1.   INTRODUCTION

The South Australian River Murray Landscape Project commenced in May 2006 and was completed in April 2007.

1.1   PROJECT DEFINITION

The objectives, background and purpose of the project, as defined by the following extracts from the project proposal by the Department of Water, Land and Biodiversity Conservation were:

"Objective
To undertake a valuation of landscape value (scenic quality) associated with the River Murray Floodplain Protection Area established under the *River Murray Act 2003*. The outcomes will contribute to the development of policies, in particular a Landscape & Amenity Policy, to assist in achieving the *Objects* and *Objectives for a Healthy River Murray* as contained in the Act.

Context
The consideration, protection and enhancement of landscape value is an important component in the sustainable management of the River Murray environs. The purpose of the Landscape Assessment Study is to assess landscape value with respect to scenic quality/ amenity and not ecological value, i.e. the project seeks to identify the qualities people like to see in a landscape.

Historically the assessment of landscape value has been left to the judgement of individuals in the absence of a publicly defendable and repeatable valuation.

A number of studies have recently been completed to assess the landscape value of the South Australian Coastline (Department for Environment and Heritage) and the Barossa Valley Region (Planning SA) using a consistent methodology.

Scenic quality is a significant environmental and community resource, and its measurement and mapping is fundamental to its management and enhancement, and in addressing the impact of development.

Tourism associated with the River Murray contributes significantly to the South Australian economy and increases visitor exposure to and connection with the natural environment. Nature and the natural environment were identified by 86% of South Australian and Victorian tourists as an important consideration when deciding on a holiday or short-break destination in SA.[1]

Methodology
It is anticipated that the project methodology will involve an appropriate survey mechanism to capture community views on landscape values which can be statistically tested. It will also indicate a method for the spatial analysis (GIS mapping) of the survey results and provide recommendations in the form of strategies for better planning supported by the data.

Consultation processes will be finalised with the preferred consultant based on the recommended methodology. However it is expected that consultation will be required with:

• Peak bodies
• Interested parties/stakeholders
• Community groups
• General community
• Indigenous representatives
• Individual Councils
• Regional communities

Discussion
The area to be considered by the study is the River Murray Floodplain Protection Area which is primarily based on the 1956 flood level, along with some other areas identified by Councils at the time of establishment (Figure 1.1).

The Department of Water, Land and Biodiversity Conservation (DWLBC) is responsible for administering the *River Murray Act 2003*. The policies developed using the results from the Landscape Assessment Study will help guide the decision making process for the Minister and the Minister's delegates when assessing referred statutory instruments and authorisations.

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[1].   Government of South Australia (2003), *Responsible Nature-based Tourism Strategy 2004-2009.*
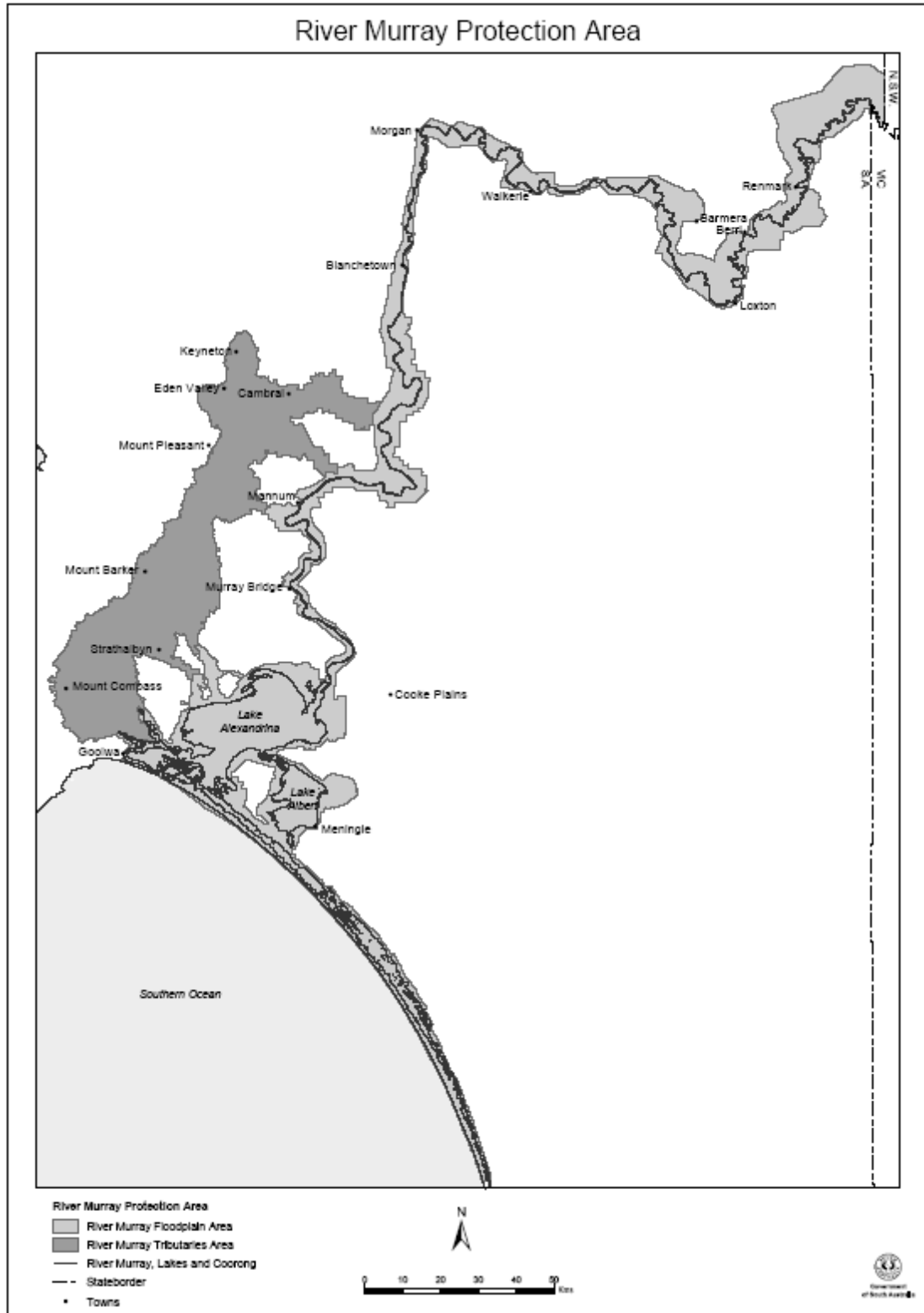
Note: The River Murray Landscape Project covers only the floodplain area and excludes the Tributaries Areas.

Source: Dept of Water, Land and Biodiversity Conservation

Figure 1.1 River Murray Landscape Project Study Area

Under the River Murray Act the Minister for the River Murray can 'switch-on' referrals under certain 'Related Operational Acts'. This causes certain statutory instruments (PARs, Management Plans, etc) and statutory authorisations (Development applications, licenses, permits, etc) to be referred to the Minister or delegates for assessment and direction or comment. Currently, only development referrals under the Development Act are 'switched on'.

Referrals must be assessed against the 'Objects' and 'Objectives' in the Act, which are quite broad and cover environmental, economic and social concerns. To assist with the assessment process referral policies are being developed, providing greater detail on specific issues, such as 'amenity value'.

The project outcomes will help DWLBC to write a referral policy on landscape and amenity values, which will in turn be used to assess referrals (primarily development applications), and also to inform the content of new PARs that DWLBC reviews.

The outcomes from the Landscape Assessment Study will also assist the South Australian Murray Darling Basin NRM Board in carrying out its responsibilities, and facilitate improved understanding and consistency between DWLBC, the Board and the community on this issue.

Relationships
The Landscape Assessment Study will provide valuable information that will contribute to other River Murray initiatives including management of the Lower Lakes Ramsar area and migratory birds, the Living Murray Initiative and South Australia's Strategic Plan.

Risk Assessment
Not undertaking the Landscape Assessment Study would contribute to a policy vacuum and a lack of direction to the Minister for the River Murray and delegates when assessing referrals.

Project Deliverables
At the completion of this project the consultant will have provided:

- Maps created in a digital computer file format suitable for transfer to DWLBC's GIS software. These include shaper files and DBF tables. Maps must be to a scale suitable for use for policy planning purposes, a suggested scale is 1:25,000;

- A report describing the methodology used, the rating system, examples of landscapes and landmarks of each quality, people consulted, with the results shown as maps;
- The report shall be presented in the form of an A4 document, delivered on CD as MS Word files, GIS files and as 6 hard copies, including all maps (which may be printed up to A0 size).

These deliverables will belong to DWLBC and the SA Murray Darling Basin NRM Board."

1.2   PRESSURES & VALUES

Pressures on the River Murray are growing. Most well known is the pressure on its finite water resources, but this is a pressure largely focussed upstream, in Queensland, NSW and Victoria.

Within South Australia, there are many competing pressures including irrigation, houseboats, housing developments, water skiing, and recreational fishing.

The drought experienced during 2006 and the lowest volume of inflows into the River Murray since records began are posing significant pressures on the River Murray's water resources on which South Australia relies.

According to the South Australian Tourism Commission[2]:

> The Riverland region (east of Blanchetown) attracted 350,000 overnight visitors (2004 figures) comprising 250,000 from South Australia, 94,000 from interstate and 6000 from overseas. Visitation amounted to 9% of regional overnight visits. The Riverland has the longest stay of any region by interstate visitors, 6.3 nights. Spending by domestic overnight visitors totalled $72 m ($79/person/night). Nearly half describe their visit "to escape and unwind", the major reason given with general sightseeing the major activity after visiting relatives & friends. The Murraylands region (downstream of Morgan) attracted 359,000 overnight visitors comprising 284,000 from South Australia, 68,000 from interstate and 7000 from overseas. Visitation amounted to 6% of regional overnight visits. Average stay was 2.4 nights; 2.9 for interstate visitors. Spending by domestic overnight visitors totalled $43 m ($57/person/night). "Escape & unwind" was again the dominant reason for the visit with

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[2]. www.tourism.sa.gov.au/ publications

sightseeing the equal main reason (with visiting relatives & friends).

The River Murray in South Australia is 640 km in length. Given that the River attracts visitors who spend around $115 m per year; this is the equivalent of nearly $18,000 per km per year, or over $49, say $50/km/day. To a considerable degree, this represents the value of the landscape quality of the region which is the key attraction together with the peace, quietness and serenity associated with the river.

Maintaining and even enhancing this landscape amenity is important in the region's economic livelihood as it comprises a significant part of the region's economic base through tourism.

1.3   LEGISLATIVE CONTEXT

The River Murray is a key responsibility of the Department of Water, Land and Biodiversity Conservation. The Department is responsible for a range of legislation relating the River including the *River Murray Act 2003*.

It is also the South Australian agency responsible for the *Murray – Darling Basin Act 1993* under which the water, land and other resources of the region are managed.

Under the *River Murray Act 2003*, the natural resources of the River Murray include:

S 3(c) cultural heritage and natural heritage, and **amenity** and geological values, connected or associated with the River Murray system (emphasis added*)*

The Act defines the River Murray system as including the river itself, plus:

all anabranches, tributaries, flood plains, wetlands and estuaries that are in any way connected or associated with the river, and related beds, banks and shores

The objects of the Act include:

S 6(a)   to ensure … measures are taken to protect, restore and enhance the River Murray in recognition of its critical importance to the South Australian community and its unique value from environmental, economic and **social perspectives** and to give special acknowledgement to the need to ensure that the use and management of the River Murray sustains the physical, economic and **social well**

being of the people of the State … (emphasis added)

The Act's objectives (S 7) cover the operation of the Act and include objectives covering river health, environmental flow, water quality and human dimensions.

The recently formed South Australian Murray Darling Basin Natural Resources Management Board was established under the *Natural Resources Management Act 2004* to manage soils, biodiversity, salinity, pest plants and animals, and water of the River Murray in South Australia.

As well as integrating the delivery of natural resources management, the Board also serves as a vehicle for the implementation of Natural Heritage Trust, National Action Plan for Salinity and Water Quality and the National Landcare Program funding initiatives of the Commonwealth.

1.4   PROJECT METHODOLOGY

The overall design and methodology of the project are summarised in Figure 1.2. The components with brief descriptions were:

(1)   Photograph the region

A significant issue was whether photographs provide an adequate basis for assessing landscape quality or whether assessment should be carried out in the field (field-based assessment vs photographs). The use of photographs as a mode of presentation is discussed in Chapter 2.

This leads to the establishment of criteria for photographs and these and their application in photographing the region are described in Chapter 3.

(2)   Classify region into landscape units of similar characteristics

The selection of photographs for use in the survey aimed to sample the characteristics and features of the region. For this, landscape units for the region were classified and photographs selected to represent each classification. These are described in Chapter 3.

(3)   Select representative photographs

Photographs for the survey were selected to adequately represent the landscapes present in the region. As part of the survey instrument, benchmark
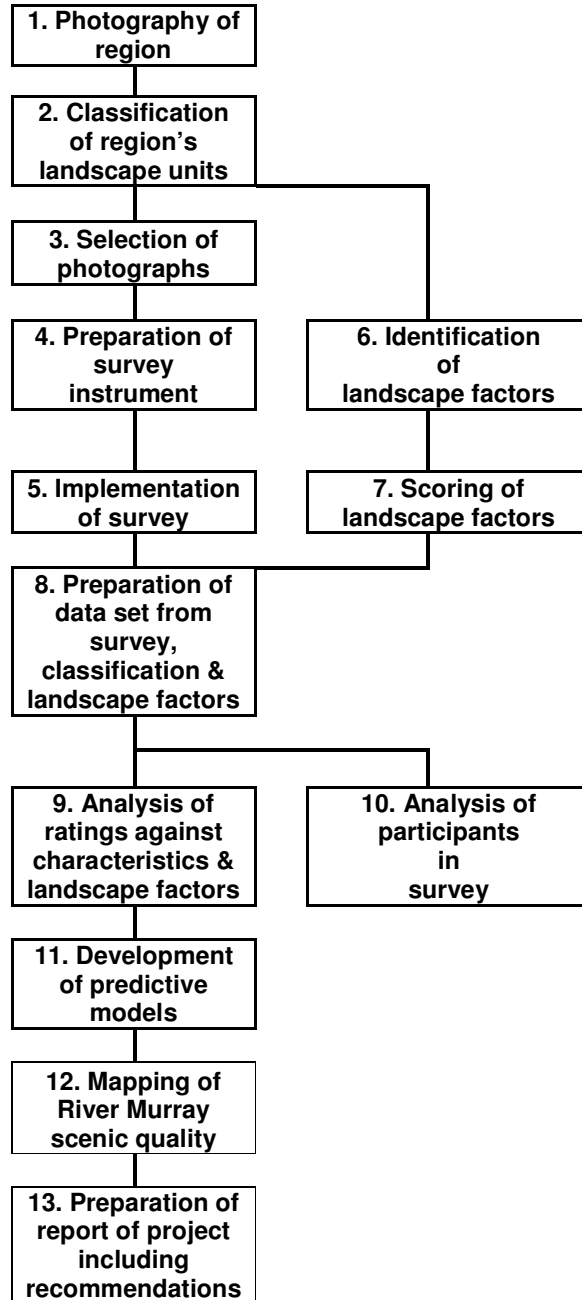
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┌─────────────────┐
│ 1. Photography of│
│     region       │
└─────────────────┘
         │
┌─────────────────┐
│ 2. Classification│
│   of region's    │
│  landscape units │
└─────────────────┘
         │
┌─────────────────┐        ┌─────────────────┐
│ 3. Selection of  │        │ 6. Identification│
│   photographs    │        │       of         │
└─────────────────┘        │ landscape factors│
         │                  └─────────────────┘
┌─────────────────┐                 │
│ 4. Preparation of│        ┌─────────────────┐
│     survey       │        │ 7. Scoring of    │
│   instrument     │        │ landscape factors│
└─────────────────┘        └─────────────────┘
         │
┌─────────────────┐
│ 5. Implementation│
│    of survey     │
└─────────────────┘
         │
┌─────────────────┐
│ 8. Preparation of│
│  data set from   │
│     survey,      │
│ classification & │
│ landscape factors│
└─────────────────┘
         │
┌─────────────────┐        ┌─────────────────┐
│ 9. Analysis of   │        │ 10. Analysis of  │
│ ratings against  │        │   participants   │
│ characteristics &│        │       in         │
│ landscape factors│        │     survey       │
└─────────────────┘        └─────────────────┘
         │
┌─────────────────┐
│ 11. Development  │
│  of predictive   │
│     models       │
└─────────────────┘
         │
┌─────────────────┐
│ 12. Mapping of   │
│   River Murray   │
│  scenic quality  │
└─────────────────┘
         │
┌─────────────────┐
│ 13. Preparation of│
│ report of project │
│    including      │
│ recommendations   │
└─────────────────┘
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Figure 1.2 Scenic quality survey methodology

scenes of the wider State landscape were included to ensure the ratings of the regional scenes reflected a State-wide perspective. The selection of photographs is described in Chapter 3.

(4)   Prepare survey instrument and rate scenic quality by a minimum of 400 participants

The Internet-based survey instrument comprised:

- The scenes to be rated for their landscape quality;
- Benchmark scenes of South Australia which were to be similarly rated;
- Introductory scenes (~6) which were not rated but which indicated the nature of scenes which followed;
- Demographic information about the participant

The photographs were arranged in random order and rated on a scale of 1 – 10. The sample size was a minimum of 400 participants. The development of the scenic quality survey is described in Chapter 3.

(5)   Implement survey

The survey was placed on an Internet server and contact was made with potential participants inviting them to carry out the survey. The conduct of the survey is described in Chapter 3.

(6)   Identify scenic quality factors

The scenic quality of any scene derives from its content – the land forms present, the trees, the presence of water, and so on. Scenic quality factors are those components of the landscape which might underlie and help explain its scenic attractiveness.

(7)   Scoring of landscape factors

Scoring of the scenic quality factors used a 1 – 5 scale and involved small groups of up to 20 people. The identification and scoring of landscape factors is described in Chapter 3.

(8)   Preparation of data set

The data set was prepared from the results of the survey and included participant data, ratings and scoring of landscape factors. The data set was examined for strategic bias. The preparation of the data set is described in Chapter 4.

(9)   Analysis of Ratings

The data derived from the surveys were analysed for:

1. Comparison of the participants with the South Australia community
2. Assessment of the data set for normality
3. Assessment of overall mean ratings, regional means and means per landscape unit and other parameters
4. Comparing the ratings with the scores for scenic quality factors

The analysis of the survey is described in Chapter 4.

(10)   Analysis of participants in survey

The characteristics of the survey participants were compared with those of the South Australian community to assess their representativeness. The analysis of participants is described in Chapter 4.

(11)   Develop predictive models of scenic quality

Multiple regression analysis was used to identify the characteristics and a formula by which the scenic quality of the region could be quantified. The models assisted in identification of the key factors influencing the scenic quality ratings. The development of models is described in Chapter 4.

(12)   Mapping scenic quality

The mapping of scenic quality was based on careful analysis of the region's ratings and the application of these ratings to similar areas. The mapping of scenic quality is described in Chapter 5.

(13)   Preparation of report including recommendations

The report was prepared concurrently with each of the components of the methodology. Policy and planning recommendations are described in Chapter 7.

2.   SCENIC QUALITY OF RIVERINE LANDSCAPES

The Study Area comprised the River Murray floodplain, Lakes and Coorong, which are significant examples of riverine landscapes. Findings from research of aesthetic preferences of landscapes involving water are summarised and reasons for human interest in water discussed.

The affective basis of landscape preferences and theories of landscape preferences are described and the influence of culture and individual differences on preferences examined.

The use of photographs in landscape surveys is then reviewed.

Finally the treatment of scenic values in natural resources management is examined and the example of wild and scenic rivers in particular.

2.1   INFLUENCE OF WATER ON LANDSCAPE PREFERENCES

Water has long been recognised as an important element in landscape preferences. Appendix 1 summarises 38 studies which have touched on or examined the effect of water on landscape preferences. The following section examines some of these studies in more detail.

Calvin *et al*, 1972 analysed responses to photographs of landscapes including several which included water. Figure 2.1 summarises the factor scores of each scene for the natural scenic beauty factor and indicates that those with water were among the highest positively scoring scenes although algae in streams was regarded negatively.

Choker & Mene, 1992 found in their study of the Nigerian city of Warri that in natural scenes, the most preferred landscape was "a natural river or water scenery with surrounding natural and well-preserved tropical rainforest vegetation". The presence of water and river was, after trees and flowers, the most important determinant of landscape quality, although dirty water or waterlogged conditions were regarded negatively. They cited the importance of nature for fishing, farming, hunting and other economic needs as the reason for the appeal of natural landscapes rather than concern for nature.

Gobster & Chenoweth, 1989 derived factor loadings on four factors for river landscapes, forest landscapes and agricultural landscapes. The four factors identified were: Factor 1 artistic descriptor: complexity, uniqueness, topography, calmness of water, awe, arousal; Factor 2 affective-informational: land use variety, degree of alteration, unity, balance;
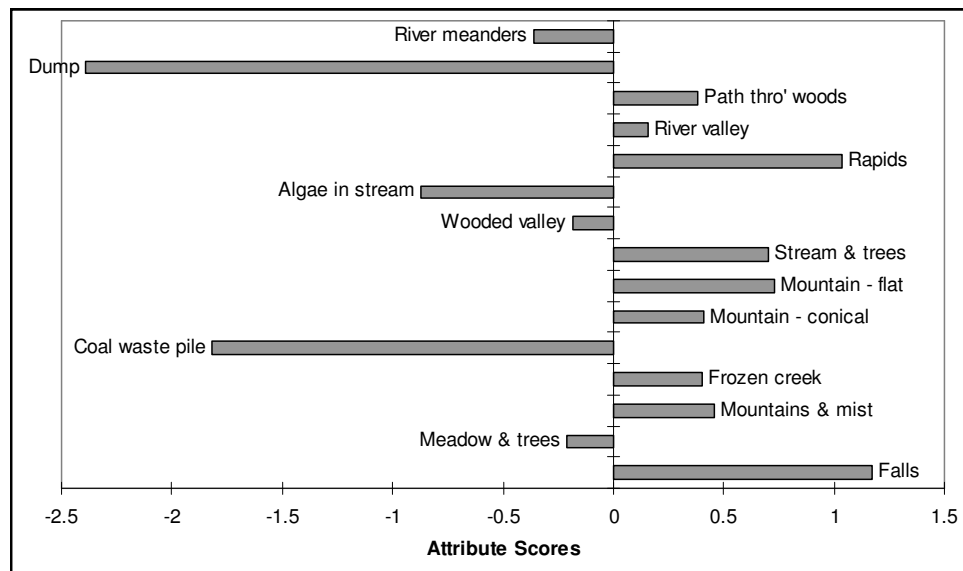
Source: Calvin *et al*, 1972

Figure 2.1 Scores for landscape scenes

Factor 3 spatial structure: distance, river width, land use variety, enclosure, mystery; Factor 4: river sinuosity. The Factor 1 descriptors together accounted for 61% of the variance and all four factors accounted for 90%.

Gregory and Davis, 1993 identified 22 factors that affected the scenic quality of riverscapes, some positively and some negatively. Scenic attractiveness was increased by the percentage of trees (i.e. in the photograph), the number of tree trunks and the depth of water. Conversely, water colour, channel-isation of the bank, percentage river bank, the sinuosity of the channel, and amount of litter decreased scenic quality.

Using regression analysis, they derived the equation (see Appendix 1) to describe the scenic preferences of riverscapes. It indicated that nearly 90% of the average scenic preference variation could be defined by the water colour, the stability of the channel banks and the average depth of water.

A key theoretical construct in understanding how humans perceive the environment has been developed by Stephen and Rachel Kaplan (Figure 2.2). Through a series of studies, they identified four predictor variables – coherence, complexity, legibility and mystery. These were grouped under *making sense of the environment* and *being involved in it.*

Herzog, 1985 tested the Kaplan model in regard to preferences for water. Using factor analysis of preference ratings, he identified four waterscape types: mountain waterscapes; swampy areas; rivers, lakes and ponds; and large bodies of water. He then used Kaplans' variables plus spaciousness and texture as the independent variables and preferences as the dependent variable.

Table 2.1 summarises the mean ratings obtained for each predictor variable showing how they varied across each type of waterscape. These indicate that:

- mountain waterscapes were distinguished by low textures
- swampy areas were distinguished by low spaciousness
- rivers, lakes & ponds were distinguished by high identifiability
- large water bodies were distinguished by spaciousness, texture and coherence but were low in complexity and mystery

Table 2.1 Influence of waterscapes on predictor variables

Variable	Mountain landscapes	Swampy areas	Rivers, lakes & ponds	Large bodies of water
Spaciousness	3.11	2.45	2.95	4.11
Texture	2.05	2.69	3.20	3.80
Coherence	3.38	3.07	3.20	3.80
Complexity	3.39	3.44	2.87	2.08
Mystery	3.25	3.24	3.23	2.42
Identifiability	2.43	2.64	3.40	3.22

Note: n = 259. Five point rating scale
Source: Herzog, 1985

Herzog found that only spaciousness and coherence were significant predictors of preference. Regression analysis of the variables against preferences indicated that "waterscapes high in spaciousness, coherence, and mystery, but low in texture (i.e. featuring coarse or uneven ground surface), were preferred to waterscapes with the opposite characteristics." The six predictor variables accounted for 71% of preference variance in mountain waterscapes and for 74% in swampy waterscapes.

In terms of content, "mountain lakes and rushing water are the people's choice,

	Understanding Making sense	Exploration Being involved
Immediate The visual array	**Coherence** Making sense now Orderly, "hangs together" Repeated elements, regions	**Complexity** Being involved immediately Richness, diversity, intricate Many different elements
Inferred Future, promised Three-dimensional space	**Legibility** Expectation of making sense in future Finding one's way there & back Predictability, distinctiveness	**Mystery** Expectation of future involvement Promise of new but related information Anticipation of new

Source: Kaplan, Kaplan and Brown, 1989; Kaplan, 1979
Figure 2.2   Kaplans' predictor variables

whereas swampy areas are unlikely ever to attract an enthusiastic following". Regarding predictor variables, the most preferred waterscapes were high in spaciousness, coherence and mystery but low in texture.

Large water bodies and mountain waterscapes, both high in spaciousness were the most preferred while swampy areas were lowest in this variable and in preference.

In a later study, Herzog and Bosley, 1992 included a wider range of scenes to evaluate the role of tranquillity on preference. Dependent variables used were mystery, coherence, spaciousness and focus, with tranquillity and preference the independent variables. The preference means for the different landscapes (Table 2.2) indicate that in terms of both tranquillity and preference, water ranks highest among the landscapes evaluated.

Table 2.2 Comparison of mean scores for tranquillity and preference

Landscapes	Tranquillity	Preference
Mountain	3.87	3.84
Field-forest	3.51	3.15
Deserts	2.98	2.81
Large water bodies	4.19	3.90
Rushing water	3.76	4.00
Gardens	3.01	3.05
Misty mountains	3.05	2.77

5 point scores
Source: Herzog & Bosley, 1992
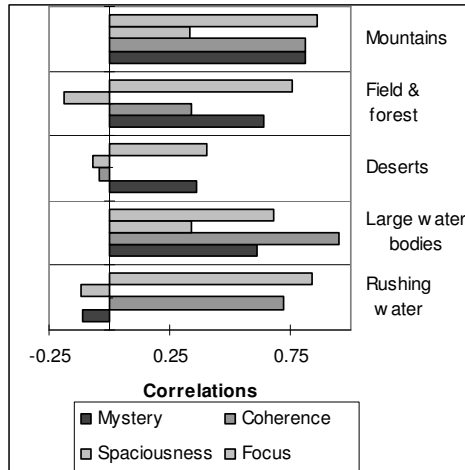
Source: Herzog and Bosley, 1992
Figure 2.3 Correlations of preference and variables

Correlations between the descriptor variables and preference for the landscapes

(Figure 2.3) evaluated indicated high correlations for coherence and, to a lesser degree, focus. Mystery and spaciousness were negatively correlated for rushing water. Not surprisingly, the authors found that the turbulence in rushing water reduced the sense of tranquillity. While turbulence can focus one's attention thereby aiding preference, it also conveys a lack of calmness which depresses tranquillity.
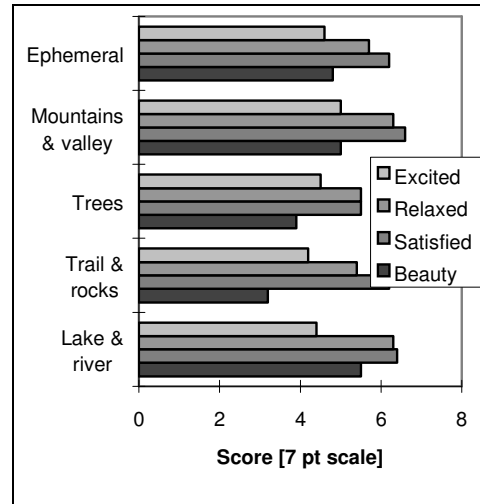
Source: Hull & Stewart, 1995
Figure 2.4 Feeling states along trails

Using tape recorders and visitor photography, Hull & Stewart, 1995 surveyed trail users on the views they encountered. Feeling states were recorded by participants *en route* and were classified thus: beauty, satisfied, relaxed, and excited. Figure 2.4 summarises the average rating of these. It indicates that the water bodies contributed most in terms of beauty and were also rated high for satisfaction and relaxation. However they ranked lowest for excitement which probably reflects the placid types of lake and river encountered.

Table 2.3 Features viewed from road in Rockies

Positive rated scenes		Negatively rated scenes	
evergreen forest	86.9%	billboards	78.3%
high mountains	80.5%	commercial bldgs	62.6%
waterfalls/rapids	72.9%	industry & railroads	51.8%
ocean	66.4%	swamps & marshes	49%
parks & recreation		scrubland	46.9%
	53.1%	deserts	44.3%
swift rivers	52.5%	suburban houses	43.2%
snow & glaciers	51.4%		
cliffs, capes, rocks	49.9%		
canyons	46.3%		
harbors/waterfront	46.1%		
beaches	44.0%		

Source: Jones, *et al*, 1976

Jones *et al*, 1976 surveyed the community on their enjoyment of views from a road through the Rockies in the state of Washington. Prominent among the positive features were natural scenes, while negative scenes included artificial features but also natural features such as deserts, wetlands and scrubland (Table 2.3). This suggests that it is not simply naturalism *per se* which influences preferences, but also the content of the scene.

Mosley, 1989 found water ranked the fifth factor in New Zealand after forests, view angle, relative relief and snow and ice. Significantly he found the river environment to be more important than the river itself in determining preferences. He found scenic attractiveness to be related to the percentage of the scene in native forest (Scenic attractiveness = 4.6 + 3.56*[% native forest]) with an r^2 of 0.41.

Palmer, 1978 reported the results of an extensive landscape research project in Connecticut River valley led by Ervin Zube. The study identified 22 landscape dimensions including water/land edge density per unit area and percentage water area per unit area. About 50% of the variation in scenic resource value was explained by seven of these landscape dimensions. Scenic value was found to increase with naturalism, landform variation, water/land edges and the length of views. Findings related to water included:

- Farm landscapes - water area density had a major negative influence, suggesting that farm views dominated by large areas of water were not as scenic as those with smaller areas or water accents.
- Open water landscapes - scenic value increased with water/land edge and decreased as the proportion of water surface area increased.
- Wetlands and streams landscapes - scenic value increased with naturalness.

Schroeder, 1991 analysed the meaning that the Morton Arboretum in Chicago had for its many visitors. The Arboretum included water features - lake, pond, stream and river. These, together with the forest and colours were the most frequently mentioned features. Serenity was a word used to describe places with water. The "ability of trees, other vegetation, and bodies of water to function as 'natural tranquilizers' may be

one of the most significant human benefits of preserving nature...".

In his analysis of landscape photographs used in the development of a regression equation, Shafer *et al*, 1969 found through factor analysis that water features had among the highest factor loadings of any of the variables in the correlation matrix. The area of the water features - stream, waterfall and lake, yielded slightly higher loadings than the perimeter of these features. Shafer's regression equation contained ten terms and the water area featured in three of these, thereby indicating the importance of water in the landscape (Table 2.4).

Table 2.4   Shafer's predictive model of landscape preferences

$Y = 184.8 - 0.5436 X_1 - 0.0929 X_2 + 0.002069 (X_1 . X_3) + 0.0005538 (X_1 . X_4) - 0.002596 (X_3 . X_5) + 0.001634 (X_2 . X_6) - 0.008441 (X_4 . X_6) - 0.0004131 (X_4 . X_5) + 0.0006666 X_1^2 + 0.0001327 X_5^2$

where: Y = preference
       X_1 = perimeter of near vegetation
       X_2 = perimeter of middle distant vegetation
       X_3 = perimeter of distant vegetation
       X_4 = area of near vegetation
       X_5 = area of any kind of water
       X_6 = area of distant non-vegetation

Note: negative items contribute positively, while positive items contribute negatively (i.e. the lower the score the better the landscape).

Urlich's, 1981 study found that while attentiveness declined regardless of the environment viewed, "the drop was significantly less when the scenes contained water". He considered that water had "greater attention-holding properties". He also found that whereas scenes of urban areas increased feelings of sadness, that water had a stabilising effect on emotions and in particular sharply reduced feelings of fear.

Yang and Brown, 1992 found the most preferred scenes to be those with a dominance of water and a Japanese garden style. Reflections across the water of surrounding trees were a common feature. In contrast to other researchers who used photographs, Brown and Daniel, 1991 used 12 second video clips to capture the dynamic nature of streamflow not apparent in still photographs. Although the study focussed on the influence of streamflow

volume to scene quality, the researchers took care to ensure that this was not apparent. Paired comparisons were used, one showing a higher streamflow than the other, and the respondent choosing the most attractive. Regression analysis was used to analyse the influence of a range of variables in the landscape estimated from the video scenes. These included the proportion of sky, water, exposed riverbed, stream channel width and vegetation in the scenes.
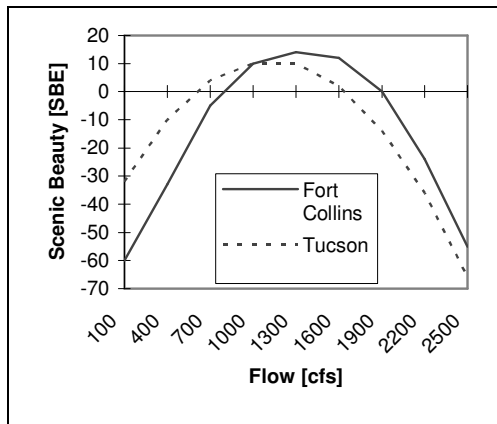
Source: Brown & Daniel, 1991

Figure 2.5 Influence of river flow on scenic beauty

The results indicated that scenic beauty increased with stream flow to a mid point and then diminished (Figure 2.5). In two groups sampled, the scenic beauty was maximised at 1285 cubic feet per second [cfs] in the Fort Collins case and 1092 cfs in the Tucson case. Scenic beauty ratings for low flows at 100 cfs were similar for high flows at 2000 cfs (all p < .001).

The findings indicated that flow quantity influences riparian scenic beauty up to a point and then decreases at higher flows. This finding was consistent across a wide range of vegetation, topographic and scene compositions. This suggests that in respect of the slow flowing River Murray, that scenic quality will be lower than if the river was faster flowing.

Summary - Influence of water on landscape preferences

It is evident from the range of studies that water has a profound effect on landscape preferences. The studies reported that scenic value increased with:

- Water edge (Anderson *et al*, 1976; Palmer, 1978; Whitmore *et al*, 1995);

- Water area (Anderson *et al*, 1976; Brush & Shafer, 1975);
- Channel stability & depth are important factors in river scenic quality (Gregory & Davis, 1993)
- Moving water (Craik, 1972; Dearinger, 1979; Hammitt *et al*, 1994; Whitmore *et al*, 1995, Brown & Daniel, 1991)

Factors which were found to decrease the scenic value of water included pollution and waterlogging (Choker & Mene, 1992), water colour (Gregory & Davis, 1993), and litter, erosion, water quality and structures (Nieman, 1978). Interestingly Hodgson & Thayer, 1980 found that water bodies labelled as artificial rather than natural (e.g. reservoir instead of lake) scored lower than natural labels.

Serenity and tranquillity contrasting with awe and arousal were found to be psychological factors deriving from water bodies (Gobster & Chenoweth, 1989; Herzog & Bosley, 1992; Schroeder, 1991). Water held one's attention and had a stabilising effect on emotions (Urlich, 1981).

Why is water an important landscape element ?

Given the importance of water in the River Murray study, it is worth asking why water is such a significant landscape element.

While the studies have established the importance of water in the landscape they offer little explanation of the reasons for this importance. Is it simply, as Bourassa, 1991 noted, that humans have consistently had a need "to remain fairly close to bodies of water because humans need a constant supply of fresh water". However this fails to explain human delight in the sea, which is not fresh water.

It is noteworthy that in a significant textbook *Water and Landscape - an aesthetic overview of the role of water in the landscape*, Litton *et al*, 1974 approached the subject from a landscape architect's viewpoint and offered no discussion on the role that water might play in the human psyche. However, other literature provides some discussion of this.

Herzog, 1985 provided a useful review of the information processing approach to water preferences. Given that water is essential for survival and that the key tenet of the information processing approach is that "humans evolved in environments wherein the

processing of spatial information was crucial to survival", it would be expected that the preference for water therefore lies in its survival enhancing qualities. Good quality water, i.e. fast flowing or large bodies of water would be preferred over swamps and small ponds.

Herzog's findings about the preferences for different water bodies support this. He concluded from his study that the "results confirm the general usefulness of the informational approach in accounting for waterscape preferences." Based on the results, he suggested that clarity and freshness of water, as embodied in mountain lakes, and rushing water, are highly valued.

Urlich, 1983 however suggests that the appeal of water may be partly biologically-based and largely independent of informational characteristics. Earlier Urlich, 1977 suggested that water may serve:

"as a focal element and by enhancing subjective depth. The major preference effects of water, however probably stem more from content *per se* than from informational factors."

The Kaplans, 1989 noted that the appeal of water was not just as a pretty picture - people loved to live near water and many recreation activities involved water.

Ryback and Yaw, 1976 traced the historic value of water as a sacred element, noting the importance of springs to the Greeks; the mythical "fountain of youth" and "water of life" notions, with the concept of Eden being associated as a place of eternal spring. The Christian sacrament of baptism symbolises purification and rebirth and fountains have been symbols of purity. The practice of throwing coins in fountains for a wish or good luck may have developed from an appeasement to the gods of the waters.

Whalley, 1988 reviewed the importance of water as a landscape element in the gardens of history.

A further idea relates the preference for water to its utility value (transport, fishing, recreation, industry etc), but this use is unrelated to aesthetic preferences. One uses a road, a mineral, air or land for a variety of purposes without any feeling of aesthetic delight being associated with its use. While the ever changing appearance of water (changing light,

sparkling, smooth or rough) contributes to its enjoyment, it is insufficient of itself to substantiate the strength of preference for water. Clouds exhibit similar changeability, and consist of water vapour, but they do not stimulate the same level of preference apparent for liquid water.

Most theories about human landscape preferences rely on an evolutionary perspective (Orians 1992, Appleton 1975, Urlich 1991, Kaplan & Kaplan, 1989) that humans prefer that which is survival enhancing. Stephen Kaplan expressed it thus:

"Aesthetic reactions reflect neither a casual nor a trivial aspect of the human makeup. Aesthetics is not the reflection of a whim that people exercise when they are not otherwise occupied. Rather, such reactions appear to constitute a guide to human behaviour that has far-reaching consequences." (Kaplan, S., 1987)

The various explanations - information processing, evolutionary, cultural, historical, and utility, all fail to explain sufficiently the depth of attachment and affinity which humans have for water and the positive role it plays in landscape preferences.

For example, the survival theory fails to discriminate between fresh water and undrinkable seawater despite cues such as sandy beaches and the smell of salt laden air. The dislike of polluted and stagnant water can be due to factors such as smell, concern about health and mosquitoes.

The definitive explanation of why water exerts such a powerful influence on human landscape preferences has yet to be made.

2.2 LANDSCAPE AESTHETICS

This section examines some of the theoretical aspects of landscape aesthetics.

(1) Affective basis of aesthetic preferences

Following from the preceding review of studies of the influence of water on landscape preferences, the nature of aesthetics is described to assist in understanding why the approach used in this study was selected.

Aesthetics is not an attribute that can be measured in the way that physical characteristics of the landscape can be measured. This is because aesthetics is an

affective quality. Dictionaries reinforce this in their definition of aesthetics: "things perceptible by the senses as opposed to things thinkable or immaterial (Shorter Oxford, 1973), and "pertaining to the sense of the beautiful or the science of aesthetics" (Macquarie, 1981).

Aesthetics derives from the affects or preferences of individuals. Affects do not derive from cognitive analysis. An individual's liking of a composer derives from their liking for their music, not from an analysis of the composer's competency as a composer, his or her use of instruments, his or her scoring for the orchestra etc. The individual knows immediately whether or not they like a piece of music, although sometimes a piece may grow on the individual and he or she comes to like it. But it still derives from the individual's preferences, not from cognitive analysis. Similarly a person's liking of another person derives from intuitive preferences, not from cognitive reasoning.

Preferences for landscape do change over time but are remarkably stable. The shift that occurred at the start of the 17th century transformed the Western view of mountainous landscapes, from features regarded as the haunts of devils, uncouth areas fit for the scrap heap[5], to features in which we delight. In *Mountain Gloom and Mountain Glory*, Margaret Nicolson (1959) traced the revolutionary change that occurred in the space of a generation in Western attitudes to mountainous areas which led to the contemporary love of mountainous landscapes.

More recently the wilderness movement has influenced landscape preferences by heightening an appreciation of natural areas compared with areas where human influence is evident. In my study of South Australian landscape preferences, naturalness was second only to diversity as a predictor of landscape preferences (Lothian, 2000).

The affective model of preference is based on the premise that emotional (i.e. affective) responses to landscapes occur before cognitive information processing. With the

development of cognitive psychology in the 1960s, affects were regarded as products of cognition, i.e. they were post-cognitive. In a widely quoted paper, *Feeling and thinking, preferences need no inferences,* R.B. Zajonc (1980) argued against affect being post-cognitive and provided experimental evidence that discriminations (like-dislike) could be made in the complete absence of recognition memory. He argued that preferences preceded cognition. He concluded that affect and cognition were:

> "under the control of separate and partially independent systems that can influence each other in a variety of ways, and that both constitute independent sources of effects in information processing."
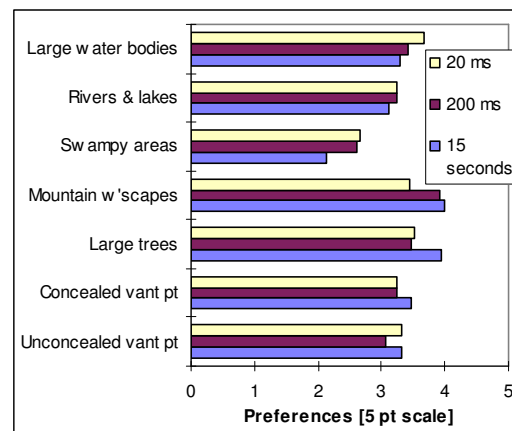
Source: Herzog, 1984 & 1985
Figure 2.6 Effect of viewing times on preferences

Preferences are registered extremely quickly which supports them being pre-cognitive. Herzog (1984, 1985) used scenes which respondents viewed for 20 milliseconds (i.e. 1/50 sec) or 200 milliseconds (i.e. 1/5 second) and compared the responses with 15 seconds. As Figure 2.6 indicates the ratings, though not identical, were very similar. The instantaneous rating of what we like and dislike is obviously a skill that everyone possesses.

(2) Theories of landscape aesthetics

Theories of landscape quality, which seek to explain *why* we like what we like rather than simply describing *what* we like, all derive from an evolutionary perspective. These theories essentially argue that landscape preferences are survival enhancing. Human preferences are moulded by what enhances our capacity to survive as a species. These theories are summarised briefly below.

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5. A typical description of the European Alps, by John Evelyn who crossed them in 1644: "which now rise as it were suddainly … as if nature had here swept up the rubbish of the Earth in the Alps, to forme and cleare the Plaines of Lombardy." (Nicolson, 1959)

G.H. Orians, an evolutionary biologist, proposed the *habitat theory* with the biological imperative for humans to "explore and settle in environments likely to afford the necessities of life …" (Orians & Heerwagen, 1992). He focussed on the African savanna which contains scattered trees amongst extensive grassland and is believed to be the environment in which humans evolved. He argued that there would be a strong preference for this type of environment. Using the characteristic shape of the acacia trees present he found strong human preferences for these trees.

Similar environments are found in our public parks comprising extensive lawns and isolated trees. Our gardens and backyards often reflect this form which reinforces Orians' case.

Jay Appleton proposed the *prospect-refuge theory* in which landscapes are preferred which enable one to see without being seen; they provided places (prospects) where one could spy out game, the enemy or other objects, while also providing places (refuges) in which to hide. However when these ideas were tested empirically, the proof has not been compelling (Clamp & Powell, 1982, Nasar *et al*, 1983). While prospects tend to correspond with the appeal of mountains and trees, refuges (e.g. caves) tend to be regarded negatively.

Roger Urlich proposed the *affective theory* in which natural settings and landscapes produce in their viewers, emotional states of well-being. Measured on a like-dislike dichotomy, it correlated closely with scales such as beautiful – ugly or scenic quality scales. A disciple of Zajonc's view that preference is pre-cognitive, Urlich provided supporting evidence from preference studies. He proposed that:

> "immediate, unconsciously triggered and initiated emotional responses - not 'controlled' cognitive responses - play a central role in the initial level of responding to nature, and have major influences on attention, subsequent conscious processing, physiological responding and behavior" (Ulrich, *et al*, 1991)

Using various physiological measures of brain activity and of feelings, Urlich has found that urban scenes without trees or natural objects produced negative feelings while scenes of nature provided positive feelings, and that these produced physiological benefits. In a study of hospital patients, for example, he found that those patients with a view of trees recovered more quickly and required fewer analgesics than those without this view (Urlich, 1984).

The overarching theory of environmental perception is information processing theory which has been applied in the field of landscape aesthetics by Stephen and Rachel Kaplan. They suggested that in extracting information from the environment, humans sought to *make sense* of the environment and to *be involved* in it. They have identified four predictor variables: *coherence* and *legibility* help one understand the environment, while *complexity and mystery* encourage its exploration (see Figure 2.2).

Coherence and complexity involve minimal analysis and are registered immediately while legibility and mystery require more time and thought. Research of these has found that coherence is the strongest predictor and mystery, the most consistent.

Studies of the Kaplans' information processing model that have been conducted provide support for its elements (e.g. Herzog, Table 2.1). There would appear however to be a considerable degree of interpretation required in the application of these four predictor variables in the landscapes studied. The nebulousness of the concepts involved suggests that they are still evolving and this is likely to continue for some time.

Stephen Kaplan describes the theory as an evolutionary view based on habitat theory, with human preferences deriving from the adaptive value offered by particular settings (Kaplan, 1987). He regarded preferences as:

> "An intuitive guide to behavior, an inclination to make choices that would lead the individual away from inappropriate environments and towards desirable ones"

An evolutionary perspective, in which preference aids the survival of the individual, led Stephen Kaplan to conclude:

> "Aesthetic reactions reflect neither a casual nor a trivial aspect of the human makeup. Aesthetics is not the reflection of a whim that people exercise when they are not otherwise occupied. Rather, a guide to human behavior that has far-reaching consequences." (Kaplan, S., 1987)

Brown & Itami, 1982 built on the Kaplan model to propose a model which related scenic resource values to landscape preference components (Table 2.5).

Table 2.5 Models by Kaplan, Brown & Itami

Kaplan model:

	Making sense	Involvement
Visual array	Coherence	Complexity
3-D space	Legibility	Mystery

Brown & Itami model:

	Making sense	Involvement
Visual array	Slope	Spatial diversity
	Relative relief	Relief contrast
3-D space	Naturalism	Height contrast
	Compatibility	Internal variety

The Brown & Itami framework comprised two inter-related systems - the natural (land form) and cultural (land use). These described the physical components. Landform reflected the permanent "immutable" components and the cultural system was reflected by the land use and land cover pattern. This model was used by Edwards, 1987 in his assessment of the Kangaroo Island coastal landscape.

Clearly a robust theory of landscape which provides an all encompassing framework with which to understand and to predict landscape preferences does not currently exist. At present there are a range of theories which offer explanations of aspects of landscape preferences but which fall well short of a definitive explanation.

(3)   Influence of culture on landscape preferences

Cross-cultural studies of landscape have indicated that landscapes were rated similarly regardless of the cultural origins of the participants. Studies of the influence of culture on landscape preferences include the following.

Hull and Revell, 1989 found the level of agreement regarding the scenic beauty of Bali among the Western tourists was significantly higher (correlation of 0.86) than among the Balinese (0.79) which was surprising given that they came from many countries. They considered that the Balinese who had been exposed to Western culture for decades might have adopted western values. Overall they concluded that despite the "enormous differences which exist between the Balinese and western culture" that "the results suggest that there was perhaps more similarity than difference between the two groups in their scenic evaluations" of the Balinese landscape.

Purcell *et al*, 1994 compared the responses by Italian and Australian students to photographs of landscapes from both countries. Preferences by the Italian participants were generally higher than by the Australian participants but the differences were only slight (Figure 2.7).
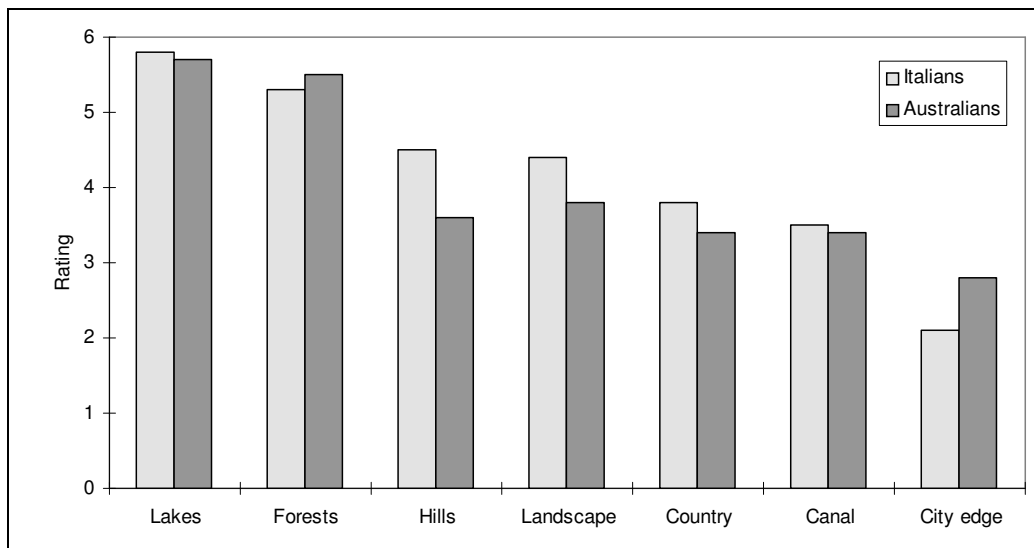
Source: Purcell *et al*, 1994.

Figure 2.7 Comparison of Italian and Australian landscape preferences
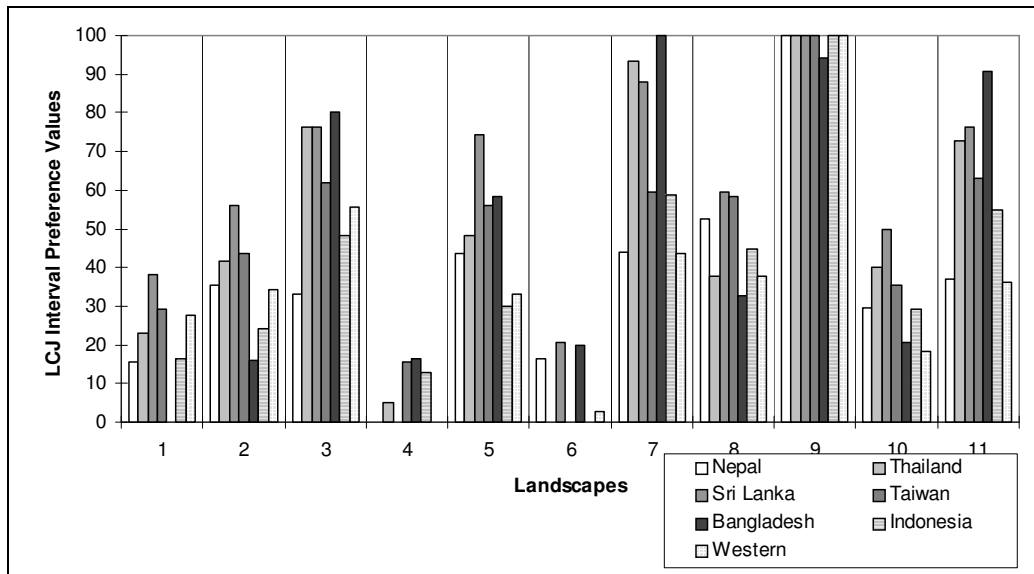
Source: Tips & Savasdisara, 1986
Figure 2.8 Preference values for eleven landscapes

Figure 2.8 indicates the preference values obtained by Tips & Savasdisara, 1986 from people from a range of national backgrounds. They found, with some exceptions, a reasonable degree of similarity across different nationalities.

These and similar studies suggest that human preferences for landscape are deep seated, deriving from past human development. While culture has some influence, the core of our aesthetic preferences is innate.

(4)   Individual differences in landscape preferences

Many studies have examined the influence of respondent characteristics such as age and gender on landscape preferences and have generally found there to be little difference.

Among the findings:

- Age generally had little effect, the exception being young children whose preferences differed markedly from adults
- There were slight differences between genders in the types of landscapes preferred
- Education, employment and socio-economic status appeared to have nil or negligible influence on preferences

Studies that the author has undertaken (Lothian, 2000; 2003; 2004, 2005a and 2000b)

support these conclusions; overall the similarities in preferences across respondents were greater than the differences. This is illustrated by Figure 2.9 which indicates the similarity of average preferences across the differing age, gender, education and birthplace (i.e. born inside or outside of Australia).

Familiarity is one component of observer characteristics which does appear to influence preferences. Some studies have found a direct correlation between familiarity and preferences (e.g. Hammitt, 1979). Nieman, 1980 examined the landscape preferences of residents near the Long Island coast and the Great Lakes shore and found they strongly preferred the environment with which they were most familiar (Figure 2.10). Similar results were found when respondents were asked which coastal area they would most prefer to live - in both cases, 82% preferred to live where they were rather than in the other location.

In my study of South Australian coastal landscape quality(Lothian, 2005a), the author found that being *familiar* with the region increased ratings by, on average, nearly 2% and being *very familiar* increased ratings by 4.4% (Figure 2.11).
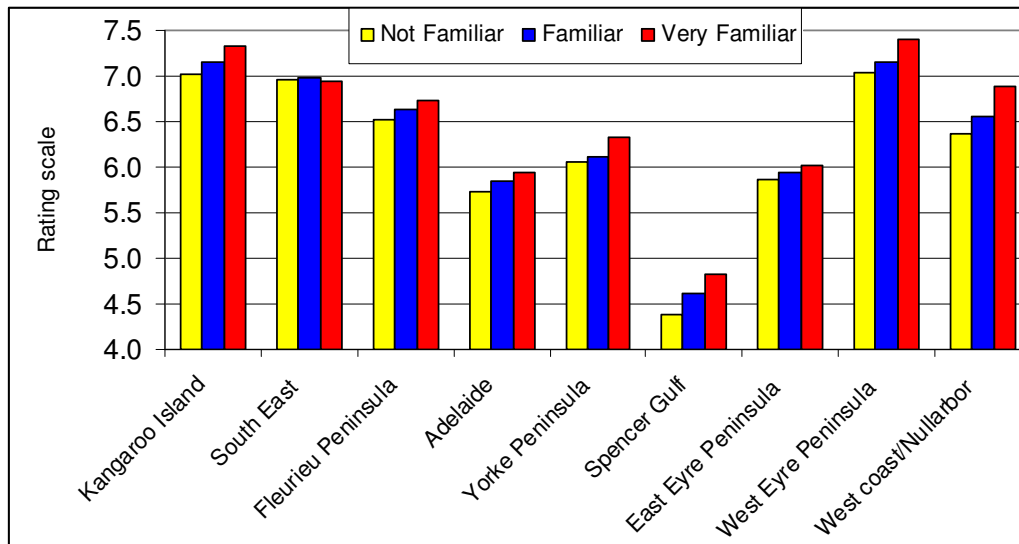
Generally if respondents do not normally respond positively to a scene, familiarity will not alter this, however where a scene elicits a positive response, this will be reinforced and even increased by familiarity.
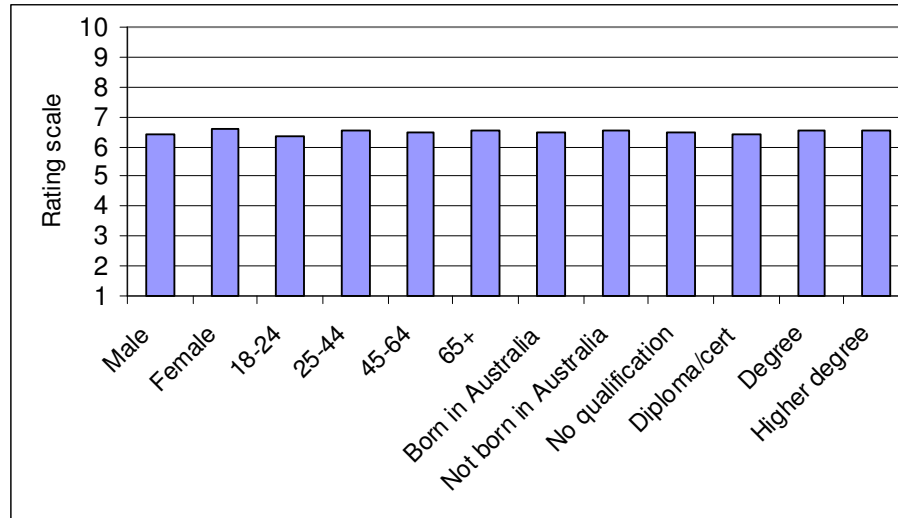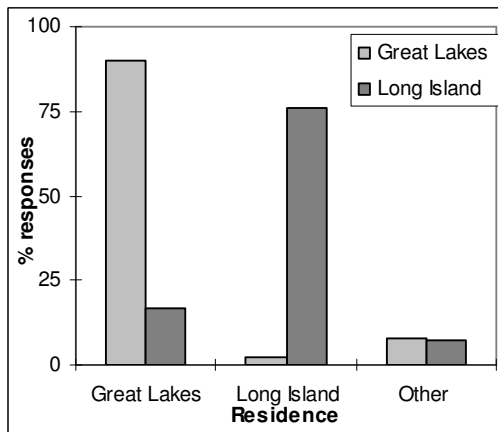
Source: Lothian, 2005a
Figure 2.9 Mean average ratings by participant characteristics

Source: Lothian, 2005a
Figure 2.11 Influence of familiarity on coastal regional ratings

Source: Neiman, 1980
Figure 2.10 Preferences vs familiarity

2.3 USE OF PHOTOGRAPHS IN LANDSCAPE SURVEYS

Photographs of scenes are generally used in ascertaining the preferences of participants. These have obvious advantages over transporting large numbers of people into the field to visit widely dispersed locations. It would be clearly impractical to take 300+ people along the length of the River Murray, Lakes and Coorong for the purposes of rating scenic quality. However the issue is whether photographs can be relied upon as substitutes for field assessments.

There have been many studies of this issue and their overall finding is that providing the

photographs meet certain criteria then the ratings gained from them will not differ significantly from ratings gained in a field situation. Some of these studies are summarized below.

Zube, *et al*, 1975 reported on a series of studies including the responses from field vs surrogate assessments. Using a range of techniques (semantic scales, rank order and Q-sort) and groups of field and non-field populations, they found high correlations between field and non-field assessments. Comparing the field and non-field evaluations for eight views, the average R^2 was 0.92.

Daniel and Boster, 1976 used their Scenic Beauty Estimation (SBE) method to compare results produced by on-site vs slide judgements of forest landscapes. The SBEs derived from on-site judgements were generally slightly lower (i.e. based on the scale used, the scenes were judged to be of higher quality) than those derived from slide judgements. The correlation coefficients were highly significant statistically.

Table 2.6 Comparison of field and laboratory assessments

Group	Mean value	Mean deviation	Range of variation
Basic group - field	56.9	6.8	44 - 63
- laboratory	56.1	7.8	42 - 65
Comparison group - lab	55.1	8.2	43 - 63
City dwellers - lab	55.9	10.2	40 - 66
City dwellers - lab	54.0	9.4	40 - 65

Source: Kellomaki and Savolainen, 1984

Kellomaki and Savolainen, 1984 used a variation of the semantic differential method to assess the scenic values of selected tree stands in Finland. Three groups of participants evaluated the scenic values:

- a Basic Group of forestry students assessed the scenic values in the field and laboratory
- a Comparison Group, also students, assessed the values only in the laboratory
- 2 groups of City Dwellers only assessed the values in the laboratory

The results indicated very close assessments between the three groups (p<.01) (Table 2.6). While only one group rated the scenes in the field, the mean value of their assessment was only marginally higher than the laboratory assessments but their range of variation was slightly less.

A definitive study on the use of photographs as a surrogate for field observations was undertaken by Shuttleworth, 1980. Being concerned that many of the studies that had examined this issue used different populations to assess the sites and the photographs, Shuttleworth used the same group in both situations.

His study used landscapes in rural areas and on the urban fringe (East Anglia, England). Colour and black and white prints were used as surrogates. Semantic differential (SD) and bipolar scaling techniques were used. The sample population of students (n = 93) was divided into two groups all of whom visited all the field sites and half viewed the colour and half the b/w photographs. Various techniques were used to ensure randomness (e.g. changing the sequence of field vs photograph assessments) and to enable within-group and between-group analysis.

Shuttleworth found no differences between groups in responses to landscapes in the field and found little difference in responses to the photographs. However he did detect distinctly more differences between responses to b/w photographs and field views than between colour photographs and field views. He found that with b/w photographs, participants tended to "make much more definite and differential responses by reinforcing likes and dislikes; responses to them thus tended far more to extremes of opinion than did responses to colour photographs".

Shuttleworth concluded that the results "indicated that there were very few differences of significance between the reactions to and perceptions of the landscapes either when viewed in the field or as photographs" with any differences being explainable by content. He proposed that photographs can be used providing they are in colour and that they are wide-angled to provide a lateral and foreground context.

In conclusion, with few exceptions, surveys have established that photographs can provide a viable surrogate for landscape, however there are slight differences in responses and certain rules should guide their use. Photographs tend to provide more objective, more dispassionate responses, while site

assessments can yield a more subjective response influenced by a range of site factors unrelated to landscape quality. Black and white photographs can reinforce likes and dislikes and produce more extreme responses than colour photographs. Generally, photographs should be in colour and provide a wide view to provide sufficient context.

2.4 SCENIC QUALITY IN NATURAL RESOURCES MANAGEMENT

A difficulty encountered in addressing scenic quality is that it has yet to be recognised as a legitimate consideration in natural resources management in Australia.

The *South Australian Natural Resources Management Act 2004* defines natural resources as including (emphasis added):

(a)   soil;
(b)   water resources;
(c)   geological features and *landscapes*;
(d)   native vegetation, native animals and other native organisms;
(e)   ecosystems;

The term "landscapes" in this definition is not defined and the Act makes no further reference to it.

The objects of the Act are aimed at the achievement of ecologically sustainable development in a manner that –

(a) recognises and protects the intrinsic values of natural resources

Intrinsic values, which are assumed to include scenic values as well as Aboriginal values, wilderness values and cultural heritage, are thus recognised by the Act.

In early 2006, the Draft State Natural Resources Management Plan was released[6]. Landscape was defined in the Plan as an area of ecosystems and land uses but omits any reference to aesthetic and cultural content. The Plan's goals refer to landscape scale management, prosperity, ecological sustainability, and integrated management but omits any reference to community values. The Federal Agency responsible is Land and Water Australia. The Land and Water Australia website includes a comprehensive description

of Riverine Landscapes (www.rivers.gov.au). The site describes extensive programs covering rivers in Australia but there is little mention of aesthetic values. The programs include:

• National Rivers Consortium
• National Riparian Lands R&D Program
• National Rivers Contaminants Program
• Environmental Water Allocation Program
• Tropical Rivers Program

The programs have issued many newsletters and research reports but aesthetic values are scarcely mentioned.

However under a heading of Riparian Management, the site includes a section on scenic values:

> *The landscape setting and features of riparian country are often highly valued for their scenic amenity, providing either essential elements or a backdrop to many varied activities. These values can influence everything from real estate prices to recreational opportunities.*

This is the only reference to scenic quality.

Similarly the leading academic institution involved in riverine environments, Griffith University's Centre for Riverine Landscapes[7] omits mention of scenic values.

The Centre aims to: *gain world-wide recognition for excellence in research and education on rivers and their catchments*.

The major objective of the Centre is to undertake multidisciplinary research within the unifying context of rivers in their landscape. It aims to improve the understanding of catchment and floodplain processes that ultimately influence the physical and chemical characteristics of rivers and the way they function as ecosystems. Its research has a strong focus on aquatic biodiversity and biophysical processes and includes *consideration of social and economic issues that must also be addressed* to protect and restore rivers and floodplains (emphasis added).

Five research programs have been developed:

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6. www.dwlbc.sa.gov.au/nrm/nrmplan/ index.html accessed May 2006

5. www.gu.edu.au/centre/riverlandscapes, accessed May 2006

- Water Allocation and Environmental Flows;
- Land Management;
- Biodiversity and Conservation;
- River and Riparian Rehabilitation; and
- Ecosystem Health Assessment

None of the research programs cover the aesthetic aspects of riverine environments.

Wild and Scenic Rivers

The Wild and Scenic Rivers system in the United States is the prime example of recognition of the scenic values of rivers. Designated under the *Wild and Scenic Rivers Act, 1968*, over 150 rivers have been designated with wild and scenic status.

These rivers are protected on the basis of their "outstandingly remarkable" qualities including

scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values.
The Act requires that they:

> *shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.*

Designation does not halt use of a river; instead, the goal is to preserve the character of a river. Uses compatible with the management goals of a particular river are allowed; change is expected to happen. However, development must ensure the river's free flow and protect its "outstandingly remarkable resources." The intent of Congress was to create a national system of protected rivers that co-existed with use and appropriate development. The term "living landscape" has

Table 2.7 Classification criteria for wild, scenic and recreational river areas

Attribute	Wild	Scenic	Recreational
Water resources development	Free of impoundment	Free of impoundment	Some existing impoundment or diversion. The existence of low dams, diversions, or other modifications of the waterway is acceptable, provided the water remains generally natural and riverine in appearance
Shoreline development	Essentially primitive. Little or no evidence of human activity. The presence of a few inconspicuous structures, particularly those of historic or cultural value, is acceptable. A limited amount of domestic livestock grazing or hap production is acceptable. Little or no evidence of past timber harvest. No ongoing timber harvest.	Largely primitive & undeveloped. No substantial evidence of human activity. The presence of small communities or dispersed dwellings or farm structures is acceptable. The presence of grazing, hay production, or row crops is acceptable. Evidence of past or ongoing timber harvesting is acceptable, providing the forest appears natural from the riverbank.	Some development. Substantial evidence of human activity. The presence of extensive residential development and a few commercial structures is acceptable. Lands may have been developed for the full range of agricultural and forestry uses. May show evidence of past and ongoing timber harvest.
Accessibility	Generally inaccessible except by trail. No roads, railroads or other provision for vehicular travel within the river area. A few existing roads leading to the boundary of the river area is acceptable.	Accessible in places by road. Roads may occasionally reach or bridge the river. The existence of short stretches of conspicuous or longer stretches of inconspicuous roads or railroads is acceptable.	Readily accessible by road or railroad. The existence of parallel roads or railroads on one or both banks as well as bridge crossings and other river access points is acceptable.

been frequently applied to wild and scenic rivers[8].

Determinations are made regarding the candidate river's eligibility, classification and suitability. Eligibility and classification represent an inventory of existing conditions. Eligibility is an evaluation of whether a candidate river is free-flowing and possesses one or more outstandingly remarkable values (ORVs). If found eligible, a candidate river is analysed as to its current level of development (water resources projects, shoreline development, and accessibility) and a recommendation is made that it be placed into one or more of three classes - wild, scenic or recreational.

Under section 3 of the Act, a detailed management plan is required which defines the boundaries and classification of the river area and presents a plan for its public use, development and administration. General management principles apply to the management plan and primary emphasis is to be given to protecting its aesthetic, scenic, historic, archaeological and scientific features.

Table 2.7 defines the criteria for the three designations under the Act. The strictest criteria apply to the wild category, less restricting criteria apply to the scenic category, and the recreational category has little restriction. Different sections of the River Murray could be classified into each of these categories.

Following the passage of the Federal Wild and Scenic Rivers Act, some states in the United States have followed with State Acts and designations. These adopt the Federal classification and criteria for the rivers – e.g.

• Ohio's Scenic Rivers Act 1968 (www.ohiodnr.com/dnap/sr/ accessed May 2006)
• North Carolina Natural and Scenic Rivers Act 1989 (www.nps.gov/rivers/wsr-lumber.html accessed May 2006).
• Maryland's Scenic and Wild Rivers Act 1968 (www.dnr.state.md.us/resource planning/scenicrivers.html, accessed May 2006).

To date no Australian government has legislated to proclaim wild and scenic rivers. However in 1980, the Australian Conservation

Foundation adopted a policy on wild and scenic rivers modelled on the US system.

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8. www.nps.gov/rivers, accessed May 2006