INTRODUCTION

The Mount Lofty Ranges Landscape Quality Assessment project was carried out during 2015 to measure and map the scenic quality of the region in South Australia. The study area stretched from Cape Jervis in the south to Truro in the north, east to the Palmer escarpment and west to include the Hills Face Zone near Adelaide as well as the McLaren Vale area. The area is around 4,700 sq km.

NATURE OF LANDSCAPE QUALITY

Landscape quality is an aesthetic quality which is assessed via our affective capacity, our likes and dislikes, our aesthetic preferences, not via our cognitive abilities which analyse and logically comprehend the environment. Early attempts often measured every aspect of the landscape – height, aspect, geology, vegetation, land use, in the hope that its scenic quality would emerge but it never did as it can only be assessed aesthetically. The scientific basis is psychophysics, the measurement of the effect on the brain of stimuli from the senses – sight, sound, taste, touch and smell. Research has established the use of photographs as a vehicle for measuring preferences. Strict criteria apply to the photography of the landscape so that the rating is of the quality of the scene, not the quality of the photograph.

HISTORY OF THE MT LOFTY RANGES

The Aboriginal habitation of the area extends back millennia and involved three tribes, the Peramangk in the central Ranges, the Kaurna on the western plains to Cape Jervis, and the Ngarrindjeri along the Fleurieu Peninsula and east to the Lakes and River Murray. Many traces of their habitation exist by rock art throughout the Ranges.

European exploration of the region commenced with Matthew Flinders and Nicholas Baudin in 1802 as they passed the coast in their ships. With colonisation in 1836, exploration of the interior commenced and explorers waxed lyrical about the beauty of the Ranges. Wakefield’s systematic colonisation of the area began in 1836 and towns sprung up over the following decades throughout the Ranges. Farming required the clearance of the tall native trees, a process that took years. Transforming the land to resemble England was the aim of many settlers. Some areas such as the southern plateau remained uncleared and undeveloped until after WW2 when trace element deficiencies were
rectified and the area cleared for agriculture. Post war development also saw the construction of reservoirs, electricity infrastructure and major roads including the South Eastern Freeway through the Ranges and the establishment of parks and reserves.

In the 1970s, earnest proposals to declare an English-style National Park over the entire Mt Lofty Ranges to protect its beauty eventually ptered out, although they did stimulate several studies of its landscape quality to be undertaken.

The recent proposal to seek listing of the Ranges under the World Heritage Convention is the latest of many measures to recognise the attractiveness of the Ranges.

Physically the Ranges comprise north-south trending uplands, the highest being 727 m at Mt Lofty overlooking Adelaide. The vegetation comprises dry sclerophyll forests in the higher wetter areas, and the savannah woodland formation in the drier eastern area. The region’s landscape character comprises the high ranges, the lower ranges and escarpments, and the undulating country and wide flat valleys.

ACQUIRING THE DATA

The report describes six previous studies by the author which included parts of the Ranges.

Twenty-one landscape units were defined across the Ranges of areas having similar features and characteristics.

Method

The research method involves respondents rating photographs of the landscape and a smaller group scoring the visual significance of certain components in the landscape (e.g. land forms, water, colour), analysing the ratings and component scores and from this gaining a thorough understanding of the landscape quality and the components that contribute to it. This knowledge is then applied in mapping the landscape quality.

Independent variables
Dependent variable

Landscape sampled and characteristics described
Human preferences derived for landscapes

Survey

Prepare & implement survey involving participants

Analysis

Statistical analysis of results and identifying relationships between preferences and landscape components

Applications

Applications of knowledge gained including mapping landscape quality

Framework of landscape quality assessment

Photography & Surveys

The project commenced with three months of photography throughout the region in
which 7,000 photos were taken. These supplemented 6,000 photos previously taken of the region. For the first time, this survey used spliced photos, two images spliced together to provide a wider angle of view which aids immersion of the viewer in the landscape.

A total of 142 images were selected to cover land forms, land cover, land uses, presence of water, seasonal colour, fire damaged landscape and landscape units, and included images used in the author’s PhD Thesis (Landscape Quality Assessment of South Australia, Uni. Adelaide, 2000) and in the previous Barossa study. Also included were 8 benchmark scenes of South Australia which enable the ratings to be related to studies from elsewhere in the State.

Of the 150 images, 119 were spliced and the remaining 31 were single photos. A statistical principle is that each type of scene should have three examples and this was followed throughout, e.g. three scenes of tall dense trees.

In addition to the main survey instrument, six surveys covered the landscape components: land form, land cover, naturalness, visual diversity, colour and water. These were scored out of 5 on the basis of their visual significance in the scenes. The author also scored a further eight attributes. The surveys used the Survey Monkey® on-line survey facility which proved excellent.

**Participation in survey**

In order to gain participation in the landscape survey, invitations were emailed to approximately 1700 addresses, located from Internet searches of outdoor, sports, social and interest clubs, councils, churches, service and environmental groups, and newspapers, throughout Adelaide and the Ranges. Mailing invitations commenced on 7 July and the on-line survey terminated on 22 July after 16 days with 560 responses. Meanwhile invitations to score the six component surveys were forwarded and the required 30 responses obtained for most surveys by 27 July. The responses indicate the effectiveness and efficiency of using the Internet for such surveys.

**DATA ANALYSIS**

Analysis of the results was postponed for two months by trips overseas and was completed in early November. Mapping was then undertaken in November.
Responses

Of the 560 responses, two-thirds (379) completed all 150 scenes. Following removal of 38 who rated no scenes, and two more who showed strategic bias by rating all scenes ‘10’, the data set was 519 responses. This has a confidence interval of 0.043, better than the 0.05 confidence interval at the 95% confidence level which is the benchmark for the social sciences.

Of the 519 respondents, slightly more females than males participated, 82% of participants were in the 45+ age groups, 77% were born in Australia, and 63% had either a degree or higher degree. Compared with the South Australian community, respondents’ age, birthplace and education were significantly different but gender was not statistically different to the general population. Overall the survey participants were better educated, with more middle aged and more females and more Australian-born than the South Australian community.

If these differences affected results it would be expected that the means would differ markedly across the range of respondent characteristics but in fact they are very similar, a difference of less than 2%.

Familiarity with the Ranges

Over half (52%) of respondents either live in or commute through the Ranges so it is not surprising that 66% indicated that they were either very familiar or extremely familiar with the region. The mean rating of those who live in the Ranges was 6.00 compared with 5.88 for those who live outside the area.

Over 50 respondents commented on their familiarity with the Ranges, and a further 55 comments from those who live in or commute through them. There were 100 comments about the survey itself, many expressing negative views about the photo quality and that being taken largely through summer did not capture the winter green.

Influence of familiarity on rating

<table>
<thead>
<tr>
<th>Category</th>
<th>Mean rating</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never visited</td>
<td>5.65</td>
<td></td>
</tr>
<tr>
<td>Visited but not familiar</td>
<td>5.61</td>
<td>100.0</td>
</tr>
<tr>
<td>Somewhat familiar</td>
<td>5.91</td>
<td>105.3</td>
</tr>
<tr>
<td>Very familiar</td>
<td>5.99</td>
<td>106.7</td>
</tr>
<tr>
<td>Extremely familiar</td>
<td>6.06</td>
<td>108.0</td>
</tr>
</tbody>
</table>

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Overall ratings

The ratings for the Mt Lofty Ranges range from 4 to 7, apart from an 8 for the Morialta waterfalls. The majority of ratings are 5 and 6 with 5 applying to the flatter land and 6 to the undulating and steeper land, particularly...
with tree cover. Flat barren land rated 4. Rugged land such as Morialta achieves a rating of 7.

The following figures show the influence on ratings of landscape components on ratings.

Influence of land form on ratings

Influence of land cover on ratings

Ratings of dense trees by height

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Flat or undulating grazing land rates 5 and for steeper land rates 6. Average land cover, such as scattered trees on grazing land rates 5 rising to 6 for denser land cover. Flat cropping land rates 4. Land used for market gardens, such as in Piccadilly Valley, rates 5. Plantations of pines or native trees rates 4.

Influence of seasonal colour

Scenes of pastures and vines in summer and winter were rated. The following table shows that in both cases, the green colour rates higher than either brown pasture or
yellow vines although in the case of vines the ratings are nearly identical.

<table>
<thead>
<tr>
<th></th>
<th>Pasture</th>
<th>Vines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>6.46</td>
<td>5.97</td>
</tr>
<tr>
<td>Brown or yellow</td>
<td>5.68</td>
<td>5.90</td>
</tr>
<tr>
<td>Difference</td>
<td>0.78</td>
<td>0.07</td>
</tr>
<tr>
<td>%</td>
<td>12.07</td>
<td>1.23</td>
</tr>
</tbody>
</table>

The colour change particularly affects those areas of the Ranges with scattered trees over pastures and the eastern cropping areas. In many areas this is the difference between a 5 and a 6 rating.

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Water

There are 9,100 dams in the Mt Lofty Ranges so they are a significant land use. Whether the water is brown or blue, they rate 6. Three reservoirs in the survey also rate 6.

### Influence of water colour in rating of water

<table>
<thead>
<tr>
<th></th>
<th>Scenes</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown water</td>
<td>2</td>
<td>6.02</td>
</tr>
<tr>
<td>Blue water</td>
<td>17</td>
<td>6.34</td>
</tr>
</tbody>
</table>

### Naturalness and diversity

Ratings increase by 0.54 for each unit increase in the naturalness score and by 0.84 for the visual diversity score.

## Inference of naturalness on ratings

Trend line $y = 0.54x + 4.37$, $R^2 = 0.32$
Landscape components

The influence of each of the landscape components on ratings was analysed.

Mean ratings

The following table displays the average ratings obtained from the survey. The study analysed each of these features and components in detail.
Area or feature | Rating
---|---
**Land forms**
Land form score 1 | 4
Land form score 2 | 5
Land form score 3 | 5
Land form score 4 | 6
Land form score 5 | 6
Rugged terrain and rock faces | 7
Substantial waterfalls | 8
Flat & undulating land without trees | 5
Flat & undulating land, scattered trees | 6
Steep land with scattered trees | 7
**Land cover**
Land cover score 1 | 3
Land cover score 2 | 4
Land cover score 3 | 5
Land cover score 4 | 6
Land cover score 5 | 8
Stands of dense trees (low, medium & tall height) | 6
Roadside trees (dense with undergrowth) | 6
Exotic vegetation (excl. pines) | 6
Pines and tree plantations | 4
Land barren of tree cover | 5
**Land use**
Flat cropping land | 5
Market gardens | 5
McLaren Vale vines | 5
Vines in Ranges – undulating land | 5
Vines in Ranges – steep land | 6
Orchards – undulating land | 5
Orchards – steep land | 6
**Water**
Farm dams & reservoirs | 6
**Naturalness**
Naturalness score 1 | 4
Naturalness score 2 | 5
Naturalness score 3 | 5
Naturalness score 4 | 6
Naturalness score 5 | 7
**Diversity**
Diversity score 1 | 4
Diversity score 2 | 5
Diversity score 3 | 6
Diversity score 4 | 6
Diversity score 5 | 7

However a model with only two components achieved a respectable $R^2$ of 0.81:

$$Y = 1.075 + 0.66 \text{ naturalness} + 1.03 \text{ diversity}$$

**Mapping Landscape Quality**

**Principles**

In mapping the landscape quality, certain principles were followed:

- Parts of the scene elicit different ratings but are averaged by the respondent in rating the scene;
- Ratings grade like contours around the landscape and progressively rise and fall;
- The rating reflects what is viewed from a location, it does not provide the rating of that viewing location but rather what is seen from it;
- In mapping, the rating applies to the landscape beneath, not what may be seen over it in the distance.

These principles are discussed in the study report.

**Resources**

The resources available for mapping the landscape quality included the rating of the 142 scenes (i.e. excluding the South Australian scenes), analysis of scenes by landscape types (e.g. land forms, water), scoring of the landscape components, ratings of comparison scenes of seasonal colour, comparison of the ratings with the component scores. In addition there were 13,000 other photos of the region plus maps and Google Earth®.

Mapping proceeded through each of the 21 landscape units and, based on the detailed results, the entire Mt Lofty Ranges was mapped.

**Map**

The resultant summary and map of landscape quality for the Mt Lofty Ranges are shown below.
Landscape quality map of the Mt Lofty Ranges
Summary of landscape quality ratings

<table>
<thead>
<tr>
<th>Rating</th>
<th>Sq km</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>14</td>
<td>0.30</td>
</tr>
<tr>
<td>4</td>
<td>181</td>
<td>3.82</td>
</tr>
<tr>
<td>5</td>
<td>1070</td>
<td>22.60</td>
</tr>
<tr>
<td>6</td>
<td>3315</td>
<td>70.03</td>
</tr>
<tr>
<td>7</td>
<td>152</td>
<td>3.21</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4734</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Proportions of landscape quality ratings for Mt Lofty Ranges

**Discussion**

The highest rating of 8 is for two waterfalls in the Adelaide Hills Face, the Morialta and Waterfall Gully falls.

The next highest rating, 7, applies to the Hills Face Zone overlooking Adelaide, the steep land to the north and south of the Kangaroo Creek Reservoir, the Deep Creek – Blowhole Creek – Talisker area near the tip of Fleurieu Peninsula, and sections of the Fleurieu coast.

The dominant rating throughout the Ranges is 6, reflecting the prevalence of undulating agricultural land with either scattered trees or tracts of trees. The 6 rating also applies to roadside trees and exotic trees, vineyards on steep land, the hills faces of the Barossa Ranges, the Willunga Scarp and the Inman and Hindmarsh Valleys, areas of dense vegetation, and to the seven reservoirs in the Ranges. Tree-lined creeks in the eastern ranges rate 6.

The 5 rating applies to the many vineyards including the McLaren Vale and those scattered throughout the Ranges. It also applies to flat land with trees and to undulating but barren land. The undulating but bare cropping land south of Truro rate 5. Market gardens and orchards rate 5. The eastern ranges rates 5. The Hills Face south of Gawler and also overlooking Morphett Vale both rate 5.

Pine forests rate 4 throughout the Ranges and are a significant land use in the Mt Crawford, Kuitpo and Inman Valley areas. The flat bare areas used for cropping in the Bremer Valley and between Strathalbyn and Woodchester rate 4.

The 3 rating applies to quarries, including those in the Hills Face Zone, sand workings at Mt Compass, Maslins and Sandy Creek, and to mines such as Kanmantoo and Brukunga. The Penrice quarry near Angaston rates 3.
Detailed analysis of the map by councils was undertaken. The Adelaide Hills Council has the most extensive areas of high quality landscapes (6 – 8), followed by Yankalilla and Mitcham Councils.

Overall the map brings out some important points:

- The rating 6 dominates the Ranges and is bound in the east by the bare hills and escarpment of rating 5 and in the west by the hills face at Gawler, Adelaide, Morphett Vale and Willunga, rating 5 – 7.
- The rating 6 reflects the winter rating of the undulating farmland with scattered trees, the summer rating would be mostly 5 as the landscape quality, particularly in the agricultural areas, varies with the seasons.
- Landscape quality also varies over time with changes in land use. The establishment of pine forests at Mt Crawford, Kuitpo and Second Valley decades ago transformed 5 and 6 rating landscapes to 4 rating. The current spread of tree plantations, though using native trees, will have a similar effect as they also rate 4.
- Vines are becoming the new land use across the Ranges. Pockets of vines exist from south of Yankalilla north through to the Eden Valley and across much of the central Ranges. In many areas they are transforming the landscapes of scattered trees on grazing land to monocultures of vines stretching across the undulating hills but with all remnant trees removed. Thus more vines means less trees. Vineyards do not generally tolerate trees in their midst. And it is the trees that enhance landscape quality, not vines.
- While the seasonal colour of vines in autumn might be thought to enhance the landscape, this study showed that the ratings of autuminal colour were lower than their summer green. Also, the ratings of vines in green leaf were lower than that of green pastures. Thus the argument that the spread of vines across the Ranges will enhance landscape quality is not supported by this survey.

What generates scenic appeal?

In the final chapter, the factors which generate landscape appeal are examined, ranging from individual factors through familiarity with the landscape and cultural factors to innate factors common to all people.

![Hierarchy of Societal Landscape Preferences](image)

Source: Dearden, 1989

Recent research into the restorative benefits of viewing nature are examined including people being happier, less aggressive, less fatigued and with longer attention spans. These aesthetic services have immense social and economic spinoffs.

World Heritage nomination

The proposal to nominate the Mt Lofty Ranges under Criteria 4, 5 and 6 of the World Heritage Convention is examined, and it is proposed that the additional criterion, 7b, be added: that it contains areas of exceptional natural beauty and aesthetic importance.

The current study meets the requirement that natural beauty be assessed using a method that is systematic, rigorous and transparent.
**Council Development Plans**

Current provisions of Development Plans of Councils to protect and manage landscape quality are examined in detail and while there are many excellent Objectives and Principles of Development Control across the councils, there is considerable variation among them. However the recognition of landscape by all councils is heartening. All consider also the visual impact of developments.

In order to position the Ranges better in terms of World Heritage nomination, a Ranges-wide Landscape Protection Zone is proposed that would be adopted by all Councils and included in their Development Plans. This would include strengthened Objectives and Principles of Development Control as well as provisions relating to their application by Councils. Townships would be excluded from the Zone.

**Lessons from the study**

Lessons from the study include the recognition that landscape quality can be measured and it can be mapped but that it requires an immense amount of effort, 1500 hours for the current study, and considerable attention to detail.

Although it is commonly held that “beauty is in the eyes of the beholder”, the similarity of preferences for landscape quality – the bell-shaped curve of preference with most around the average - has been found in all the author’s landscape studies and gives a lie to this adage.

Improvements to the survey include a greater mix of summer and winter photos, more scenes with farmhouses, improvements to the survey instrument, and, possibly, a lesser length of the survey.

**Recommendations**

Proposals to improve the landscape management of the Ranges are presented in the following 13 recommendations:

1. Nominate the Ranges under Criterion 7 of World Heritage Convention;
2. Include a Ranges-wide Landscape Protection Zone in all Council Development Plans with strengthened Objectives and Principles of Development Control relating to the landscape;
3. Protect hills faces in the Inman and Hindmarsh Valleys and other localities;
4. Encourage regeneration of scattered trees;
5. Protect trees in vineyard development;
6. Use mixed species in tree plantations;
7. Protect roadside trees;
8. Encourage land holders to beautify their dams;
9. Provide viewing areas along roads,
10. Designate Scenic Routes along major roads;
11. Remove eyesores;
12. Provide lookouts over reservoirs which have significant landscape value,
13. Cease further softwood plantings in the Ranges.

Proposed Scenic Routes