52)</td>
<td>-0.13</td>
</tr>
<tr>
<td>Canterbury residency</td>
<td>years</td>
<td>0.0021</td>
<td>(0.32)</td>
<td>0.0004</td>
<td>(0.80)</td>
<td>0.0026</td>
</tr>
<tr>
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<td>dummy</td>
<td>-0.078</td>
<td>(0.36)</td>
<td>-0.022</td>
<td>(0.88)</td>
<td>-0.11</td>
</tr>
<tr>
<td>Outdoors activities</td>
<td>dummy</td>
<td>-0.18</td>
<td>(0.13)</td>
<td>0.12**</td>
<td>(2.50)</td>
<td>-0.15</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>237</td>
<td>475</td>
<td>237</td>
<td>475</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Estimated with a probit model. Marginal effects reported. Heteroskedasticity-robust standard errors reported in parentheses. *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. "Negative view" is defined as identifying dairy as being one of two largest changes and stating that the changes are negative.
3.3 Quantitative evaluation of the visual landscape

This section examines participant responses to the 43 images included in this survey. In the quantitative survey, urban and rural residents show similar preferences for the visual rural landscape: four of the five most favourable images (Image 3) and all of the five least favourable images (Image 4) are identical for urban and rural survey respondents.

Image 3 The four most favourable images in the survey.
Image 4 The five least favourable images in the survey.

With reference to the discussion in section 2.2, a visual assessment study was used to quantify the marginal effects of image components listed in Table 1 on survey respondents’ subjective evaluations of each image. A cross-classified random effects model (Raudenbush & Byrk 2002) was used to account for random effects in both images and viewers (Ewing et al. 2005). Point estimates and standard errors are reported in Table 4.

Consistent with the literature on visual assessment, the point estimates on many image components are large in magnitude and statistically significant, both individually and in combination. For example, images with roadside shelterbelts score 0.62–0.73 points higher on the 7-point Likert scale relative to identical images with no shelterbelt, ceteris paribus. This effect is large – larger, in fact, than the effect of any other image component – and rural and urban people agree in this regard. Distant shelterbelts, individual trees, and horticulture also increase the subjective evaluation of the visual landscape for both groups. In contrast, irrigators, silage bales, and overgrown verges significantly detract from perceptions of the visual landscape, with irrigators reducing the rating of an image by 0.86–0.91 points.

Interestingly, the subjective evaluation of images that include sheep is higher for both urban and rural people while the subjective evaluation of images that depict dairy cows is lower for
both groups. However, urban and rural residents split on beef cattle: the presence of beef cattle does not affect the score assigned to images for rural people, but it negatively affects the score for urban people. One possible explanation is that most survey respondents dislike seeing dairy cows but that urban residents have a harder time distinguishing between dairy cows and beef cattle.

Prominent weeds do not significantly impact the visual assessment of images for either rural or urban residents, and this variable has been omitted for the sake of parsimony. The simple correlation between prominent green paddocks and image score is negative, suggesting that green paddocks are disliked by survey respondents. However, green paddocks are highly collinear with irrigators and dairy cows, complicating interpretation of results when this variable is included in the multivariate regression. Hence, this variable too has been omitted from the quantitative results.

Table 4 Visual assessment study

<table>
<thead>
<tr>
<th>variable</th>
<th>unit</th>
<th>rural</th>
<th></th>
<th>urban</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelterbelt in image</td>
<td>dummy</td>
<td>0.73***</td>
<td>(0.051)</td>
<td>0.62***</td>
<td>(0.035)</td>
</tr>
<tr>
<td>Distant shelterbelt</td>
<td>dummy</td>
<td>0.34***</td>
<td>(0.038)</td>
<td>0.36***</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Individual trees</td>
<td>dummy</td>
<td>0.19***</td>
<td>(0.037)</td>
<td>0.14***</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Sheep</td>
<td>dummy</td>
<td>0.62***</td>
<td>(0.056)</td>
<td>0.46***</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Beef cattle</td>
<td>dummy</td>
<td>-0.0032</td>
<td>(0.056)</td>
<td>-0.089**</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Dairy cows</td>
<td>dummy</td>
<td>-0.34***</td>
<td>(0.044)</td>
<td>-0.28***</td>
<td>(0.030)</td>
</tr>
<tr>
<td>Horticulture</td>
<td>dummy</td>
<td>0.38***</td>
<td>(0.038)</td>
<td>0.25***</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Irrigator</td>
<td>dummy</td>
<td>-0.91***</td>
<td>(0.050)</td>
<td>-0.86***</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Silage bales</td>
<td>dummy</td>
<td>-0.33***</td>
<td>(0.050)</td>
<td>-0.33***</td>
<td>(0.034)</td>
</tr>
<tr>
<td>Overgrown verge</td>
<td>dummy</td>
<td>-0.15***</td>
<td>(0.030)</td>
<td>-0.14***</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Electric/telephone poles</td>
<td>dummy</td>
<td>-0.035</td>
<td>(0.031)</td>
<td>-0.037*</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Hills</td>
<td>dummy</td>
<td>0.11***</td>
<td>(0.032)</td>
<td>0.074***</td>
<td>(0.022)</td>
</tr>
<tr>
<td>Male</td>
<td>dummy</td>
<td>-0.0087</td>
<td>(0.080)</td>
<td>0.036</td>
<td>(0.063)</td>
</tr>
<tr>
<td>Age</td>
<td>years</td>
<td>0.0081**</td>
<td>(0.0033)</td>
<td>0.00021</td>
<td>(0.0025)</td>
</tr>
<tr>
<td>Pakeha</td>
<td>dummy</td>
<td>-0.056</td>
<td>(0.13)</td>
<td>-0.15</td>
<td>(0.095)</td>
</tr>
<tr>
<td>Māori</td>
<td>dummy</td>
<td>-0.10</td>
<td>(0.26)</td>
<td>-0.31*</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Canterbury residency</td>
<td>years</td>
<td>-0.00019</td>
<td>(0.0024)</td>
<td>0.0016</td>
<td>(0.0020)</td>
</tr>
<tr>
<td>Farm family</td>
<td>dummy</td>
<td>0.095</td>
<td>(0.11)</td>
<td>0.039</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Outdoors activities</td>
<td>dummy</td>
<td>0.025</td>
<td>(0.13)</td>
<td>-0.046</td>
<td>(0.074)</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td>-0.082</td>
<td>(0.25)</td>
<td>0.41***</td>
<td>(0.15)</td>
</tr>
<tr>
<td>Number of groups</td>
<td></td>
<td>244</td>
<td></td>
<td>494</td>
<td></td>
</tr>
</tbody>
</table>
Stamps (1999) shows that most heterogeneity in subjective evaluation scores stems from differences in image characteristics rather than differences in viewer characteristics. Hence, it is not surprising that images are evaluated similarly by men and women, people of different ethnicities, newcomers and long-term residents, farm and non-farm families, and outdoors enthusiasts and others. That being said, older rural residents rated images slightly higher than younger urban residents, and urban Māori rated images 0.31 points lower than other urban residents, ceteris paribus, underscoring the importance of controlling for viewer effects. In addition, prominent telephone and electricity poles lower the subjective score assigned to images, while prominent hills raise the scores. As noted above, individual landowners have little control over some factors, but the statistical significance of these variables underscores the importance of controlling for potential correlates of image score in a multivariate regression framework.

Given the strong, positive effect of shelterbelts on viewers’ assessments of images and the ability of shelterbelts to mitigate the visual impact of irrigators, silage bales, and other less unfavourable image components, a cross-classified random effects model was estimated with different categorisations of shelter belts. Results are shown in Tables 5–8; although the same set of control variables was included in these estimates, results were nearly identical and the point estimates are suppressed for the sake of parsimony.

Table 5 shows that while exotic and native shelterbelts are both preferred to no shelterbelts, native shelterbelts are strongly preferred by both rural and urban people. Specifically, images with native shelterbelts score 0.29 points higher on the 7-point Likert scale than images with exotic shelterbelts (which in turn score 0.24 points higher than those without shelterbelts) among urban respondents, ceteris paribus (significant at the 1% level); images with native shelterbelts score 0.35 points higher than images with exotic shelterbelts for rural people, ceteris paribus (significant at the 1% level).

Table 5  Visual assessment study with shelterbelt origin

<table>
<thead>
<tr>
<th>variable</th>
<th>rural</th>
<th></th>
<th>urban</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unit</td>
<td>estimate</td>
<td>std err</td>
<td>estimate</td>
</tr>
<tr>
<td>Exotic shelterbelt</td>
<td>dummy</td>
<td>0.34*** (0.045)</td>
<td></td>
<td>0.24*** (0.031)</td>
</tr>
<tr>
<td>Native shelterbelt</td>
<td>dummy</td>
<td>0.69*** (0.052)</td>
<td></td>
<td>0.53*** (0.035)</td>
</tr>
<tr>
<td>Number of groups</td>
<td></td>
<td>244</td>
<td></td>
<td>494</td>
</tr>
<tr>
<td>Observations per group</td>
<td>38</td>
<td>38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

Respondents also have strong preferences for different species of plants and shrubs in shelterbelts. Specifically, images with gum shelterbelts score 1.26 and 1.14 points higher than images without shelterbelts for rural and urban respondents, respectively, ceteris paribus.
(significant at the 1% level). Images with shelterbelts comprising mixed native trees score 1.21 and 1.07 points higher than images without shelterbelts. The least favoured types of shelterbelts are gorse hedgerows and pine trees: images with gorse hedgerows score 0.35–0.53 points lower than images without shelterbelts while those with pine shelterbelts score 0.27–0.35 points higher than those without shelterbelts.

Table 6 Visual assessment study with shelterbelt types

<table>
<thead>
<tr>
<th>variable</th>
<th>rural</th>
<th>urban</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unit</td>
<td>estimate</td>
</tr>
<tr>
<td>Poplar shelterbelt dummy</td>
<td></td>
<td>1.11***</td>
</tr>
<tr>
<td>Gum shelterbelt dummy</td>
<td></td>
<td>1.26***</td>
</tr>
<tr>
<td>Gorse shelterbelt dummy</td>
<td></td>
<td>-0.53***</td>
</tr>
<tr>
<td>Pine shelterbelt dummy</td>
<td></td>
<td>0.35***</td>
</tr>
<tr>
<td>Macrocarpa shelterbelt dummy</td>
<td></td>
<td>0.88***</td>
</tr>
<tr>
<td>Pittosporum shelterbelt dummy</td>
<td></td>
<td>0.71***</td>
</tr>
<tr>
<td>Flax shelterbelt dummy</td>
<td></td>
<td>0.62***</td>
</tr>
<tr>
<td>Mixed native shelterbelt dummy</td>
<td></td>
<td>1.21***</td>
</tr>
<tr>
<td>Number of groups</td>
<td></td>
<td>244</td>
</tr>
<tr>
<td>Observations per group</td>
<td></td>
<td>38</td>
</tr>
</tbody>
</table>

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.

For both urban and rural respondents, tall shelterbelts are strongly preferred to short shelterbelts, ceteris paribus (Table 7) but short shelterbelts are strongly preferred to no shelterbelts (both significant at the 1% level). Finally, rural respondents prefer trimmed shelterbelts to untrimmed (i.e., ‘natural’) shelterbelts, ceteris paribus, (Table 8) but trimming does not affect the scores that urban respondents assign to images of shelterbelts.

Table 7 Visual assessment study with shelterbelt height

<table>
<thead>
<tr>
<th>variable</th>
<th>rural</th>
<th>urban</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>unit</td>
<td>estimate</td>
</tr>
<tr>
<td>Short shelterbelt dummy</td>
<td></td>
<td>0.48***</td>
</tr>
<tr>
<td>Tall shelterbelt dummy</td>
<td></td>
<td>0.67***</td>
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<td></td>
<td>244</td>
</tr>
<tr>
<td>Observations per group</td>
<td></td>
<td>38</td>
</tr>
</tbody>
</table>

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.
3.4 Qualitative evaluation of the visual landscape

Every participant in the rural focus group reported that s/he liked seeing trees and shelterbelts in the rural landscape. They noted that trees and shelterbelts provide animal welfare, soil protection, and bird habitat. Rural participants also noted that trees provide variety in colour, shape, and texture, giving interest to flat, monotonous landscapes. Deciduous trees were especially liked by some participants as they provide seasonal variety.

The urban focus group spent less time discussing shelterbelts, although some distinctive features of roadside shelterbelts did arise. Specifically, one participant did not like poplar trees planted too close together because the trees cause sunlight to flicker on the road, creating distracting driving conditions. Another participant mentioned that densely planted macrocarpa shelterbelts can increase the ice on roads in winter.

Rural focus group participants reported that they generally like seeing animals, but sheep were especially valued, consistent with results from the visual assessment study. Rural participants noted that sheep and other animals are relaxing to look at and aesthetically pleasing. Apart from a vegetarian member of the group, urban focus group participants also generally liked seeing farm animals. Two people mentioned seeing less sheep than they had in the past (reflecting results in Figure 4), with one person stating a preference for sheep over cows because they felt that sheep are ‘kinder to the land’.

Most of the rural focus group participants qualified their preferences by stating that they did not like seeing animals without shelter provided by trees, especially when it was raining or snowing. Only one person in the urban group qualified their preference for animals in the landscape by explaining they only liked seeing ‘well cared for’ animals. Note that none of the images in the visual preference study depicted animals in poor weather conditions, so this specific result would not have showed up in the visual survey.

Some of the rural focus group participants reported that they did not like seeing under-fed animals or animals in bare paddocks. However, the farmers in the rural focus group suggested that bare paddocks usually have piles of supplementary feed and that underfed stock is generally a sign of financial stress rather than a common farming practice. This result might

<table>
<thead>
<tr>
<th>variable</th>
<th>unit</th>
<th>rural</th>
<th></th>
<th>urban</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Truncated shelterbelt</td>
<td>dummy</td>
<td>0.80***</td>
<td>0.056</td>
<td>0.62***</td>
<td>0.038</td>
</tr>
<tr>
<td>Natural shelterbelt</td>
<td>dummy</td>
<td>0.63***</td>
<td>0.060</td>
<td>0.61***</td>
<td>0.041</td>
</tr>
<tr>
<td>Number of groups</td>
<td></td>
<td>244</td>
<td></td>
<td>494</td>
<td></td>
</tr>
<tr>
<td>Observations per group</td>
<td></td>
<td>38</td>
<td></td>
<td>38</td>
<td></td>
</tr>
</tbody>
</table>

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.
suggest that people who are familiar with farming practices are less inclined to hold negative views of some visual impacts of farming.

One participant in each focus group specifically mentioned that s/he disliked seeing dairy cows. The participant in the urban focus group explained that s/he had this reaction because s/he associated dairy farming with the over-use of water resources. The rural focus group participant disliked dairy cows in part because having grown up on a farm in Canterbury s/he was not used to seeing a prevalence of dairy cows and in part because s/he considered dairy cows to look ‘bony’ and ‘over worked’, as opposed to beef cattle, which s/he described as ‘sleek and beautiful’.

Irrigation and pasture colour were discussed enthusiastically by both focus groups. Some focus group participants perceived that irrigation over-extended the carrying capacity of land in some parts of Canterbury, thus straining water resources. Conversely, some participants associated green grass with increased productivity, stock health, and rejuvenated rural communities. People also reported having historic memories connected to the colour of the rural landscape; three people consider green pasture to be aesthetically pleasing, but they also love the golden colour of late summer pasture and hills in Canterbury, which they associate with memories of past summers and with a sense of place. Finally, several participants commented that they dislike irrigated green pasture because irrigation reduces the visual diversity of the Canterbury region.

Focus group participants consistently and strongly prefer diversity in the visual landscape. Features mentioned by participants included views of hills/mountains; different colours and shapes of trees; and varied land uses. Conversely, focus group participants dislike uniformity which they associate with dairy conversion. While they liked seeing ‘tidy’ farms, they missed the ‘old wooden fences and the bath tubs in the paddock’. In addition to uniformity, some people also described the converted dairy farms as being visually ‘bleak’, ‘messy’, with dirt showing through pasture, piles of tree stumps, and large irrigators. In contrast, one rural participant described other rural land uses as looking ‘shiny and bright’. The importance of maintaining visual landscape diversity emerged as one of the most important themes in the qualitative analysis.

### 3.5 Biodiversity and shelterbelt options

At the conclusion of the survey, participants were asked to re-evaluate four images (Image 5) featuring shelterbelts after being given additional information pertaining to their biodiversity values. The first image featured a macrocarpa shelterbelt, which has a medium biodiversity value; like the first five images included in the visual preference survey, it was used primarily for learning and calibration. The second and third images featured a poplar shelterbelt and a flax shelterbelt, which have low and moderately high biodiversity values, respectively. The final image depicted a shelterbelt comprising mixed native trees, including pittosporum, cabbage trees, caprosma, and ribbonwood; the biodiversity value of this shelterbelt is very high.
Given additional knowledge regarding biodiversity, poplar shelterbelts become less attractive for approximately 38% of survey respondents (Figure 6), although urban respondents are 27% more likely than rural respondents to assign lower scores to images featuring poplar shelterbelts (significant at the 5% level). Approximately 40% of respondents report finding flax more attractive and approximately 58% of respondents report finding mixed native shelterbelts more attractive after learning about their respective biodiversity values. Interestingly, differences in the point estimates for flax and mixed natives are not statistically significant at the 10% level, i.e., urban and rural residents are equally likely to find flax and mixed natives more attractive, given additional knowledge regarding biodiversity.
Figure 6  Biodiversity values and the relative attractiveness of shelterbelt options.

4 Conclusion

The objective of the research is to identify whether Canterbury residents have noted visual changes to the Canterbury rural landscape, what specific changes they are particularly concerned about, and whether land managers in primary industry can adopt practices to mitigate those visual changes. To explore these questions, we also need to know which visual landscape features Cantabrians particularly value and do not want to lose.

Survey results show that the majority of Canterbury residents have noticed visual changes to the rural landscape. The majority of those who note changes view those changes unfavourably (64.15% of urban residents and 53.73% rural residents). This finding provides evidence to support the adoption of land practices and supporting public policies to mitigate negative visual changes to the rural landscape.

Irrigators, dairy cows, and the removal of trees and shelterbelts are disliked. Why people dislike these features varies between individuals, and preferences for certain landscape features are influenced by a number of factors and not only visual aesthetics. For example, some associate irrigators with regional water issues, conflating visual impacts of dairy conversion with non-visual impacts. Therefore, even if measures are taken to improve the visual aesthetics of dairy farms, some people are still likely to hold negative views on dairy conversion.

Canterbury residents are consistent about the features of the landscape that they dislike and the features that they prefer. The positive effect of having a roadside shelterbelt in the survey
image is greater than any other feature. Residents also respond positively to shelterbelts in the
distance and to individual trees. Trees, therefore, are an important feature of the rural
landscape for Canterbury residents, and trees have the added advantage of screening features
such as irrigators and dairy cows that are consistently disliked by residents. Indeed, the
highest rated image included in the survey depicts a mixed native shelterbelt screening a
dairy farm.

The survey and focus groups results show that people value visual diversity. People like
seeing trees, crops, sheep, hills, different shapes, colours, textures, and rural activities.
Driving down rural Canterbury roads, it is common to see rows of alternating shelterbelt
species, some trimmed and others natural, and vistas into paddocks alternated with rows of
trees. This is a critical point because increased dairy farming has reduced the visual diversity
of the Canterbury landscape.

Finally, the survey results show that Canterbury residents prefer mixed native shelterbelts and
that this preference increases when respondents are made aware of their high biodiversity
value. Developing policy to encourage farmers to plant mixed native shelterbelts can therefore meet two objectives – improving the visual landscape of Canterbury and increasing
biodiversity on farms.

5 Recommendations

Based on the above findings, the following land management practices are recommended:

1. **Maintain existing shelterbelts** except where trees need to be removed to increase
   road safety or to create windows for views. Internal shelterbelts within paddocks
   should be maintained wherever possible, particularly on riparian margins.

2. **Increase the biodiversity value of existing exotic shelterbelts** by under- or inter-
   planting with native plant species.

3. **Establish new shelterbelts with high biodiversity values.** In order to provide visual
   diversity and increase biodiversity, new shelterbelts along roadsides should comprise
   a mix of plant species and a high percentage of those plants (at least 25%) should be
   New Zealand native. It is preferable to use locally sourced natural indigenous species
   rather than cultivars or hybrids that may have no nectar or fruit for wildlife.
   Recognized pest species should be excluded.

4. **Publicly promote any on-farm planting programmes that increase rural
   biodiversity** as biodiversity is important to Cantabrians; however, many people are
   unaware that mixed native shelterbelts provide greater biodiversity value than
   monoculture exotic shelterbelts.

---

1 Recommendation 3 is based upon Dr Colin Meurk’s expert judgement.
5.1 Guidance on creating new shelterbelts with high biodiversity values

In contrast to monoculture shelterbelts and exotic shelterbelts, shelterbelts comprising mixed plant species with a high percentage of native plants provide a more diverse range of food and habitat to support and enhance biodiversity, particularly native wildlife. Typical landscaping and shelter trees in rural New Zealand are exotic, deciduous, or coniferous species with dry seeds of little value to the predominant fruit- and nectar-eating birds in the native fauna. In contrast, 75% of New Zealand native trees and shrubs produce fruit and/or nectar for birds and lizards.

Specific combinations of trees and shrubs which are matched to the local climate and soil type provide shelterbelts which

- establish easily and remain hardy
- have a high biodiversity value
- may include some exotic species for relatively rapid height growth, and
- are highly valued by Canterbury residents

Image 6 depicts a native shelterbelt designed by Landcare Research and established at Lincoln University’s research dairy farm. The shelterbelt is nearly four years old and the plant species include lowland ribbonwood/manatu (Plagianthus regius), cabbage tree/ti kouka (Cordyline australis), karamu (Coprosma robusta), marsh ribbonwood (Plagianthus divaricatus), kohuhu (Pittosporum tenuifolium), tauhinu (Ozothamnus leptophyllus) and small-leaved coprosmas.

Image 7 is a mixed (native/exotic) shelter belt with European alder, ribbonwood, pittosporums, golden akeake (Olearia paniculata). It is about 20 years old and was planted in heavy soil. The alder gives quick early growth and nitrogen fixation, but can be weedy around wetlands and along waterways.


![Image 6](Mixed native shelter belt trial, Lincoln University Dairy Unit.)
5.2 Guidance on increasing the biodiversity value of existing shelterbelts

The biodiversity values of monoculture exotic shelter belts (e.g., macrocarpa) can be improved by growing specific native species at the base of the existing exotic shelter plants. For example, the native scrambling pohuehue (*Muehlenbeckia complexa*) provides habitat for native butterflies and fruit-eating bush birds. This species can be planted at the base of macrocarpa (Image 8), poplar, and willow. Normal hedge trimming can continue as most native woody plants can be hedged.

Other recommended native under-planting of existing exotic shelterbelts include pittosporums (image 9), olearias, akeake (*Dodonaea*), broadleaf (*Griselinia*), lacebark/houhere (*Hoheria angustifolia*). However, North Island varieties of these species should not be used in Canterbury.

Image 9 provides another example of under-planting natives into existing shelterbelts, illustrating native kohuhu (*Pittosporum tenuifolium*) planted under an established willow shelterbelt in the Canterbury Plains approximately 20 years ago. This shelterbelt provides a mix of deciduous and evergreen foliage and shelter for tree-nesting birds. The sticky kohuhu seeds are attractive to small birds, which then disperse them, whereas the willow pollen is collected by bees.
5.3 Additional biodiversity considerations

Maintaining internal shelterbelts is also important to provide greater connectivity of wildlife corridors. Image 10 depicts a low-growing mixed native hedge over which the arm of a centre pivot irrigator can pass. Equally, the non-irrigated corners of a dairy paddock provide the opportunity to develop solid blocks of native species with more ‘interior’ and proportionally less ‘edge’ habitat (Image 11). This is an important consideration as linear habitats alone have limitations for the range of species that can be protected, and should be considered as links between more substantial vegetation patches.

Image 9 Native kohuhu planted under an established willow shelterbelt, Lincoln.

Image 10 Lower growing mixed native plants over which the arm of a centre pivot irrigator can pass. The nearer part of the hedge has cabbage trees, but a gun sprayer on the end of the irrigator boom irrigates these outer extremities.

Image 11 Mixed native planting in the corner of a pivot-irrigated dairy paddock.
6 References


Appendix 1. Focus group questions

1. Where in the Canterbury region have you travelled in the last 12 months?

2. Which features or types of landscapes do you most like when you are driving down rural roads in Canterbury? Why is that?

3. Which features or types of landscapes do you least like driving down rural roads in Canterbury? Why is that?

4. Have you noticed any significant visual changes to the landscape in rural Canterbury over the last few years? What are they?

5. How do you feel about those changes? Why?
Appendix 2. Survey questions

Rural Landscape Preferences in the Canterbury Region

Introduction

Thank you for agreeing to complete this survey.

It will take approximately 15-20 minutes to complete. A progress bar along the top tells you how far through the survey you are.

Responses and personal information are kept completely confidential and you will never be identified in any research reports.

Landcare Research will donate $10 to charity for each survey completed.

To move through the survey

Clicking the >> button at the bottom of each page saves your answers and moves you to the next page. The << button allows you to review your answers on previous pages. If you cannot see these buttons, maximise the page and/or scroll down.

You may close the browser window at any point and when you return to the survey again (by clicking the link on the email) the answers to the questions you have already completed will be retained.
Basic Information

We would like to begin by collecting some basic information about you. This will help us to ensure that all Cantabrians have a voice in our research and that our sample is representative of Canterbury's population. We will also ask for your telephone number in case we need to contact you to clarify an answer.

Gender

☐ Male
☐ Female

Which of these age groups do you fall into?

☐ 17 years and under
☐ 18-19
☐ 20-24
☐ 25-29
☐ 30-34
☐ 35-39
☐ 40-44
☐ 45-49
☐ 50-54
☐ 55-59
☐ 60-64
☐ 65-69
☐ 70-74
☐ 75 and over
☐ Prefer not to say
Ethnicity
(tick all that apply)

☐ NZ Pākehā
☐ NZ Māori
☐ Other European
☐ Pacific Peoples
☐ Asian
☐ Middle Eastern/Latin American/African
☐ Other
☐ Prefer not to answer

Which of the following regions best describes where you live?

☐ Northland Region
☐ Auckland Region
☐ Waikato Region
☐ Bay of Plenty Region
☐ Gisborne Region
☐ Taranaki Region
☐ Manawatu-Wanganui Region
☐ Hawke's Bay Region
☐ Wellington Region
☐ Marlborough Region
☐ Tasman/Nelson Region
☐ West Coast Region
☐ Canterbury Region
☐ Otago Region
☐ Southland Region
Postal code

*If you do not know your postcode you can find it here:*

Which of the following best describes which area of Canterbury you live in?

- [ ] Ashburton District
- [ ] Timaru District
- [ ] Waitaki District
- [ ] Mackenzie District
- [ ] Waimakariri District
- [ ] Christchurch City
- [ ] Hurunui District
- [ ] Kaikoura District
- [ ] Waimate District
- [ ] Selwyn District
- [ ] Other (specify) [ ]
- [ ] Unsure

Which of the best describes where you live?

- [ ] A city or large urban area
- [ ] A town or small urban area
- [ ] A rural area within about 10km of a town or city (about a 10-15 minute drive)
- [ ] A rural area beyond 10km of a town or city; (more than 15 minute drive)
- [ ] A remote rural area
- [ ] Unsure
How long have you lived in Canterbury?

- 1 year or less
- 1-2 years
- 2-3 years
- Longer than 3 years – please note number of years

**Occupations**

We would now like to ask about the occupations of people in your household. This includes you, your partner or spouse, any children that live with you, and any other relatives that live with you.

Does any member of your household spend at least half of the typical working day in…?

*(check all that apply) [note: appears in random order]*

- Dairy farming
- Health and social services
- Manufacturing
- Education
- Tourism/lodging/food services
- Plant/fruit/nut/wine production
- Forestry/fishing/hunting
- Sheep/beef/grain production
- Professional/scientific/technical services
- Government and safety
- Other livestock production
- Construction
- Transportation/storage
- Wholesale/retail trade
- Legal/scientific/technical services
In your opinion, which sector is **the most** important for Canterbury's future economic growth? [note: appears in same order as previous list]

- Dairy farming
- Health and social services
- Manufacturing
- Education
- Tourism/lodging/food services
- Plant/fruit/nut/wine production
- Forestry/fishing/hunting
- Sheep/beef/grain production
- Professional/scientific/technical services
- Government and safety
- Other livestock production
- Construction
- Transportation/storage
- Wholesale/retail trade
- Legal/scientific/technical services
- Do not know
In your opinion, which sector is second most important for Canterbury's future economic growth? [note: appears in same order as previous list]

- Dairy farming
- Health and social services
- Manufacturing
- Education
- Tourism/lodging/food services
- Plant/fruit/nut/wine production
- Forestry/fishing/hunting
- Sheep/beef/grain production
- Professional/scientific/technical services
- Other livestock production
- Construction
- Transportation/storage
- Wholesale/retail trade
- Legal/scientific/technical services
- Do not know
Hobbies and Activities

We would now like to ask about hobbies and activities in which you regularly participate.

How often do you... [note: appears in random order]

<table>
<thead>
<tr>
<th>Activity</th>
<th>Daily</th>
<th>Weekly or more (but less than daily)</th>
<th>Monthly or more (but less than weekly)</th>
<th>Yearly or more (but less than monthly)</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watch television or use the Internet for news or entertainment?</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Go camping?</td>
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<td>☐</td>
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<tr>
<td>Hunt or go bird watching?</td>
<td>☐</td>
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<td>Read books, magazines, or newspapers?</td>
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<td>Participate in sport or do regular exercise?</td>
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<td>Do gardening?</td>
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<tr>
<td>Go fishing or boating?</td>
<td>☐</td>
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<td>Tramp or hike?</td>
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<td>Participate in civic, cultural, or religious activities?</td>
<td>☐</td>
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</table>
Travel in the Canterbury Region

We would now like to ask about your travel within Canterbury, whether by car, train, motorbike, or bicycle. Specifically, we would like to know about where you travel for business and leisure.

In the last year, how often did you travel through or to … for either business or leisure?

<table>
<thead>
<tr>
<th>Area</th>
<th>I live in this area</th>
<th>I travel there often</th>
<th>I travel there occasionally</th>
<th>I don't travel there</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akaroa area/Banks Peninsula</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>Arthur's Pass area</td>
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<td>Ashburton area</td>
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<td>Christchurch City</td>
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<td>Culverdon/Hanmer Springs/Lewis Pass area</td>
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<tr>
<td>Fairlie/Mt. Cook/Twizel area</td>
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<td>Geraldine/Rangitata/Pleasant Valley area</td>
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<td>Kaiapoi/Waikuku Beach area</td>
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<tr>
<td>Kaikoura/Cheviot area</td>
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<td>Mt. Hutt/Mt. Sommers/Methven area</td>
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<tr>
<td>Oxford/Eyrewell Forest area</td>
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<tr>
<td>Rakaia/Leeston/Southbridge area</td>
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<tr>
<td>Rangiora/Ashley Forest area</td>
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<tr>
<td>Sheffield/Coalgate/Darfield/Kirwee area</td>
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<td>Timaru/Temuka area</td>
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<td>Waimate area</td>
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<tr>
<td>Waipara area</td>
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</table>
Changes in the Canterbury Landscape

Throughout New Zealand's history, people have shaped the landscape in important ways. We would like to ask you a few questions about some of the changes to the landscape that people have caused.

Have you noticed significant human-caused changes in the landscape of rural Canterbury in recent years?

☐ Yes
☐ No

In what area have these human-caused changes been most noticeable?

(tick 2 boxes) [note: appears in random order]

☐ fewer shelterbelts
☐ more lifestyle blocks
☐ reduction of water quality in rivers and streams
☐ more wineries
☐ more dairy farming
☐ less forested area
☐ less sheep farming
☐ less land for growing food crops
☐ other (specify: )

On balance, do you view these changes…?

<table>
<thead>
<tr>
<th></th>
<th>Favourably (i.e., good)</th>
<th>Unfavourably (i.e., bad)</th>
<th>Neither favourably nor unfavourably</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice #1</td>
<td>☐</td>
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<td>☐</td>
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<tr>
<td>Choice #2</td>
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</tbody>
</table>
Visual Assessment Study

This portion of the survey consists of 47 images of typical Canterbury landscapes, all from the perspective of the driver of a car traveling down the road. Please view each image and then indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.

Please view each image and then indicate whether your reaction to the landscape depicted is extremely positive, extremely negative, or somewhere in between.
Landscapes and Biodiversity

In this last section of the survey, we would like to tell you a bit more about 4 of the images that you have already seen and to ask you whether the new information influences your feeling about them.

Many people think that trees and shelterbelts increase the attractiveness of the visual landscape. In addition, some trees and shelterbelts attract birds and insects by providing protection and food, increasing the 'biodiversity' of the landscape.

Scientists at Landcare Research have estimated the biodiversity of the environments shown in each of the following 4 images, classifying them as 'very high', 'moderately high', 'medium', or 'low'.

The shelterbelt shown in this image is comprised of macrocarpa. Its biodiversity index is medium.

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. 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. Its biodiversity index is **moderately high**.

![Image of shelterbelt](image)

*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 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 following question is for statistical purposes only, to make sure we have an accurate sample.

- [ ] What is your year of birth? 
- [ ] Prefer not to answer

**That is the end of the survey. Thank you for taking part – your opinion is very important and taking part in this survey will help decision makers understand how Cantabrians feel about their region.**

Finally, please choose from the following charities for your $10 donation.

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