Scenic Amenity of the Sugar Catchments: Moreton Mill Area

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for **CSIRO Sustainable Ecosystems** St Lucia

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Cover photograph: Mt Coolum (Peter Richards)

Measuring the Aesthetic Value of Ecosystems

Cultural services

Throughout human evolution, societies have developed in close interaction with the natural environment, which has shaped their cultural identity, value systems, and language (Millennium Ecosystem Assessment 2005).

Studies which aspire to understand the relationship between humans and their natural environment are increasingly looking at ways to measure the value of Ecosystem Services in order to maintain or improve the contribution of ecosystems to human well-being. These studies include the Millennium Ecosystem Assessment, established by the United Nations to assess the consequences of ecosystem change for human well-being, and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being (Millennium Ecosystem Assessment 2005). Other important contributions include work by Dr Robert Costanza and others of the Gund Institute for Ecological Economics (Costanza, d'Arge et al. 1997) and the Australian CSIRO Ecosystem Services Project (Abel, Cork et al. 2003).

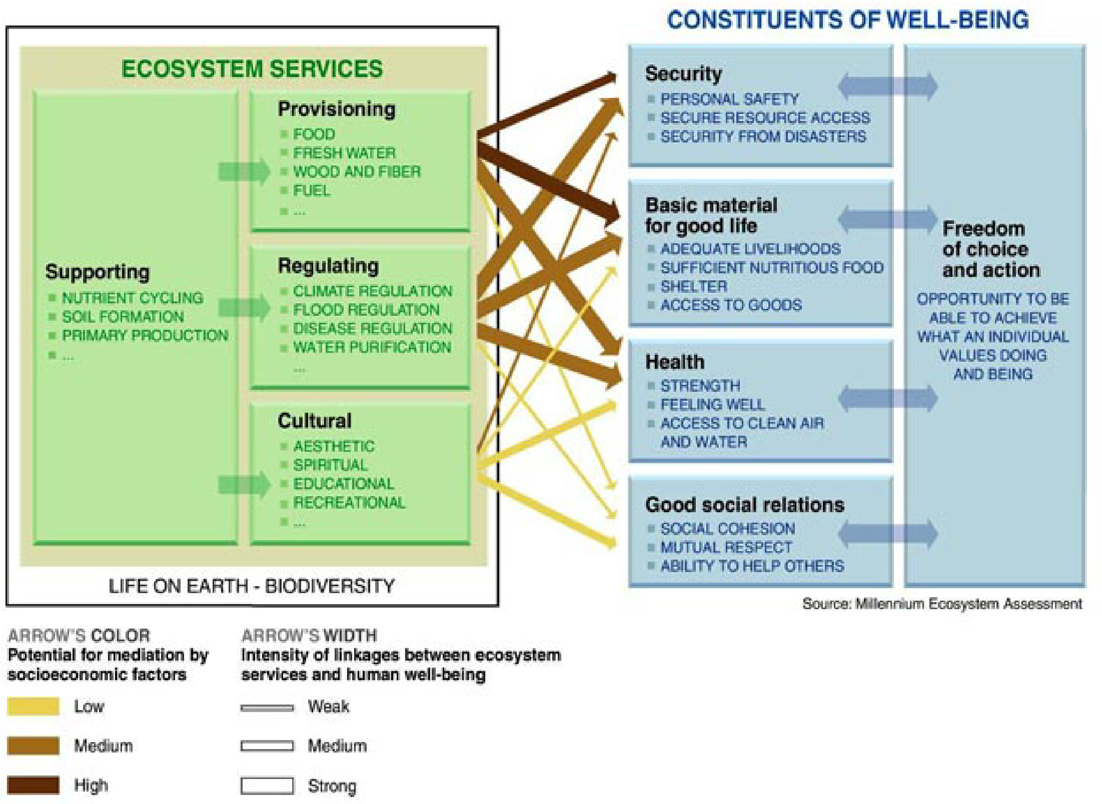


Figure 1. *Linkages between Ecosystem Services and Human Well-being (Millennium Ecosystem Assessment 2005)*

Ecosystem services (Figure 1) consist of flows of materials, energy, and information from natural capital stocks which combine with manufactured and human capital services to produce human welfare[1]. Ecosystem services include *Provisioning Services* such as food,

[1] Source: Costanza, R., R. d'Arge, et al. (1997). "The value of the world's ecosystem services and natural capital." Nature **387**.

water, timber, and fiber; *Regulating Services* that affect climate, floods, disease, wastes, and water quality; *Cultural Services* that provide recreational, aesthetic, and spiritual benefits; and *Supporting Services* such as soil formation, photosynthesis, and nutrient cycling.

Aesthetic values are one of these Cultural Services (de Groot, Wilson et al. 2002; Millennium Ecosystem Assessment 2005) which contribute to people's Security, provide Basic Material for Good Life, contribute to Health, and Good Social Relations. Other Cultural Services include cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, social relations, sense of place, cultural heritage values, and recreation and ecotourism (Table 1).

Table 1. *Components of Cultural Services (Millennium Ecosystem Assessment 2005)*

Cultural diversity. The diversity of ecosystems is one factor influencing the diversity of cultures.
Spiritual and religious values. Many religions attach spiritual and religious values to ecosystems or their components.
Knowledge systems (traditional and formal). Ecosystems influence the types of knowledge systems developed by different cultures.
Educational values. Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.
Inspiration. Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising.
Aesthetic values. Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations.
Social relations. Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.
Sense of place. Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem.
Cultural heritage values. Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.
Recreation and ecotourism. People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

In general, the contribution of Cultural Services to Human Well-being is less than the contribution of Provisioning and Regulating Services, which directly affect people's basic needs. The relative importance of aesthetic or other cultural services is influenced by the socio-economic conditions of a region and constituent demographic groups.

Because people across cultures and regions generally express an aesthetic preference for natural environments over urban or built ones, the conversion of relatively natural environments has diminished this value in particular areas. Issues such as rapid urbanisation, breakdown of extended families, and loss of traditional institutions, easier and cheaper transportation, and growing economic and social globalization have impacted on the provision of many Cultural Services. In some locations, the loss of Cultural Services from natural ecosystems has been supplanted by the creation of urban parks and other urban green space (Millennium Ecosystem Assessment 2005).

The contribution of aesthetic values to human health

In general, changes in cultural services can have strong influences on health, since they affect spiritual, inspirational, aesthetic, and recreational opportunities, and these in turn affect both physical and emotional states (Millennium Ecosystem Assessment 2005).

The most widely documented contribution of aesthetic value to human well-being is in the area of mental health and functioning (Wolf 2005). Urban living and modern work practices can lead to stress, cognitive fatigue, reduced function and more severe physical symptoms ranging from chronic fatigue to depression (Evans 2003; Grahna and Stigsdotter 2003).

The experience of nature, including the viewing of nature, provides restorative benefits such as faster recovery from illness (Ulrich 1984), restful brain activity (Ulrich 1981),and greater perceptions of well-being and neighbourhood satisfaction (Kaplan 2001).

Underlying these positive responses to nature is the theory of attention restoration (Kaplan 1995) which suggests that the mental health of people under stress will benefit from the experience of natural areas.

Metrics for recording aesthetic value

While there is considerable empirical and theoretical evidence to support the conclusion that natural environments have greater aesthetic value than urban or built environments (Berlyne 1971; Appleton 1975; Dearden 1984; Kaplan, Kaplan et al. 1989), there is also considerable diversity within what might be called ‘nature’, indeed many ‘semi-natural environments’ such as parks and agricultural landscapes have important aesthetic values (Hunziker 1995) as well as some urban environments (Im 1984).

While it is clear that natural ecosystems provide general aesthetic value and benefits to human well-being, this level of generalisation requires considerable refinement in order to isolate the contribution of specific ecosystem components. This requires consideration of a specific metric (or dependant variable) for recording aesthetic value which can then be used to assess the exact contribution of various ecosystem components (as independent variables).

In the context understanding and measuring the ecosystem services provided by particular landscapes, the challenge is to identify an appropriate metric.

Ecosystem services are commonly assessed under either a utilitarian paradigm using a financial metric (ie. monetary value) derived from application of econometric techniques. On some occasions, ecosystem services can also be valued under a social-political paradigm which ascribes a metric associated with an intrinsic value which are then protected by laws, government policies, or regulations (Millennium Ecosystems Assessment 2005).

The majority of empirical studies of aesthetic value have used a non-monetary social research approach to assess the relative influence of various landscape attributes on people’s preference for different views. These studies commonly deploy a psychometric survey instrument where people rate their preference for a selection of photographs chosen to represent various views. In some instances the study also includes a second stage which produces maps showing the relative importance of different landscape components.

Some examples of this non-monetary assessment method include: assessing the relative influence of built structures and trees in cities (Anderson and Schroeder 1983); identifying preferred elements of agricultural landscapes (Arriaza, Canas-Ortega et al. 2004); estimating scenic beauty in managed forest landscapes (Daniel and Boster 1976); comparison of preference for wilderness through to peri-urban environments (Dearden 1984); identifying affective properties of scenes that influence people’s aesthetic judgements (Galindo and Rodríguez 2000); identifying the affective and cognitive properties of the natural and built environment that affect people perception of character (Green 1999); identifying affective and cognitive factors that influence people’s visual preference (Hagerhall 2000); understanding cross-cultural responses to different landscapes (Herzog, Herbert et al. 2000); evaluating relative preferences of local residents compared to tourists (Hunziker 1995); assessing visual preference for design properties of building exteriors (Nasar 1994); understanding the perceived restorative value and familiarity of preferred scenery (Purcell, Peron et al. 2001); and understanding the influence of enclosure on preference in urban settings (Stamps and Smith 2002).

On the other hand, econometric methods have also been used to identify the monetary value of different views using methods such as hedonic pricing (Benson, Hansen et al. 1998; Bourassa, Hoseli et al. 2003), contingent valuation (Quah and Tan 1999), and travel cost methods (Adamowicz, Louviere et al. 1994). The most common method is hedonic modelling, which identifies the impact of views on property values. Bourassa (2003) reports 35 studies conducted between 1973 and 2003 which use hedonic modelling. Most of these studies report that a view has a positive impact on residential values, which ranges between 1% and 147%, depending on the quality of the view (Bourassa, Hoseli et al. 2003).

Both psychometric and econometric modelling approaches have strengths and weaknesses for the appraisal assessing the ecosystem service of aesthetic value. The main obvious strength of econometric approaches is that they provide a monetary value, and are then potentially comparable to other ecosystem services based on a monetary value.

The main limitation of econometric approaches is that available data from hedonic pricing, contingent valuation, or travel cost studies, only provides a surrogate value for the "real" benefits of aesthetics, particularly when it comes to aggregating individual values to a socially and geographically relevant unit (Farber, Costanza et al. 2002). Econometric data about ecosystem services is ideally 'scale independent' – that is, it can be translated from the scale it was collected at to a larger or smaller scale, in a straight forward way through simple addition or subtraction (Millennium Ecosystems Assessment 2005). Scale-dependant econometric data can also be used, provided that scaling rules or models are also available.

Some psychometric studies of aesthetic have given great attention to this question of scale independence because of the importance attributed to producing resource maps. Of particular relevance, is a 'scenic amenity' approached for aesthetic assessment that has been developed as a planning and management tool in South East Queensland, Australia. Scenic Amenity is defined as "a measure of the relative contribution of each place in the landscape to the collective community appreciation of open space, as viewed from places which are important to the public" (Preston 2001).

While some aspects of the scenic amenity method are near-identical to other psychometric rating methods, it has been modified in three ways to provide a scale independent and aggregated index of benefit to the community derived from aesthetically pleasing landscapes. These three adaptations are (a) rating scale data and models that predict preference from a viewpoint are modified to provide an index of preference for the scenery (ie. a place in the landscape) (b) the scenic amenity index is modified according to the extent that a place in the landscape is seen, and (c) the index is modified to reflect the socially accepted intrinsic value of high quality landscapes. These adaptations are discussed in greater detail below.

The scenic amenity instrument is also aligned to government policies for south east Queensland to protect areas with high scenic amenity (Office of Urban Management 2005). Scenic amenity assessments have now been incorporated into two local government planning schemes in south east Queensland (ie. Caboolture Shire and Esk Shire).

In conclusion, while scenic amenity does not yet ascribe a monetary value to ecosystems, this methodology does provide valid index of the aesthetic value of ecosystems to human well-being. Scenic Amenity provides what economists term 'safe minimum standard', which reflects the interaction between a political metric and a utilitarian metric (Millennium Ecosystems Assessment 2005).

The meaning of aesthetic value: Alternative perspectives

As introduced above, scenic amenity is a valid index of the aesthetic value of ecosystems to human well-being. However, the contemporary studies of aesthetic value in most planning studies have not followed a rating-scale approach to assessing aesthetic value, and instead use criteria developed by professionals to classify landscapes into either 'visual quality' classes after the 'Visual Management System' developed by the US Forest Service (USDA-FS 1974), or ‘visual character’ classes under a system developed by the UK Countryside Commission (Swanwick 2002).

Such professional assessments are inclined to regard aesthetic value as being inherent in the landscape and primarily independent of a utilitarian or community perspective (Porteous 1996). More recent evolution of the United States ‘Visual Management System’ have seen some major developments with adoption of a new ‘Scenic Management System’ (USDA-FS 1995) that places greater emphasis on public appraisals and adoption of a series of other new conventions. Many of these new procedures have yet to be embraced by practicing landscape architects in Australia (Chenoweth 2004; Brodbeck 2005).

The important distinctions between scenic amenity, other psychometric rating methods, economic valuation and professional classifications are summarised in Table 2.

Table 2. *Comparison of alternative perspectives for measuring aesthetic value*

	Psychometric rating of visual preference (subjective)	*Economic valuations using hedonic pricing*	*Professional classifications of visual quality or character (objective)*
Similarity with scenic amenity	● Both approaches use an empirical rating scale / metric to indicate value	● Both approaches use an empirical rating scale / metric to indicate value	
Difference with scenic amenity	● Do not consider the full community experience or use of views (ie. visual exposure).	● Uses a dollar / market value instead of a social metric ● Usually ascribe value to a viewpoint, not to the landscape (ie scenery) ● Do not usually consider the full community experience or use of views (ie. visual exposure).	● Classifications of Visual Quality provide a coarse classification of relative value (high, medium, low) ● Classifications of Visual Character do not provide any indication of relative value. ● Usually consider people’s experience / use of views to be independent of overall aesthetic value. ● Usually give secondary consideration to community preferences.

Scenic amenity method

The scenic amenity method is based on the calculation of two factors: scenic preference – a measure of the relative contribution of community preference for scenic areas, and visual exposure – a measure of the relative visibility of different parts of the landscape (Preston 2001). These two factors are combined using a look-up table which has been iteratively refined since the first scenic amenity in 2001. The most recent version of this table (Figure 2) has been applied to the assessment of regional scenic amenity for Brisbane (Flavell *pers comm.*).

This table illustrates that Scenic Amenity rating increases with Scenic Preference. Scenic Amenity also increases with higher levels of Visual Exposure where Scenic Preference is greater than 4, and Scenic Amenity decreases with higher levels of Visual Exposure where Scenic Preference is lower than 4. This change-over at the preference rating of 4 reflects people’s positive response to landscapes with a rating of 5 or more, and people’s negative reports to landscapes with a rating of 3 or less. The table reflects the assumption that seeing more of something with a positive response increases community benefit, whereas seeing more of something with a negative response decreases community benefit.

The table also indicates that amenity is more influenced by preference than exposure, to reflect the societal tendency to place a high intrinsic value on landscapes. Landscapes with a Scenic Preference Rating of 10 can only vary by 3 points between 8 and 10, whereas landscapes with a Visual Exposure Rating of 10 can vary 10 points between 1 and 10.

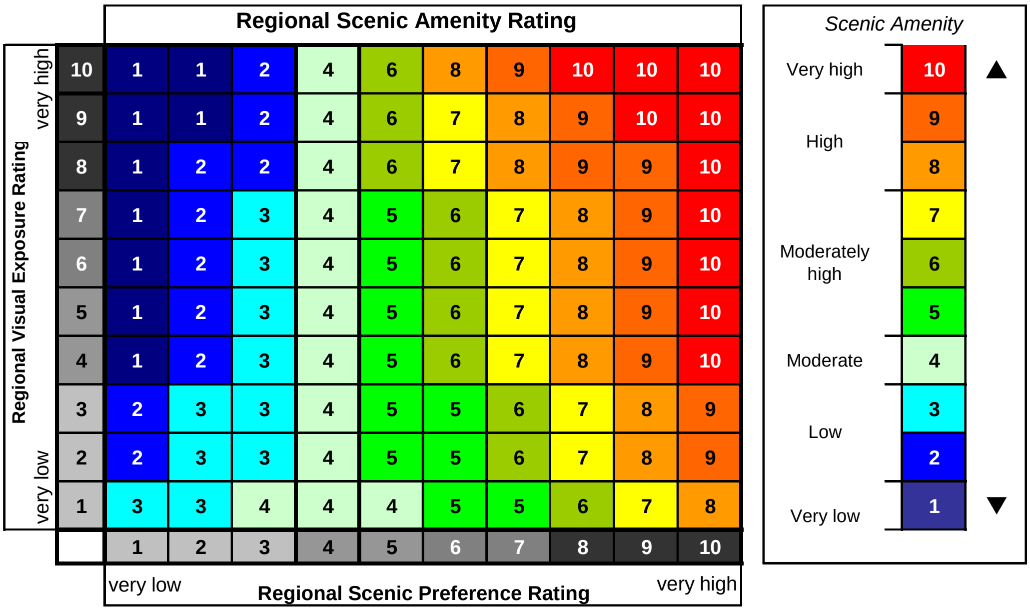


Figure 2. *Scenic Amenity Look-up Table (Brisbane City Council 2005)*

Scenic Preference

Scenic preference is recorded as a rating between 1 and 10 based on community surveys. An example of this scenic preference rating was developed by the Caboolture Shire Scenic Amenity Study and subsequently applied across the South East Queensland Region as an interim measure to identify the scenic amenity of the region (South East Queensland Regional Scenic Amenity Study 2004). As seen in **Table 3**, highest scores were allocated to beaches and water (9, 8), and lowest scores were allocated to Electricity corridors and earthworks (3,1).

Table 3. *Interim Scenic Preference Ratings applied to the SEQ Region (South East Queensland Regional Scenic Amenity Study 2004)*

	Scenic Preference Rating			
		Topographic Steepness		
Land cover		*Flat and Low slope*	*Moderate slope*	*Steep slope*
Sandy beach	9			
Rivers, creeks, dams	8			
Ocean	8			
Eucalypt forest or rainforest		7	7	8
Native plantations		7	7	8
Mangrove forest	7			
Melaleuca forest	7			
Sedgelands	7			
Open parkland	7			
Muddy beach	7			

	Scenic Preference Rating			
		Topographic Steepness		
Land cover		*Flat and Low slope*	*Moderate slope*	*Steep slope*
Grassland (Pastures, low native veg)		6	7	8
Pine forest	6			
Crops	5			
Industrial farming	5			
Parkland with buildings	5			
Rural - residential	5			
Electricity corridor	3			
Earthworks	1			

Visual Exposure

The second measure, Visual Exposure, reflects the relative visibility of landscape areas as seen from public viewing locations, taking into the estimated number of people who visit the location and time they approximate time they would spend looking at the view. It is calculated in a 4 step process as follows:

1. Identify viewing locations. Estimate number of viewers and viewing duration for each point.
2. Divide landscape into cells (eg 25m) and record its location, height, and land cover.
3. Calculate the total time each landscape cell is seen from all viewing locations
4. Divide the landscape into 10 classes with equal area.

The first stage in this process helps to identify the viewing locations that have greatest influence on Visual Exposure. For example, a study of visual exposure for Brisbane (Brisbane City Council 2002) indicates that the most important type of viewing locations are highways (29,416 minutes per viewpoint), by virtue of the high number of people that use the highway each day **Table 4**. This is despite a very conservative estimate of the mean viewing time per person for a point on a highway (0.01 minutes per person).

Table 4. *Mean viewing time for different types of viewing locations (Brisbane City Council 2002)*

Type of viewing location	*Mean Viewing Time per Person* *(mean viewing time in minutes)*	*Mean no. people per day*	*Total Viewing Time per Viewpoint* *(no. people x mean viewing time)*
Highways	0.01	2,941,600	29,416
Major tourist routes	0.03	327,533	9,826
Other major roads	0.02	388,200	7,764
Lookouts	4.25	326	1,385
Tourist routes	0.02	67,800	1,356
Low volume tourist routes	0.01	73,200	732
Commuter ferries	0.10	720	72
Water cruises	0.20	180	36
Bikeways	0.17	194	33

The second stage involves mapping the height and density of Land Cover above the ground surface for each landscape cell. This informant is critical to the next stage which assesses the visibility of each cell from each viewing location.

The third modelling stage calculates the total time each landscape cell is seen from all viewing locations, taking in to account the distance between the landscape cell and the viewing location, the number of people estimated to visit the location, the estimated viewing duration (above) and the effect of intervening topography or land cover.

One of the greatest impacts on Visual Exposure is the height and density of objects adjacent to viewing locations such as sound barriers, buildings or dense vegetation. The presence of such tall and dense objects is to increase the Visual Exposure of these objects near the viewing location, and to reduce the Visual Exposure of distant landscapes, such as mountains.

The effect is modelled using estimated visibility attenuation factors for each land cover type, (**Table 5**). For example, the visibility at 500m across crops is assumed to be 90% of the visibility at 0m from the viewing location. However at 200m through dense forest the visibility falls to 0 at 200m from the viewing location.

Table 5. *Visibility attenuation for different Land Cover Types*

		Distance from viewing location (m)								
Land cover	*Decay factor*	*0m*	*25m*	*50m*	*75m*	*100m*	*200m*	*300m*	*400m*	*500m*
Water	1.000	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cropping	0.995	100%	100%	99%	99%	98%	96%	94%	92%	90%
Bare soil	0.995	100%	100%	99%	99%	98%	96%	94%	92%	90%
Pasture	0.975	100%	98%	95%	93%	90%	82%	74%	67%	60%
Low density trees	0.900	100%	90%	81%	73%	66%	43%	28%	19%	12%
Dense trees	0.750	100%	75%	56%	42%	32%	10%	3%	1%	0%
Urban	0.600	100%	60%	36%	22%	13%	2%	0%	0%	0%
Very dense trees	0.500	100%	50%	25%	13%	6%	0%	0%	0%	0%

During the final modelling step 4, the landscape is then divided into 10 classes of equal area as depicted in Table 6.

Table 6. *Visual Exposure Map has 10% of the land area*

	Least visible									*Most visible*
Class no.	1	2	3	4	5	6	7	8	9	10
Percent of landscape	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Cumulative %	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Previous studies

The scenic amenity methodology has been applied in 6 case studies at Moggill (Brisbane City Council 1999), Glen Rock (Department of Natural Resources 2001), the Lockyer Valley (Gatton Shire Council 2002), Caboolture (Caboolture Shire Council 2003), South East Queensland (South East Queensland Regional Scenic Amenity Study 2004) and Brisbane City (Brisbane City Council 2005). More recent studies for SEQ are discussed below.

Scenic Amenity of South East Queensland

Interim Scenic Amenity maps

The Interim Scenic Amenity Maps South East Queensland (Figure 3) provides a good example of the scenic amenity mapping approach. This study found that:

- Ranges and hills covered by forests or pastures have a scenic preference rating of between 6 and 8. Sandy beaches on parts of Moreton Bay, and along the Sunshine Coast and the Gold Coast, have a scenic preference rating of 9. Farm land (crops and pasture) also contributes positively to people's appreciation of scenery.
- Areas with highest visual exposure are the mountains and hills facing populated areas and open space near major roads, beaches and the Brisbane River. Much of the open space in Brisbane City has a high visual exposure with the exception of western parts of the City in the D'Aguilar Range. Large areas in northern Esk Shire, southern Gatton Shire, Laidley Shire, and Beaudesert Shire have a relatively low visibility, as well as parts of Moreton Island.
- Areas with highest scenic amenity are the steep mountain ranges and hills, and waters of the Pacific Ocean (esp. near the Gold Coast and Sunshine Coast), Moreton Bay, and central parts of the Brisbane River. Relatively unseen areas of open space in more remote parts of the region have a lower scenic amenity rating. The interim maps also show the importance of highly visible areas of open space around urban parts of Brisbane which have a scenic amenity rating of 8 or 9.
- Approximately 5% of the open space land in SEQ has a scenic amenity rating of 10 (Figure 4). A further 14% of land has a scenic amenity rating of 9. The relatively small area of classes 1, 2, 3 is present on open space occupied by transmission lines, quarries and refuse facilities.
- Areas with a high scenic amenity rating of 10 could be protected by limiting evident development when:

    1. An area is mapped as having an Interim Scenic Amenity Rating of 10.
    2. Field inspection and reference to available maps or aerial photographs indicates that the mapped scenic amenity and scenic preference classes are correct.
    3. A Government Planning Officer has determined that the community benefits from scenic amenity from this area are significant when compared to the social and economic benefits to the community of any proposed development.
    4. A Government Planning Officer has determined that other guidelines or authority do not exempt the area from these guidelines.

    In these instances the following limits would apply:

    Table 7. *Maximum evident development where Scenic Amenity is 10.*

Scenic Preference Rating	Maximum level of evident built development
10	0%
9	5%
8	10%

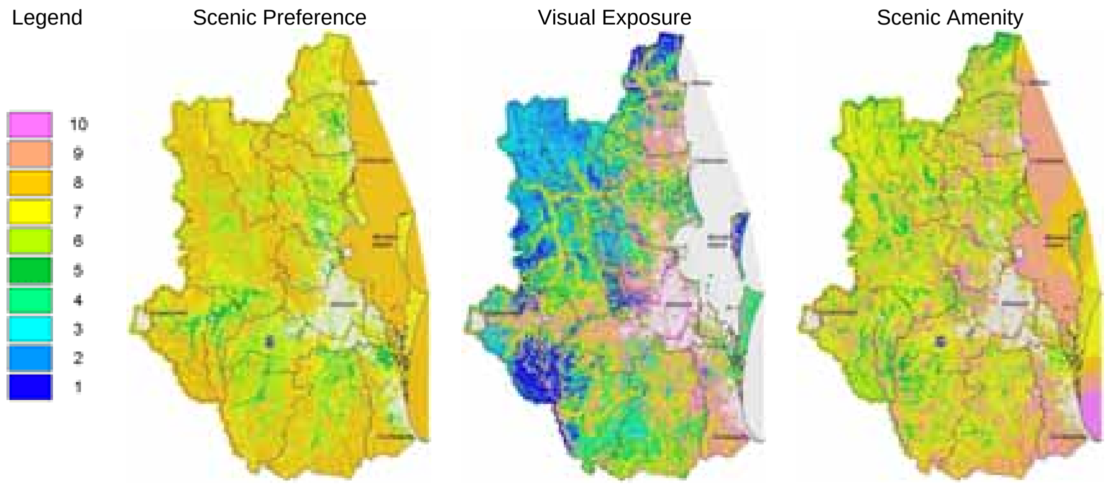


Figure 3. Interim Scenic Amenity Maps for SEQ (South East Queensland Regional Scenic Amenity Study 2004)

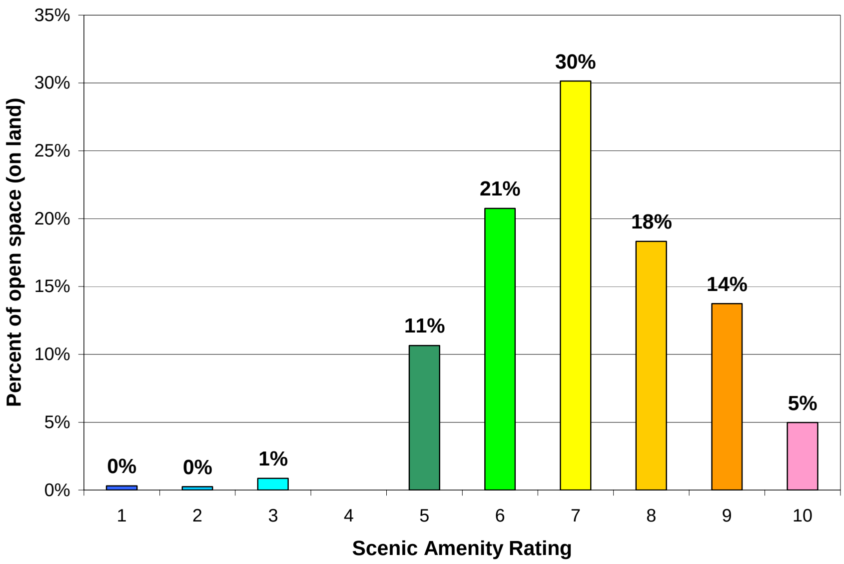


Figure 4. *Percentage of open space (on land) in SEQ by Scenic Amenity Rating (South East Queensland Regional Scenic Amenity Study 2004)*

SEQ Public Preference Survey

Having completed an interim map of Scenic Amenity for SEQ, a consortium of Governments, NRM Bodies and SEQWater undertook a survey of public preferences to review estimates used in the interim scenic amenity study and a develop site assessment tool that could be used to assess public preference from an individual viewpoint (South East Queensland Regional Scenic Amenity Study 2005).

Survey methods

The procedures used in the survey generally congruent with methods used in similar earlier studies using a survey approach eg (Bishop and Hulse 1994; Preston 2001; Arriaza, Canas-Ortega et al. 2004).

Each participant in the SEQ survey was invited to evaluate 20 different views by placing a photo representing each view on a grid with columns numbered from one (least preferred) to ten (most preferred) (South East Queensland Regional Scenic Amenity Study 2005).Up to 4 photos could be placed under each column. A section of this grid is shown in Figure 5.

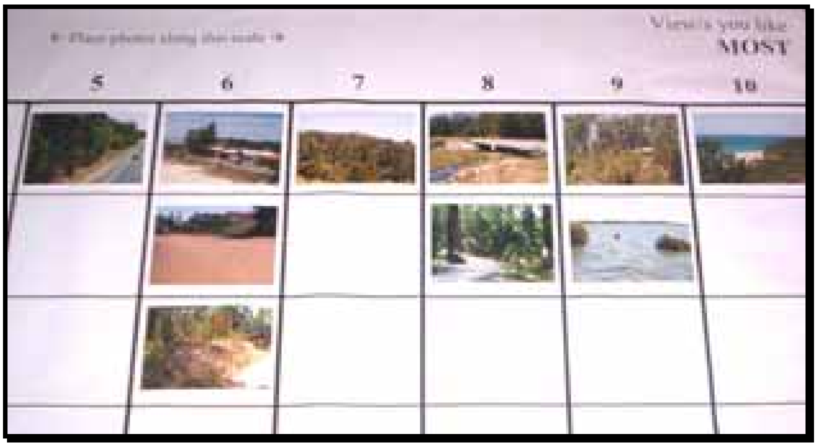


Figure 5. A section of the photo grid used in survey interviews

After rating each photo, the participant completed four other tasks (Appendix 1) which included a qualitative component that may help to explain the diversity of quantitative results and resolve some concerns about the use of statistical techniques. Before investigating this qualitative survey data, it is helpful to examine results from the quantitative component of this project.

Field work

Most of the field work for the SEQ Regional Scenic Amenity Study was conducted by members of Community Research Teams, each consisting of between two and 10 people (South East Queensland Regional Scenic Amenity Study 2005). Two teams operated to the north of Brisbane (Sunshine Coast, Moreton Bay Coast), four teams covered western parts of the region (Esk / Kilcoy, Toowoomba, Ipswich, Lockyer / Scenic Rim), three teams conducted assessment for the southern parts of SEQ (Gold Coast / Beaudesert, Redland, Logan) and one team assessed scenery for Brisbane. Members of Community Research Teams attended between one and three formal training sessions conducted by the study’s Project Manager with the support of other consultants (South East Queensland Regional Scenic Amenity Study 2005).

Photography

Photos were taken with the intention of representing views that contain a range of commonly seen objects in various contexts. Because of the myriad of objects and contexts, a list of principal objects (or Visual Elements) in different contexts (or Visual Domains) was prepared as guidelines for acquisition of survey photographs (**Table 8**).

Recognising that ‘context’ is a complex term, four Visual Domains were assumed to encompass the major contexts that occur in SEQ. These are - Bush, Rural, Urban and Coast as depicted in **Figure 6**. Other studies have used only two categories to define the context of scenes: Nature and Urban (Kaplan and Kaplan 1989).

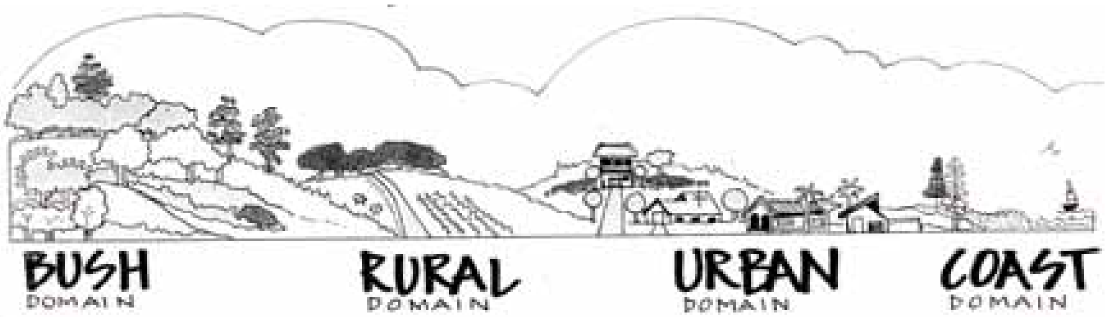


Figure 6. *Visual Domains used to describe the context for views or scenery*[2]

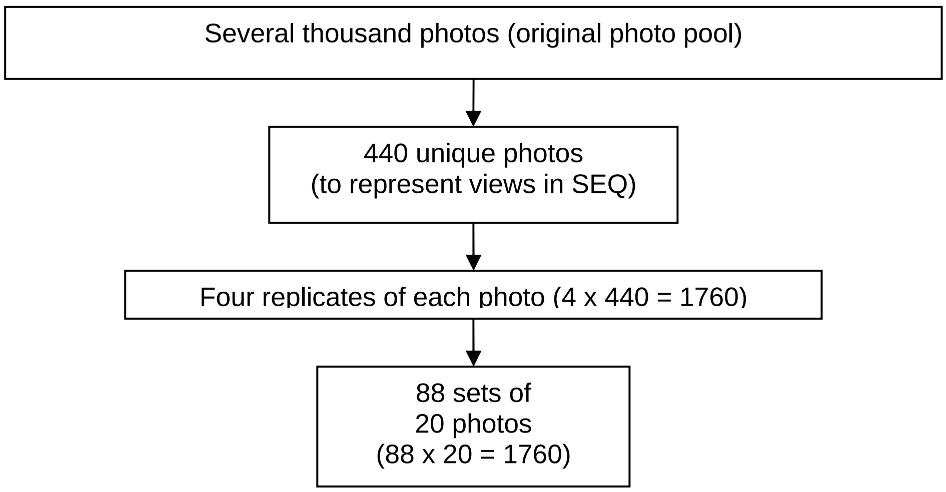


Figure 7.*Stages in reducing total photo pool to sets of 20 photos for use in interviews*

[2] Diagram by Jan Haughton

Table 8. *Guidelines for taking photos (South East Queensland Regional Scenic Amenity Study 2005)*

	Visual Domain			
Visual Elements	*Bush*	*Coast*	*Rural*	*Urban*
- Natural Elements				
Coastal vegetation	✓✓			
Crops pasture animals			✓✓	
Euc and assoc. forest	✓✓			
Garden				✓✓
Grass mown				✓✓
Grass natural	✓	✓	✓	✓
Grass unmanaged	✓		✓	✓
Modified vegetation	✓		✓	✓
Mud	✓	✓	✓	✓
Native pine	✓		✓	✓
Pine forest			✓✓	
Rainforest	✓✓			
Rock	✓	✓✓	✓	
Sand	✓	✓✓	✓	
Trees planted			✓	✓
Water bay		✓✓	✓✓	
Water constructed				✓
Water inland	✓			✓
Water ocean estuary		✓✓	✓✓	
- Built Elements				
Building low non- residential				✓✓
Building low residential				✓✓
Building low single			✓✓	
Building medium high				✓✓
Building trees grass	✓	✓	✓	✓
Built elements water		✓✓		
Farm elements			✓✓	
Fence			✓	✓
Mines, quarries, dumps	✓		✓	✓
Park cultural buildings				✓✓
Park elements	✓			✓✓
Path	✓			✓✓
People	✓	✓	✓	✓
Retaining wall				✓✓
Road freeways	✓		✓	✓
Roads	✓		✓	✓
Signs	✓		✓	✓
Towers cables poles	✓			✓
Vehicles	✓		✓	✓

These guidelines were used to obtain a pool of several thousand photos for the region. This pool was iteratively reduced to a set of 440 photos considered sufficient to represent the visual diversity of the region. Each photo was duplicated four times to provide 1760 photos for use in surveys. This set of 1760 photos was further divided into 88 individual interview sets consisting of 20 unique photos (**Figure 7**).

Prior to use in interviews, a code was written on the back of each photo. This code was not evident to survey participants until the first sorting task was completed. The first part of the code is a character (B, C, R or U) followed by 3 digits such as 001. The first character indicates the likely Visual Domain of the view. The meaning of this code was not explained to survey participants (South East Queensland Regional Scenic Amenity Study 2005).

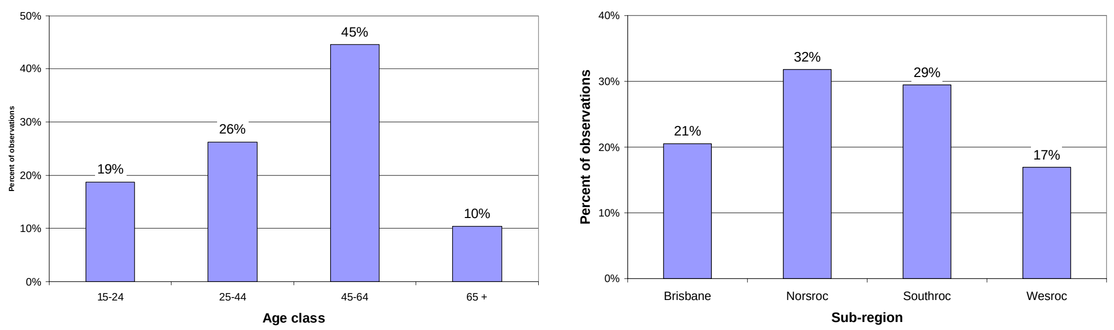
Following validation of data, checking transcription errors and outliers, the photo set was reduced from 440 photos down to 416 valid survey photos, representing all major visual elements and visual domains across SEQ. Of these, 60 photos were taken of views in Maroochy Shire by four different photographers as listed in **Table 9**.

Table 9. *Photographers and photos taken of views in Maroochy Shire*

Photographer	*Photos*								
Genevieve Jones	B040	B052	B097	B098	B099	B100	B101	C103	R047
	R124								
Henrietta McAlister	B010	B024	B026	B036	R012	R024	R033	R034	R035
	R044	R045	R094	R097	U080				
Pam Maegdefrau	B063	R049							
	B038	B048	B055	B059	B062	B077	B080	U034	U035
Peter Richards	B034	B054	B087	B088	B089	B090	B091	B092	C026
	C056	C085	R008	R011	R025	R061	R119	R120	R121
	U014	U016	U017	U022	U067	U068	U090		

Survey participants

A total of 964 people participated in interviews for the Scenic SEQ Public Preference Survey. The survey included a broad-cross-section of people from different demographic groups and all parts of the SEQ region, including people from different ages and sub-regions of SEQ as illustrated in **Figure 8**.



Proportion of participants by age class

Proportion of participants from each sub-region

Figure 8. *Proportion of survey participants by age class and subregion.*

Of the 306 people who participated in the survey from local governments in the NORSROC sub-region (Pine Rivers Shire, Caboolture Shire, Calounda City, Maroochy Shire, Noosa Shire, and Kilcoy Shire), 61 people were members of Maroochy Shire as outlined in **Table 10**.

Table 10. *Survey participants from Maroochy Shire.*

Suburb or town	*Number of people*
Alexandra Headland	2

Suburb or town	*Number of people*
Bli Bli	20
Bridges	3
Buderim	14
Chevallum	2
Coolum Beach	10
Cotton Tree	4
Marcoola	1
Mooloolaba	5
TOTAL	61

Survey results

The main quantitative results of the survey are the (a) mean preference rating for each view and (b) an equation derived from survey data which predicts preference ratings.

Mean preference ratings and other statistics for the 10 highest scoring views and 10 lowest scoring views are reproduced in **Table 11** (South East Queensland Regional Scenic Amenity Study 2005).

Table 11. *Statistics for the 10 highest scoring views and lowest scoring views in the survey*

PhotoID	*Mean SPR*[3]	*Lower C.I. Mean*	*Upper C.I. Mean*	*n*	*Std dev*	*Median SPR*
C101	10.0	10.0	10.0	36	0.0	10.0
C017	9.8	9.7	10.0	31	0.4	10.0
B020	9.8	9.7	9.9	43	0.4	10.0
B082	9.8	9.6	10.0	17	0.4	10.0
R018	9.7	9.6	9.9	38	0.6	10.0
B110	9.7	9.5	10.0	14	0.5	10.0
C065	9.7	9.4	9.9	35	0.6	10.0
C068	9.6	9.4	9.8	43	0.7	10.0
B019	9.6	9.3	9.8	38	0.6	10.0
B027	9.5	9.3	9.8	41	0.7	10.0
…	…	…	…	…	…	…
U086	1.2	1.0	1.3	37	0.4	1.0
U039	1.1	1.0	1.2	54	0.3	1.0
U126	1.1	1.0	1.3	16	0.3	1.0
U069	1.1	1.0	1.2	42	0.3	1.0
B008	1.1	1.0	1.2	59	0.3	1.0
B004	1.1	1.0	1.2	37	0.3	1.0
B007	1.1	1.0	1.2	25	0.3	1.0
U044	1.1	1.0	1.2	40	0.3	1.0
B006	1.0	1.0	1.0	31	0.0	1.0
U045	1.0	1.0	1.0	18	0.0	1.0

While it is not possible to examine and discuss all survey results here, it is helpful to develop an impression of major results by examining the views with the lowest and highest overall scores. As depicted in **Figure 9**, the highest scoring view (C101) is of a natural coastal headland, and the lowest scoring view (U045) is of a rubbish dump with some trees in the background.

[3] SPR: Scenic Preference Rating

Lowest scoring view	Highest scoring view
(Mean Rating = 1)	*(Mean Rating = 10)*
	
Photo U045 by Wally Wight	Photo C101 by Jan Haughton

Figure 9. *Lowest and highest scoring views from the 2004 SEQ survey*

The above tables highlight the ‘extremes’ of preference that are likely to be close to ‘universal’ high and low preference across all ecosystems. Scenes similar to these occur in many coastal districts of Australia, including the Maroochy Shire.

Of greater interest however, is the variation between these extremes and in particular people’s preferences in rural districts similar to the present study area. A range of photos and their mean ratings have are shown in Figure 10.

General observations about this selection of rural views are:

- Three of the top rating Rural views (R018, R020, R022) and one of the mid-high views (R027) include rivers or a dam, and are surrounded by eucalypt forest and pasture.
- The other top Rural view (R001) is of a steep rocky peak in bushland, surrounded by pasture or crops.
- Three of the mid-high rating views (R102, R110, R101) are of pasture with forested hills in the background.
- None of the top rating views or mid-high Rural views include any evident development.
- All of the middle rating Rural views have mountains or hills in the background. Two views include some solitary farm buildings (R030, R034). The other two views include some trees and pasture (R136, R070). Photo R136 includes some farm animals.
- In general, views of crops on flat land score lower than pastures on undulating land.
- Two of the lowest rating Rural views include electricity or communication towers (R128, R090). One of these is of pasture and mown grass close to a freeway (R077) and one is of a land fill rubbish dump (R032).

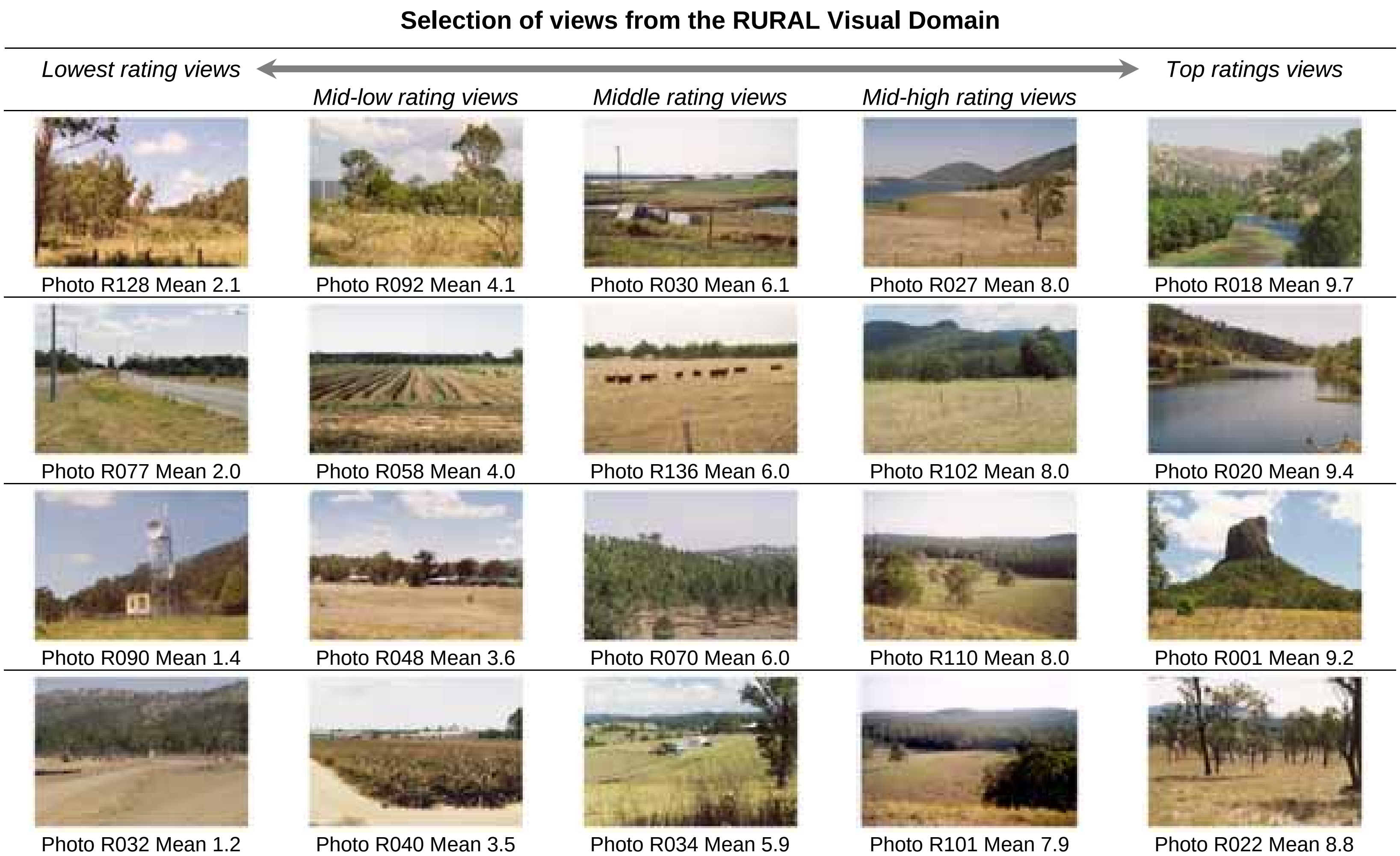


Figure 10. *Selection of views from the Rural Visual Domain*

Scenic Preference model

The project also developed an equation derived from survey data which predicts preference ratings of views based on an analysis of photo content. This was achieved by placing a transparent overlay over a photograph and delineating objects using a black marker pen (***Figure* 11**). The Visual Domain, Visual Element, and other basic variables for each photo were recorded to characterise the photo using a computer spreadsheet (**Table 12**) (South East Queensland Regional Scenic Amenity Study 2005).

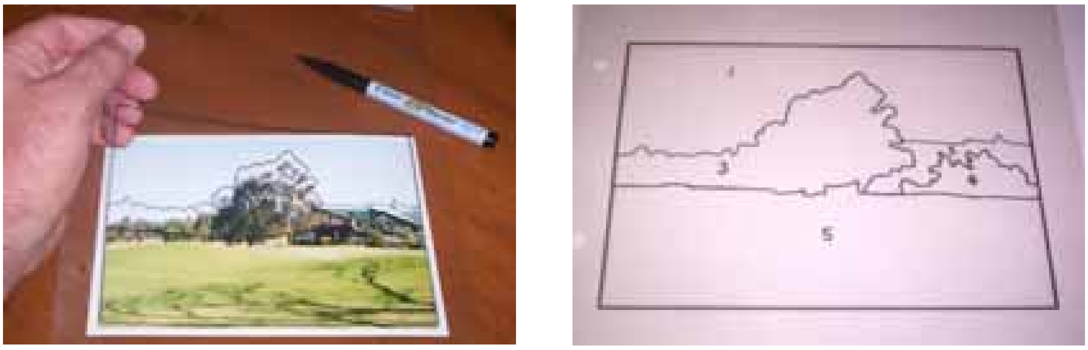


Figure 11. *Method used to delineate and code photos (example for U111)*

Table 12. *Information recorded to characterise photos (example for photo U111)*

Polygon	*Visual Domain*	*Visual Element*	*Polygon Area (sq cm)*	*Proportion of terrestrial photo area*	*Distance to element*	*Steepness*
1		Sky	n/a	n/a	n/a	n/a
2	Urban	Building low non-residential	6.75	0.06	10-100 m	Flat
3	Urban	Trees planted native	30.46	0.25	10-100 m	Flat
4	Urban	Trees planted exotic	6.15	0.05	10-100 m	Flat
5	Urban	Grass mown	78.77	0.64	10-100 m	Flat
Total			122.13	1.00		

The relationship between people’s rating of a view and the proportion of each Visual Element and Visual Domain was analysed using called Regression Analysis. The produced an equation (**Table 13**) consists of three terms: (a) an additive term which varies in magnitude depending on which two major Visual Domains are present in the view, (b) a series of multipliers based on the proportion of each Visual Element in the View a constant term and (d) the resulting predicted score between and 10.

To simply demonstrate the application of this equation, consider a photo taken at the beach looking directly out over the ocean, where the only thing visible (other than rhe sky) is the ocean. From term (a) of the equation the view would receive a score of 1.4 because everything (other than the sky) is the Coast Visual Domain. From term (b) of the equation the view would score an addition 1.8, calculated by multiplying the proportion of ocean (1.0) by the Visual Element variable for water in the ocean or an estuary (1.8). (c) The constant term is 6.7. The predicted result (d) being 9.9 out of 10 is calculated as adding each of the component terms (i.e. 1.4 + 1.8 + 6.7).

It is useful also to note that Visual Domains that include Urban receive a negative score, and most built Visual Elements receive a negative score. Water and most trees and vegetation receive a positive score.

Table 13. *Statistical equation used to predict public preference (d) from view characteristics (a) and (b)*

(a) Visual Domains present	*(b) Proportion of Visual Element*	*(c) Constant*	*(d) Predicted Result*
–1.3 x Rural and Urban –1.2 x Urban (only) –1.1 x Bush and Urban –1.0 x Rural (only) + 0.8 x Bush and Coast + 1.4 x Coast (only)	–20.2 x Signs –11.2 x Building medium high –11.0 x Building low non-residential –10.6 x Vehicles – 9.9 x Mines quarries dumps – 9.1 x Towers cables poles – 7.3 x Building low res (multiple) – 7.1 x Built elements water – 6.4 x Road freeways – 6.3 x Park elements – 5.4 x Park buildings cultural – 4.8 x Grass unmanaged – 4.5 x Roads (not freeways) – 1.8 x Fence – 1.8 x Building trees grass + 0.5 x Water bay + 0.6 x Trees planted + 0.7 x Modified vegetation + 1.3 x Rainforest + 1.5 x Euc and associated forest + 1.6 x Path + 1.7 x Water constructed + 1.8 x Water ocean or estuary + 2.5 x Rock + 3.8 x Water inland	6.7	= Preference Rating (between 1 & 10)

Tools for assessing visual impact

The above regression equation has been implemented as a spreadsheet tool for use by local government and other planners in SEQ to evaluate the impact of alternative development scenarios (South East Queensland Regional Scenic Amenity Study 2005).

This tool estimates the difference in Mean Scenic Preference Ratings between two views, and has been programmed using Microsoft® Excel as demonstrated in Figure 28. The user enters data on the proportion of Visual Domains and Visual Elements for two different views. The tool, called SPRAT-2 (Scenic Preference Rating Assessment Tool – for two views) also calculates the difference between the Mean Scenic Preference Rating of the two views, the direction of any change, and whether the change is estimated to be statistically significant.

Figure 12. *Demonstration of SPRAT-2 for estimating Scenic Preference Rating of two views*

Scenic Amenity of the Moreton Mill Canelands Area

Characteristics

Location

The Moreton Mill Canelands study area is located in the Maroochy Shire, approximately 100km north of Brisbane. It includes all land and water and within 1km of any assigned caneland (Figure 13) north of Buderim that was assigned for sugar cane production to the Moreton Mill as at June 2001.

The study area covers just over 30,000 hectares and measures approximately 18 km E-W and 26 km N-S. It includes the towns of Eumndi, Yandina, Bli Bli, and parts of Nambour and Woombye. Coastal villages of Perigean, Coolum, Marcoola, lie just to the east of the study area.

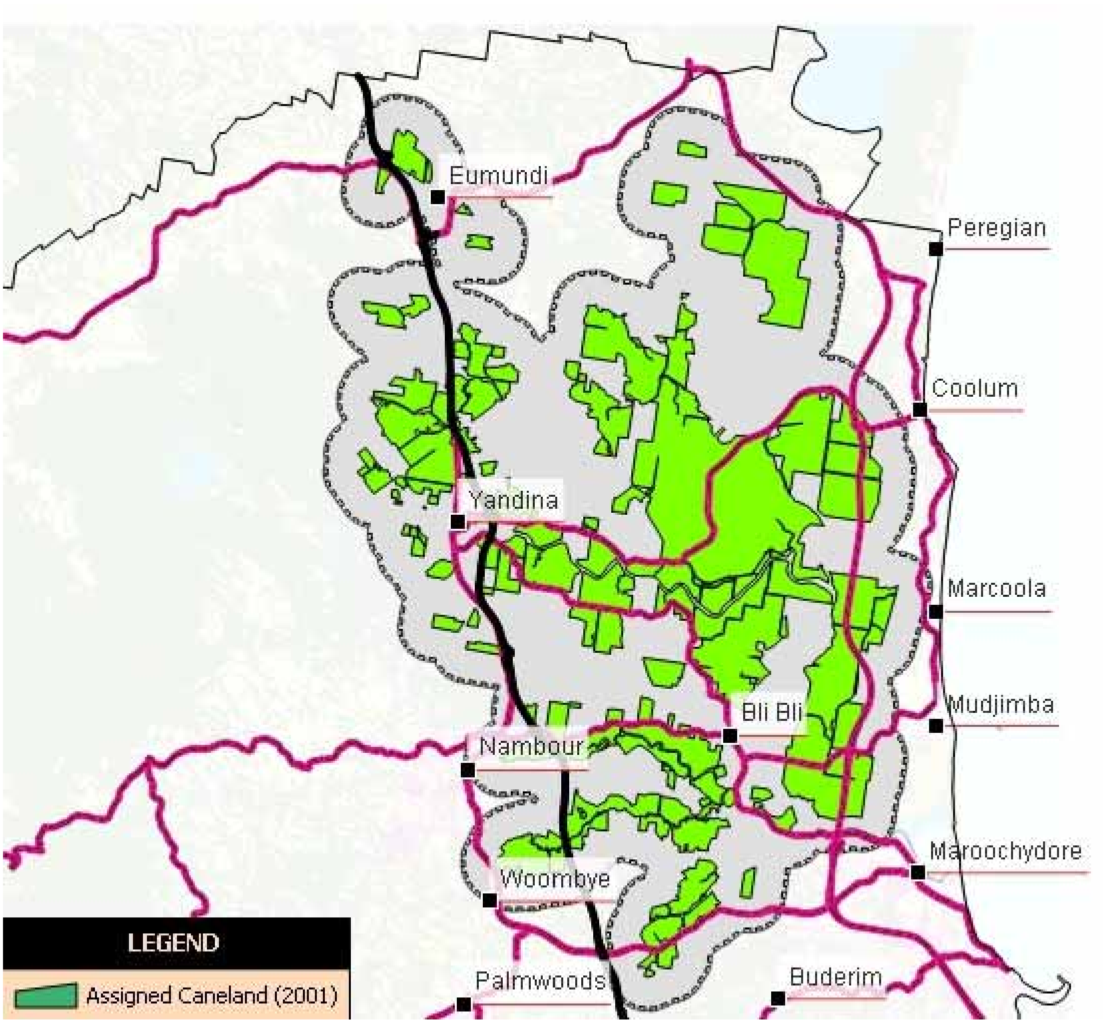


Figure 13. *Study area showing assigned caneland (Maroochy Shire Council 2000)*

Major ecosystems

Regional Maps of Land Cover (Figure 14) highlight the major ecosystems of the study area, which is covered mainly by sugar cane, eucalypt forest, and melaleuca forest. The area is also intersected by water bodies being Maroochy River Estuary, North Maroochy River and the South Maroochy River.

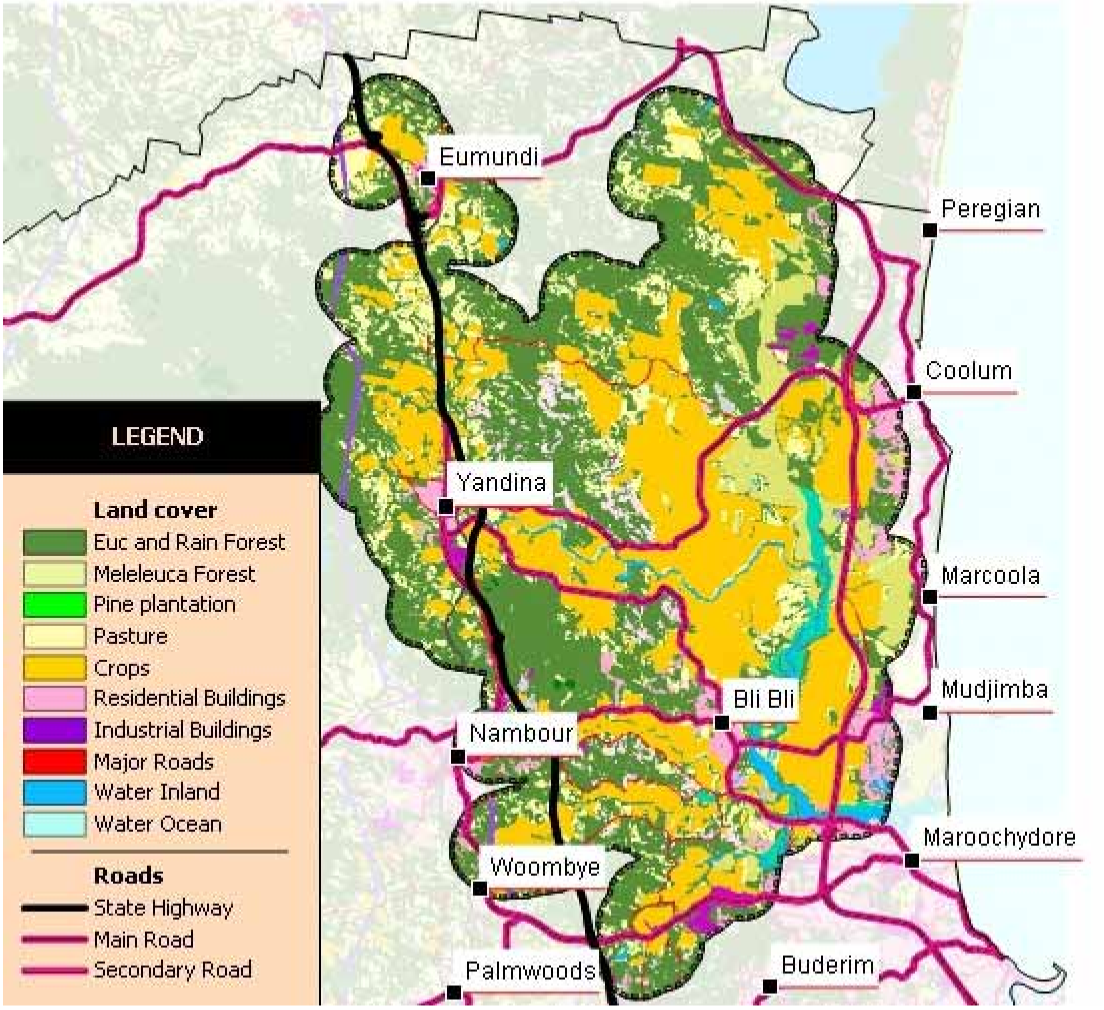


Figure 14. *Study area showing Regional Land Cover (South East Queensland Regional Scenic Amenity Study 2004)*

Topography

Most of the study is area is less than 50m above sea level, with the exception of hills and some mountains towards the edges of the study area Figure 15. Two of the more visually significant mountains in the study area are Mt Ninderry and Mt Coolum. These peaks are the highest in the study area, with a peak elevation of between 200 m and 300m.

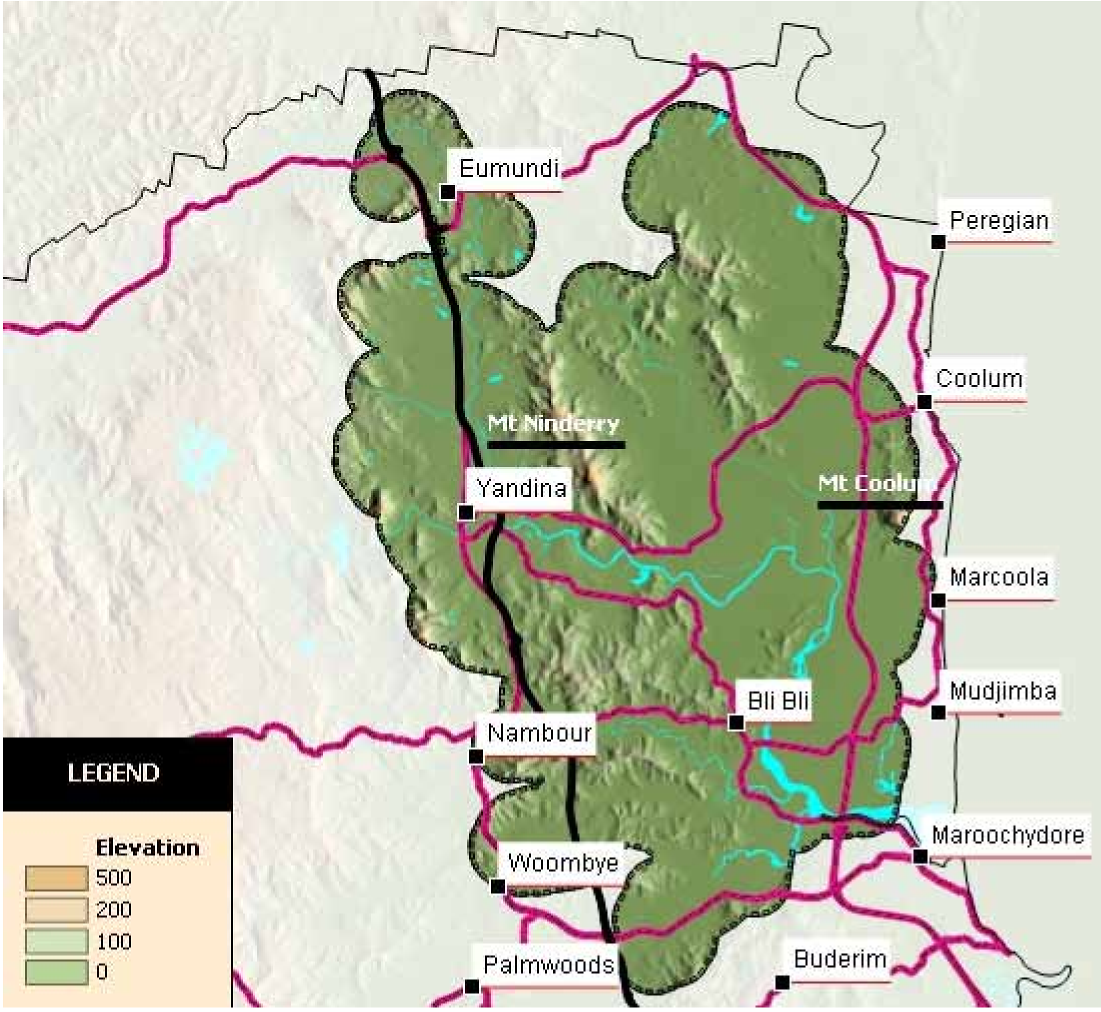


Figure 15. *Study area showing Elevation and important Mountains (South East Queensland Regional Scenic Amenity Study 2004)*

Scenic Amenity

The spatial arrangement of scenic amenity across the study area is also a major consideration in the appraisal and management of ecosystem services from these ‘sugar catchments’. Scenic Amenity can be determined for the study area by combining Visual Exposure and revised Scenic Preference Maps using new mapping models derived from the SEQ Regional Scenic Amenity Study.

Viewing Locations

Regional Viewing Locations identified during the interim regional mapping study (**Figure 16**) highlight the importance of major roads as important places that local residents and visitors to the Sunshine coast experience scenery of the study area. The classification of these viewing locations into 10 equal classes signifies those locations that have higher visitation at a regional level. Traffic volumes on the Pacific Highway to the west of the study area are among the most frequently in the region (class 10), and usage of the Sunshine Coast motorway, to the east of the study area, is also high (classes 9, 10).

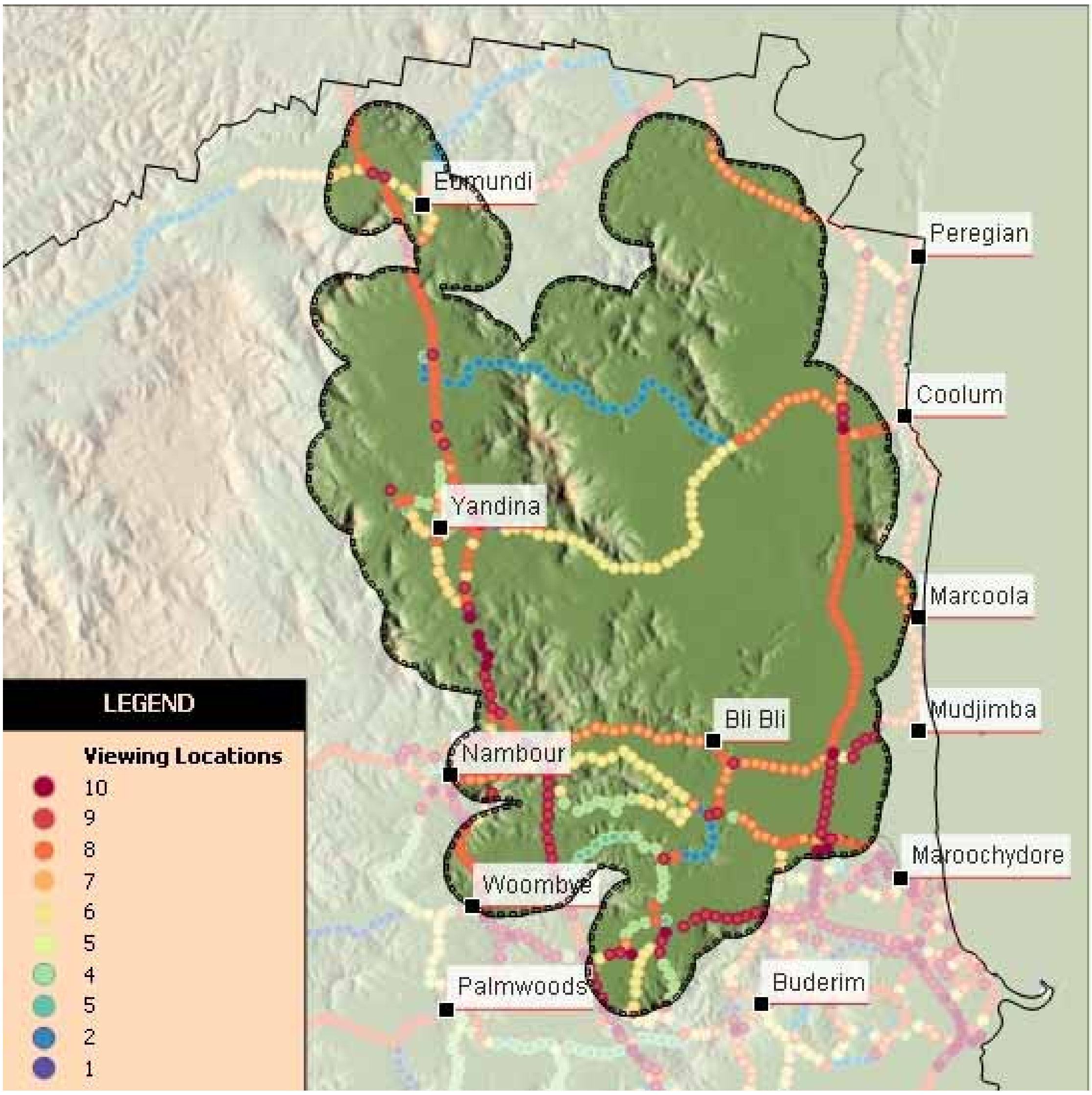


Figure 16. Regional Viewing Locations (South East Queensland Regional Scenic Amenity Study 2004)

Visual Exposure

Regional Viewing Location data were combed with an elevation model used to produce interim visual exposure maps for the region (South East Queensland Regional Scenic Amenity Study 2004) as illustrated in **Figure 17**. This map highlights the high visibility of elevated topographic features and land adjacent to highways.

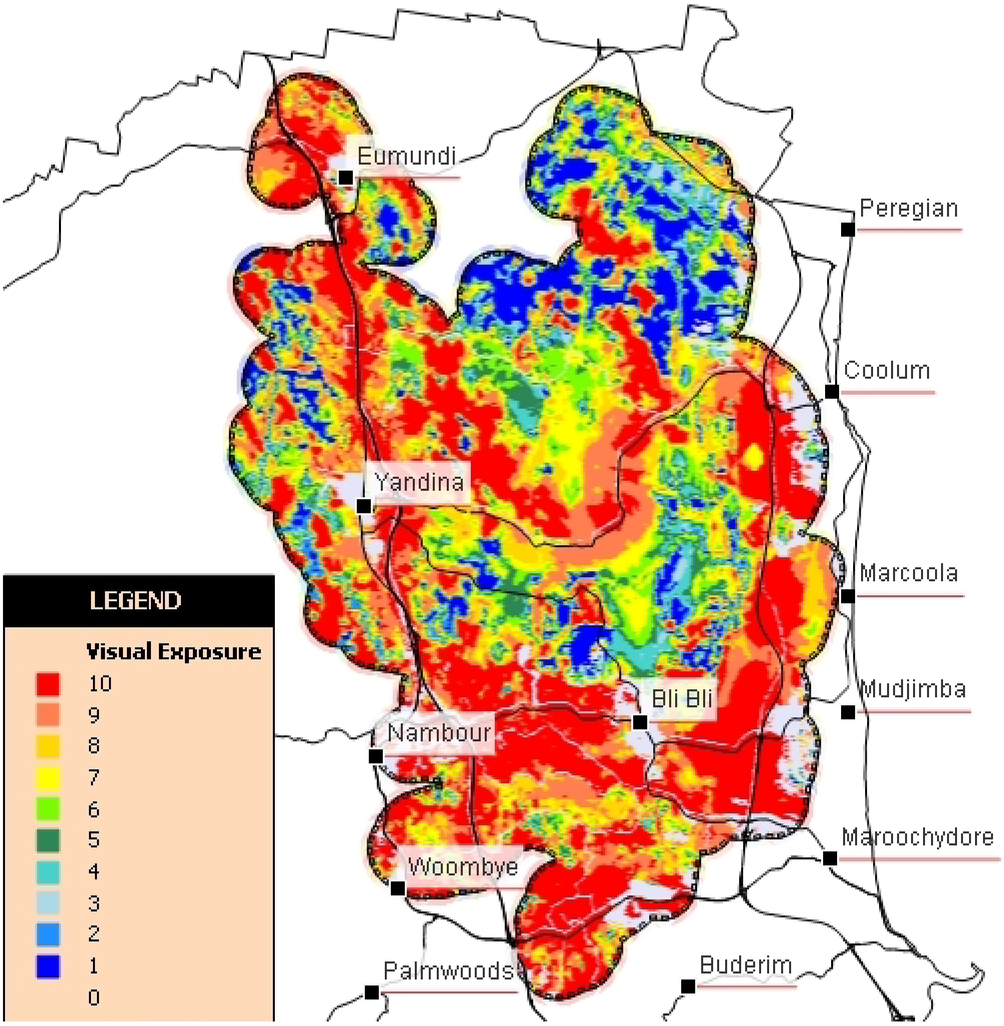


Figure 17. *Visual Exposure Map (South East Queensland Regional Scenic Amenity Study 2004)*

Scenic Preference mapping models

Scenic Preference Models developed by the SEQ Regional Scenic Preference Study can also be adopted to derive a Scenic Preference Rating for mapped ecosystems by selection of attributes to coincide with available mapped information and rescaling of regression coefficients from preference models.

The regression function used to predict Mean Scenic Preference Rating of views (**Table 13**) includes a number of variables which describe characteristics that can not be mapped, such as fences and signs.

These non-mapping variable were excluded from a regression analysis of preference rating against measured Visual Domain and Visual Elements data from the SEQ Regional Scenic Amenity Study to develop a new predictive function using only 'mappable' variables as indicated in **Table 14**.

Table 14. *Regression coefficients for a mean Scenic Preference Function using 'mappable' variables*

Variable	*Regression Coefficient*
• Visual Domain	

Urban	-0.8
Rural	0.0
Bush	0.0
Coast	1.5
• Visual Element	
Building medium high	-3.8
Towers cables poles	-3.2
Mines quarries dumps	-2.8
Building low non-residential	0.0
Building low residential (multiple)	0.0
Built elements water	0.0
Grass unmanaged	0.0
Park buildings cultural	0.0
Park elements	0.0
Road freeways	0.0
Roads	0.0
Fence	3.1
Building trees grass	4.7
Crops pasture animals	5.3
Grass mown	5.6
Native pine	5.7
Garden	5.8
Sand	6.5
Grass natural	6.9
Modified vegetation	7.1
Trees planted	7.3
Water bay	7.9
Coastal vegetation	8.0
Rainforest	8.0
Water constructed	8.1
Euc assoc forest	8.3
Water ocean estuary	9.0
Water inland	9.7
Rock	10.0
Path	11.2

These regression coefficients can then be re-scaled using a linear function to develop Scenic Preference Ratings applicable to mapping units (**Figure 18**). Further, rescaled coefficients for Visual Domains and Visual Elements can then be combined to produce the list of Scenic Preference Ratings (for map units) for combinations of Visual Domains and Visual Element show in **Table 15**.

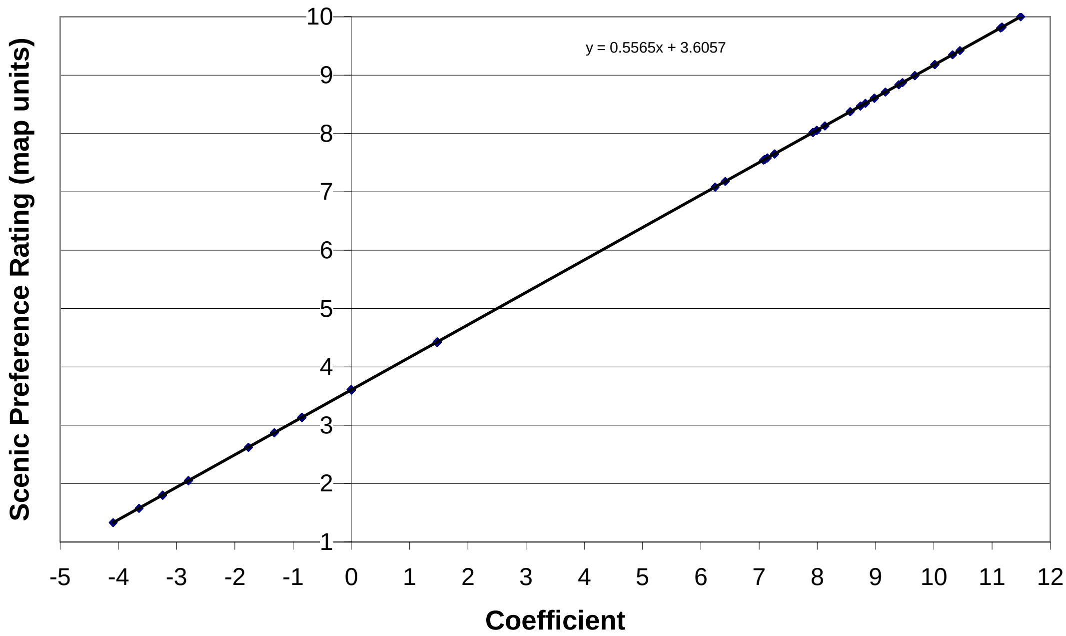


Figure 18. *Linear function used to rescale regression coefficients to Scenic Preference Rating (1-10) (for mapping)*

Table 15. *Scenic Preference Ratings (for mapping) using Visual Domains and Visual Elements*

Visual Element	*Visual Domain*			
	BUSH	*COAST*	*RURAL*	*URBAN*
Rock	9	10	9	9
Water ocean estuary	n/a	9	n/a	n/a
Water inland	9		9	9
Euc assoc forest	8	9	8	8
Water bay	n/a	9	n/a	n/a
Rainforest	8	n/a	8	8
Trees planted	8	n/a	8	7
Modified vegetation	8	8	8	7
Buildings trees grass	6	n/a	6	6
Sand	4	5	4	4
Building low non-residential	4	n/a	4	3
Building low residential	4	n/a	4	3
Building park cultural	4	n/a	4	3
Built elements water	4	4	4	3
Coastal vegetation	4	4	4	3
Crops pasture	4	n/a	4	3
Freeway railway (road freeway)	4	n/a	4	3
Grass mown	4	n/a	4	3
Grass unmanaged	4	n/a	4	3
Park elements	4	n/a	4	3
Road	4	n/a	4	3
Mines quarries dumps	2	n/a	2	2
Building medium high	1	n/a	1	1

This table highlights the importance of highly preferred components such as coastal ocean and estuaries, and inland water in bush, rural or urban environments. The ratings have moderate correspondence to interim ratings for the SEQ region (**Table 3**), for example, water rates highly in both interim and refined rating tables, and quarries rate low in both.

Of interest in the revised model is that crops and pasture are now rated 4, whereas the interim model mapped crops at 5, and pastures between 6 and 8 depending on topographic steepness. It is expected that the relativities of the current ratings are more precise since the interim preference model was developed using regression tree analysis compared to the current model was developed using linear regression. Measurements of component areas from photos in the recent SEQ analysis (South East Queensland Regional Scenic Amenity Study 2005) also followed more precise procedures than those used for the interim models, developed from the Caboolture Scenic Amenity Study (Caboolture Shire Council 2003).

Scenic Preference

Base mapping for allocation of scenic preference ratings was undertaken by preparing Visual Domain and Visual Exposure Maps by reformatting existing GIS data available from Maroochy Shire Council (Maroochy Shire Council 2000) and land cover maps from the SEQ regional scenic amenity study (South East Queensland Regional Scenic Amenity Study 2004).

A Visual Domain map showing Rural, Bush and Urban types in the study area (**Figure 19**) was prepared by combining Maroochy Shire Land Use zones as indicated in **Table 16**.

Table 16. *Strategic Land use Zones used to form Visual Domains*

Visual Domain	*Strategic Land Use Zones*
Bush	Conservation, State Forest, Water Supply
Rural	Agricultural Protection, Extractive Industry, Rural or Valued Habitat
Urban	Future Urban, Industry, Recreation, Special Purpose, Urban

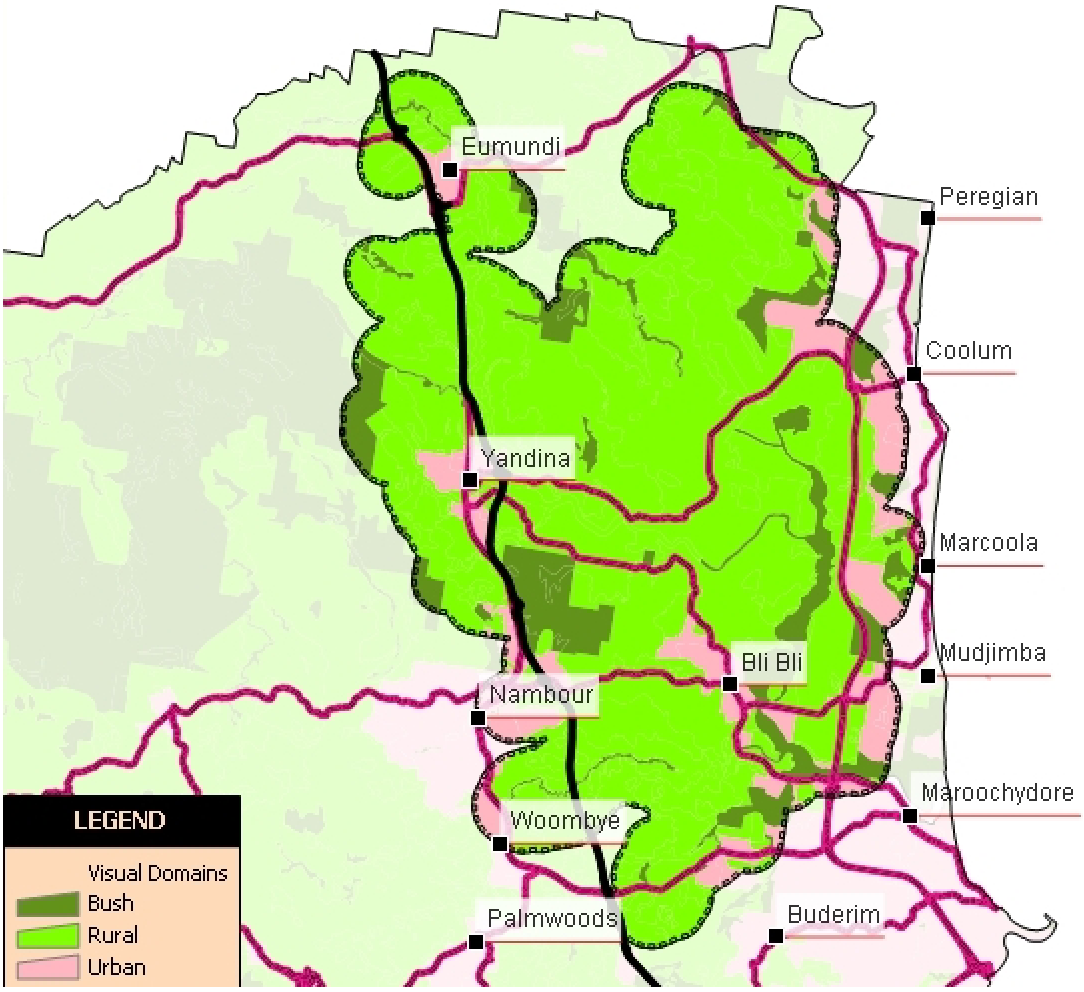


Figure 19. *Visual Domains (adopted from MSC Strategic Land Use Maps)*

Visual Element maps (**Figure 20**) were then derived from land cover mapping prepared for the 2004 Interim Scenic Amenity Maps using **Table 17**.

Table 17. *Visual Elements derived from 2004 Interim Land Cover Classes*

VE No	*Visual Element*	*2004 Interim Land Cover*	*LC No*
1	Building low non-residential	Industrial farming	8
1	Building low non-residential	Industrial or commercial	9
2	Building low residential	Residential housing	11
3	Buildings trees grass	Rural - residential	10
3	Buildings trees grass	Parkland with buildings	20
4	Coastal vegetation	Mangrove forest	2
4	Coastal vegetation	Melaleuca forest	18
4	Coastal vegetation	Sedgelands	19
5	Crops pasture	Crops	4
5	Crops pasture	Grasslands, low native vegetation	5
5	Crops pasture	Electricity corridor	7
6	Euc assoc forest etc	Eucalypt forest	1
7	Freeway railway	Major roads	13
7	Freeway railway	Major railway corridor	22

VE No	Visual Element	2004 Interim Land Cover	LC No
8	Grass mown	Open parkland	6
9	Mines quarries dumps	Earthworks	12
10	Pine forest	Pine forest	3
11	Planted trees	Native plantations	23
12	Water bay	Muddy beach	21
13	Water inland	Rivers, creeks, dams	14
14	Water ocean estuary	Ocean	16
14	Water ocean estuary	Sandy beach	17

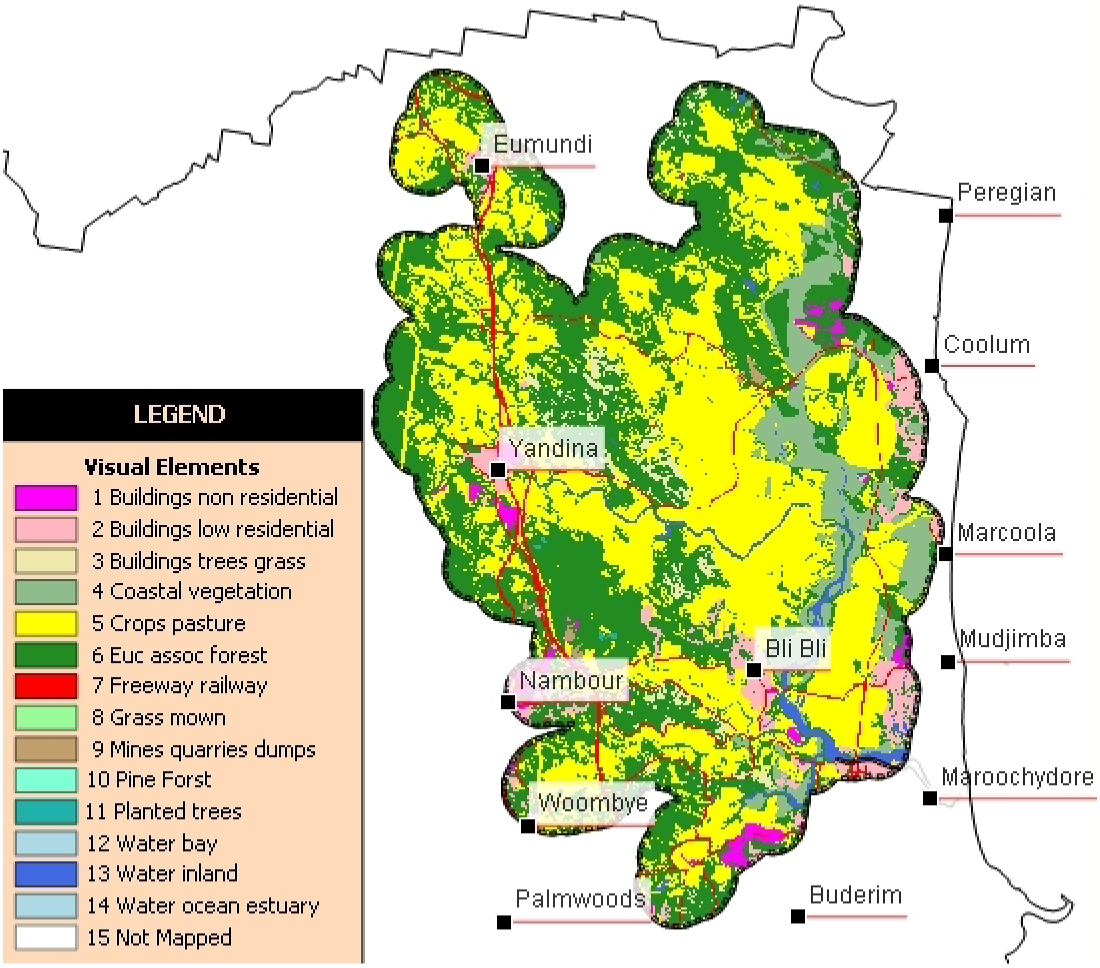


Figure 20. *Visual Elements (adopted from 2004 SEQ Interim Scenic Amenity Study)*

The final stage of producing a Scenic Preference Map was to allocate scenic preference ratings (**Table 17**) to a composite map of Visual Elements (**Figure 20**) and Visual Domains (**Figure 19**).

The Scenic Preference map (**Figure 21**) highlights people's high preference for waterways (9) in Bush, Rural and Urban areas. The largest area of very high scenic preference coincides with the lower reaches of the Maroochy River between Maroochydore and Bli Bli.

The map also highlights the high scenic preference for natural Eucalypt forest in all Visual Domains. Some of these areas (eg. Mt Ninderry, Mt Coolum) contain unmapped areas of natural rock, which is the most preferred of all ecosystems (see **Table 17**). Other large forested areas of high preference include forests to the immediate north-east of Nambour, hills to the west of Yandina, and elevated forests to the east and south-east of Nambour and Woombye.

Locations with lowest scenic preference in the study area are areas used for extractive industries to the west of column and north east of Nambour.

Most of the study area has moderate visual preference, including canelands, pasture, rural-residential areas, and areas with coastal vegetation.

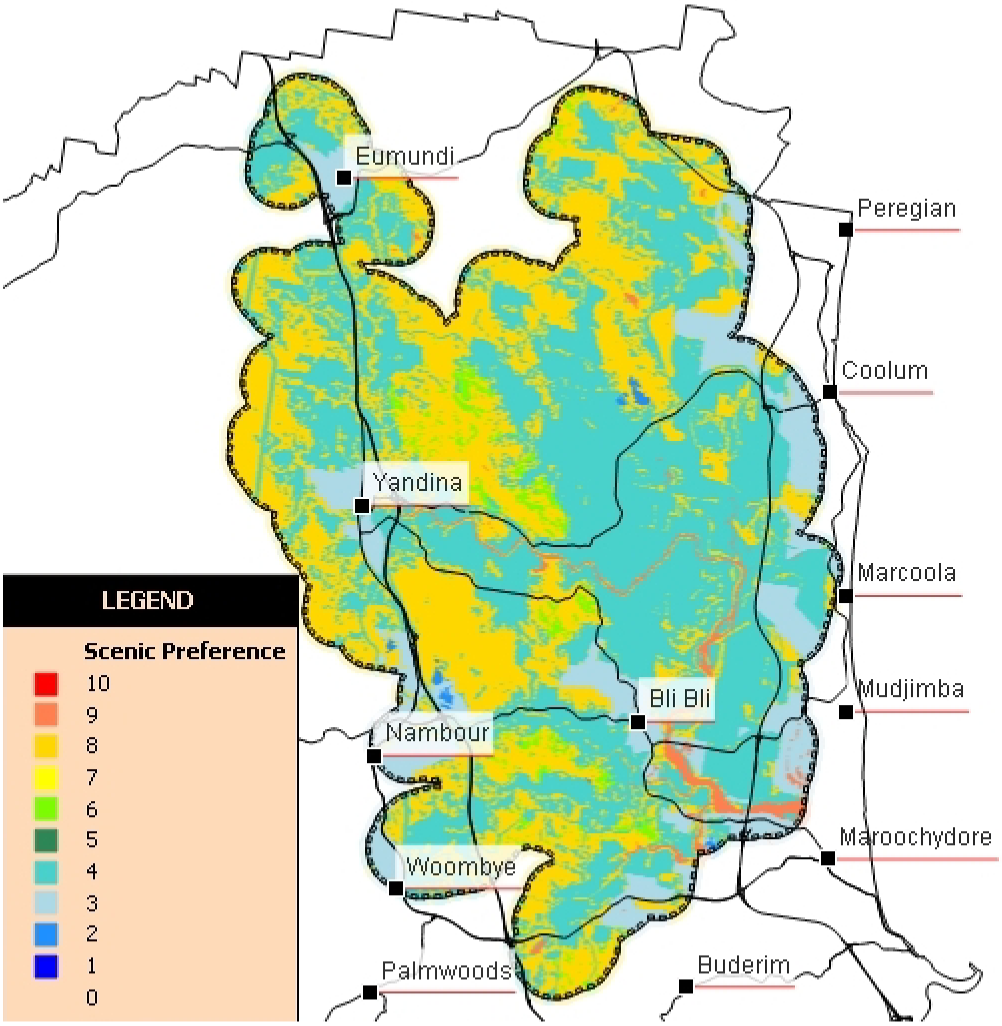


Figure 21. *Scenic Preference Map*

Scenic Amenity

Maps of Visual Exposure (**Figure 17**) and Scenic Preference (**Figure 21**) were combined using the Scenic Amenity lookup table **Figure 2** to produce a Scenic Amenity Map of the study area (**Figure 22**).

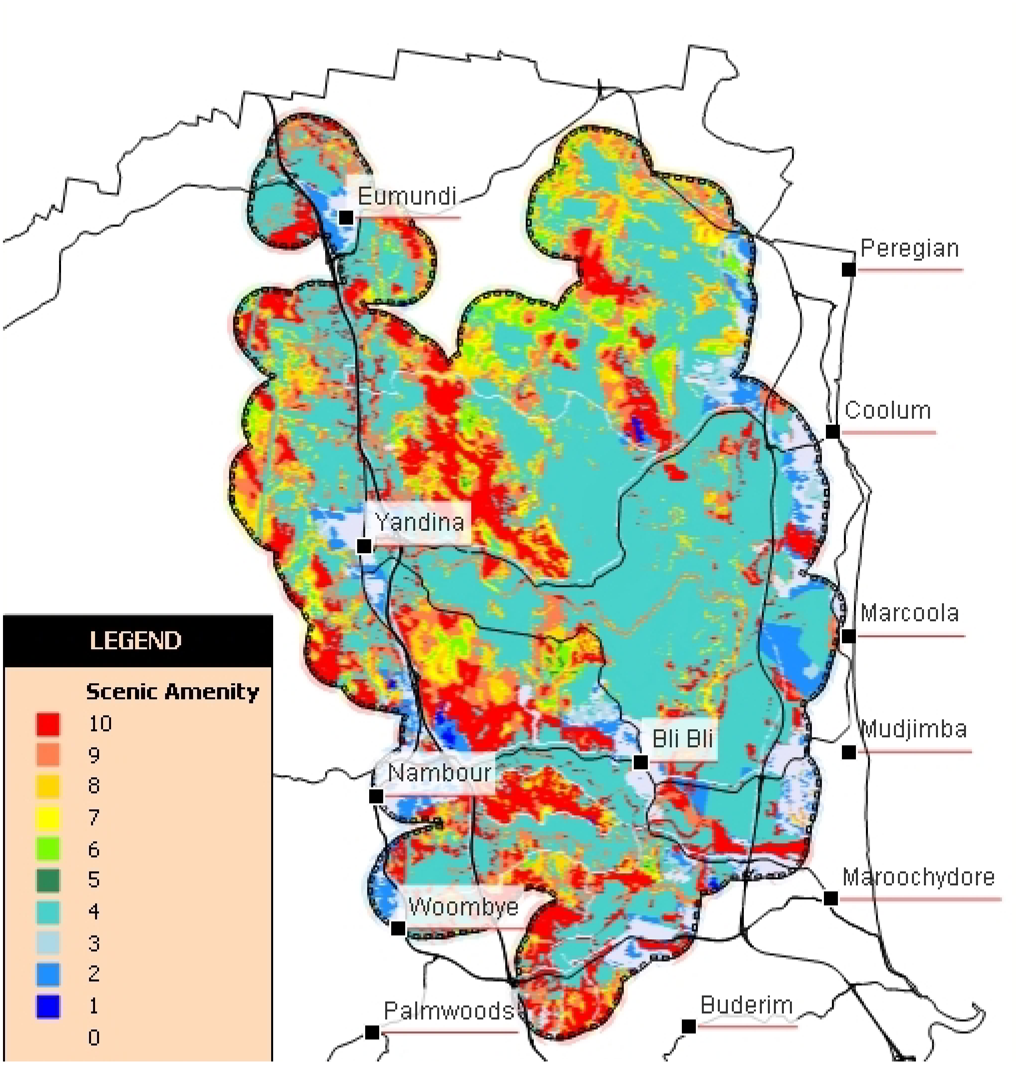


Figure 22. *Scenic Amenity Map*

This map highlights the high amenity value of waterways and forested areas visible from major highways in the Study Area.

As reflected in both scenic preference and visual exposure maps, the largest area of very high scenic amenity are:

- the lower reaches of the Maroochy River between Maroochydore and Bli Bli.
- natural Eucalypt forest and sparsely developed hillsides to the east of Yandina (Mt Ninderry)
- natural Eucalypt forest and sparsely developed hillsides to the east of Mt Coolum
- elevated hills to the west of Coolum and Perigean (towards Yandina)
- forests to the immediate north-east of Nambour,
- hills to the west of Yandina
- elevated forests and sparsely developed slopes to the east and south-east of Nambour and Woombye, north-west of Buderim.

Other important fragments of high scenic amenity also occur throughout the study area where the visible waterways and forests occur.

Impact of Alternative Land Use on Scenic Amenity

Alternative uses of rural land

Of particular interest to this study is whether land use changes will affect Scenic Amenity and the delivery of this ecosystem service. Information about these changes will contribute to an overall appraisal of research information about economic and environmental options for natural assets and ecosystem services in the study area.

With closure of the Moreton Sugar Cane Mill in December 2003, local landholders, Governments, Industry Groups and CSIRO are seeking to define alternative sustainable land uses for land formerly used for the production of sugar cane, that are commensurate with Local Government and Queensland Government plans for this area.

While this evaluation process has not yet been completed, some of the emerging alternative land uses for this area are listed in **Table 18**.

Table 18. *Alternative rural land uses for the study area*

a)	Sugar cane (for limited sugar production - transported to other sugar refineries, or other products such as livestock food)
b)	Other row crops
c)	Pasture (for livestock production)
d)	Industrial farming (poultry, aquaculture)
e)	Pine forest (for timber production)
f)	Native tree plantations (for timber production)
g)	Wetland restoration (for nature conservation and minor economic products)
h)	Low density rural housing (on large lots)

Some of these land uses will affect different components of Scenic Amenity. Different height and densities of various land uses will affect Visual Exposure, and changes in the proportions of different visual elements will affect their scenic preference rating.

Impact on Visual Exposure

The Visual Exposure of distant landscapes and landscape foregrounds will be affected by different land uses due to changes in their height and density. Experience from previous studies in the Lockyer Valley (Gatton Shire Council 2002) and Caboolture (Caboolture Shire Council 2003) suggests that changes will be either neutral, or lead to some reduction or increase in Visual Exposure as outlined in **Table 19**.

Table 19. *Influence of alternative rural land uses on Visual Exposure*

Land Use	*Approx. height and density*	*Exposure of distant views to hills and mountains*	*Exposure of Land Use in Foreground*
Sugar cane	Mature cane – very dense up to 2m high Young crops or fallow – low density and < 0.5m high	Base condition	Base condition
Other row crops	Mature – generally dense and up to 1m high Young crops or fallow – low density and < 0.5m high	+ Increase	x Negligible
Pasture	Generally dense and up to 0.5m high	+ Increase	x Negligible
Industrial farming	Dense up to 4m high	- Reduction	+ Increase

Land Use	Approx. height and density	Exposure of distant views to hills and mountains	Exposure of Land Use in Foreground
Pine forest	Dense up to 15m high	- Reduction	+ Increase
Native tree plantations	Dense up to 15m high	- Reduction	+ Increase
Wetland restoration	Dense up to 10m high	- Reduction	+ Increase
Low density rural housing	Dense up to 4m high	- Reduction	+ Increase

Impact on Scenic Preference

Land use changes will also influence Scenic Preference of Views as a result of changes in the Visual Elements associated with each Land Use, and to a lesser extent, changes in the Visual Domain. These changes can be assessed by reference to the image library and survey statistics, and by applying the Scenic SEQ Scenic Preference Model.

- Review of existing survey data and images

A range of images broadly considered ‘representative’ of land uses in **Table 18** have been selected from the image library developed by the SEQ Regional Scenic Amenity Study (South East Queensland Regional Scenic Amenity Study 2005). These images and accompanying statistics are discussed below.

Sugar cane

Four views from the Scenic SEQ Image Library were selected as representative of Sugar Cane in the Study Area as illustrated in **Figure 23**. The mean rating of these views (R061, R119, R120, R121) has a range between 5.8 and 6.5 and a mean rating of 6.2.

Other row crops

Four views from the Scenic SEQ Image Library were selected as representative of Row Crops as illustrated in Figure 24. The mean rating of these views (R054, R055, R058) has a range between 4.0 and 5.9. The mean rating of these representative views of row crops is 4.7

Photo R061. Mean Rating 6.5

Photo R119. Mean Rating 6.3

Photo R120. Mean Rating 5.8

Photo R121. Mean Rating 6.2

Figure 23. *Representative Views of Sugar Cane in Maroochy Shire*

Photo R054. Mean Rating 4.8

Photo R055. Mean Rating 4.1

Photo R058. Mean Rating 4.0

Photo R116. Mean Rating 5.9

Figure 24. Representative views of Row Crops from various areas in SEQ

Pasture

The SEQ Regional Scenic Amenity Study included approximately 50 photos depicting pastures in various topographical situations and with varying amounts of trees, water or buildings. Of these 50 photos of pastures, 4 views from Maroochy Shire have no outstanding water bodies or houses as shown in **Figure 25**. The mean rating of these views (R011, R012, R035, R097) has a range between 5.9 and 7.1. The mean rating of these representative views of row crops is 7.2.

Industrial Farming

Industrial farming, such as chicken farming, is often accompanied by presence of large galvanised iron sheds. Two photos of intensive animal farms and two photos of other industrial sheds in rural settings were included in the SEQ Regional Study, and provide an indication of the Scenic Preference Rating of this land use. The mean rating of these views (R040, R041, R042, R132) has a range between 2.3 and 4.1. The mean rating of these representative views of row crops is 3.3

Pine forest

Four views from the Scenic SEQ Image Library were selected as representative of Pine Forest as illustrated in Figure 27. The mean rating of these views (R041, R062, R069, R072) have a range between 4.9 and 5.3. The mean rating of these representative views of row crops is 5.1.

Eucalypt plantation

Only one view from the Scenic SEQ Image Library is representative of Eucalypt Plantation as illustrated in Figure 28. The mean rating of this view (R070) is 6.0.

Photo R011. Mean Rating 7.1

Photo R012. Mean Rating 8.1

Photo R035. Mean Rating 5.9

R097. Mean Rating 7.6

Figure 25. *Views of Pastures in Maroochy Shire*

Photo R040. Mean Rating 3.5

Photo R041. Mean Rating 2.3

Photo R042. Mean Rating 3.2

R132. Mean Rating 4.1

Figure 26. *Views of Industrial Farming in SEQ*

Wetland restoration

Four views from the Scenic SEQ Image Library were selected as representative of Wetlands as illustrated in Figure 29. The mean rating of these views (B069, B070, B072, B092) have a range between 6.0 and 8.5. The mean rating of these representative views of wetlands is 7.2.

Low density rural housing

Three views from the Scenic SEQ Image Library were selected as representative of Low density rural housing as illustrated in Figure 30. The mean rating of these views (R023, R033, R034) have a range between 5.2 and 5.9. The mean rating of these representative views of Low density Rural Housing is 5.6.

Photo R041. Mean Rating 4.9

Photo R062. Mean Rating 5.3

Photo R069. Mean Rating 5.1

Photo R072. Mean Rating 5.0

Figure 27. Views of Pine Forest in SEQ

Photo R070. Mean Rating 6.0

Figure 28. Views of Eucalypt Plantation in SEQ

Photo B069. Mean Rating 7.2

Photo B070. Mean Rating 8.5

Photo B072. Mean Rating 7.3

Photo B092. Mean Rating 6.0

Figure 29. Views of Wetlands in SEQ

Photo R023. Mean Rating 5.7

Photo R033. Mean Rating 5.2

Photo R034. Mean Rating 5.9

Figure 30. Views of Low density Rural Housing in SEQ

- Applying SEQ Scenic Preference models

It is also possible to estimate changes in Scenic Preference Rating using preference models developed by the SEQ Regional Scenic Amenity Study and the tool developed for estimating changes between 2 different views (SPRAT-2) (South East Queensland Regional Scenic Amenity Study 2005).

Table 20. Estimated change in Scenic Preference Ratings for alternative land use calculated from modelled estimates

	Assumed Parameters	
Land Use	*Visual Domains*	*Visual Elements*
Sugar cane (base condition)	RURAL 90%; BUSH 10%	Crops, Pasture 70% Euc forest 10% Mown grass 20%
Other row crops	RURAL 90%; BUSH 15%	Crops, Pasture 65% Euc forest 15% Mown grass 20%
Pasture	RURAL 70%; BUSH 30%	Crops, Pasture 60% Euc forest 30% Mown grass 20%
Industrial farms	RURAL 90%; BUSH 5%	Crops, Pasture 55% Euc forest 5% Mown grass 20% Low non-res building 20%
Pine forest	RURAL 100%; BUSH 0%	Crops, Pasture 0% Euc forest 0% Mown grass 20% Pine forest 80%
Eucalypt Plantation	RURAL 100%; BUSH 0%	Crops, Pasture 0% Euc forest 0% Mown grass 20% Planted trees 80%
Wetland restoration	RURAL 0%; BUSH 100%	Crops, Pasture 0% Euc forest 0% Mown grass 0% Coastal vegetation 100%
Low density housing	RURAL 90%; BUSH 10%	Crops, Pasture 50% Euc forest 10% Mown grass 20% Low residential solitary 20%

Summary

Conclusions regarding the change in Scenic Preference that would result in changes of land use can be drawn from summarised data in Table 21 and Figure 31. Major interpretations of this information are:

- Both modelled data and representative survey data suggest that the greatest reduction of Scenic Preference would result from Industrial farming, resulting in a loss of 50% to 88% in Scenic Preference.
- Both data sets also confirm that Pine Plantations would also reduce Scenic Preference by 21% to 22%.

- Both data sets also suggest that conversion to Pasture would provide a slight improvement of Scenic Preference of 3% to 14%.
- Results regarding conversion to other row crops, wetlands, or low density rural housing are less conclusive due to conflicting results between modelled data and survey data.
- Despite conflicting results between modelled data and survey data, conversion of sugar cane to other row crops, wetlands, or low density rural housing is likely to result in major changes in Scenic Preference.

Table 21. Estimated change in Scenic Preference Ratings for alternative land use

Land Use	*Modelled estimates*			*Representative survey data*		
	Mean Scenic Preference Rating	*Change in SPR*	*Change (percent)*	*Mean Scenic Preference Rating*	*Change in SPR*	*Change (percent)*
Sugar cane (base condition)	6.8	0.0	0%	6.2	0.0	0%
Other row crops	6.9	+ 0.1	1%	4.7	+ 0.1	-32%
Pasture	7.0	0.2	3%	7.2	0.2	14%
Industrial farms	4.6	- 2.3	-50%	3.3	- 2.3	-88%
Pine forest	5.7	- 1.2	-21%	5.1	- 1.2	-22%
Eucalypt plantation	6.2	-0.6	-10%	6.0	-0.6	-3%
Wetland restoration	6.7	-0.1	-1%	7.2	-0.1	14%
Low density housing	6.8	0.0	0%	5.6	0.0	-11%

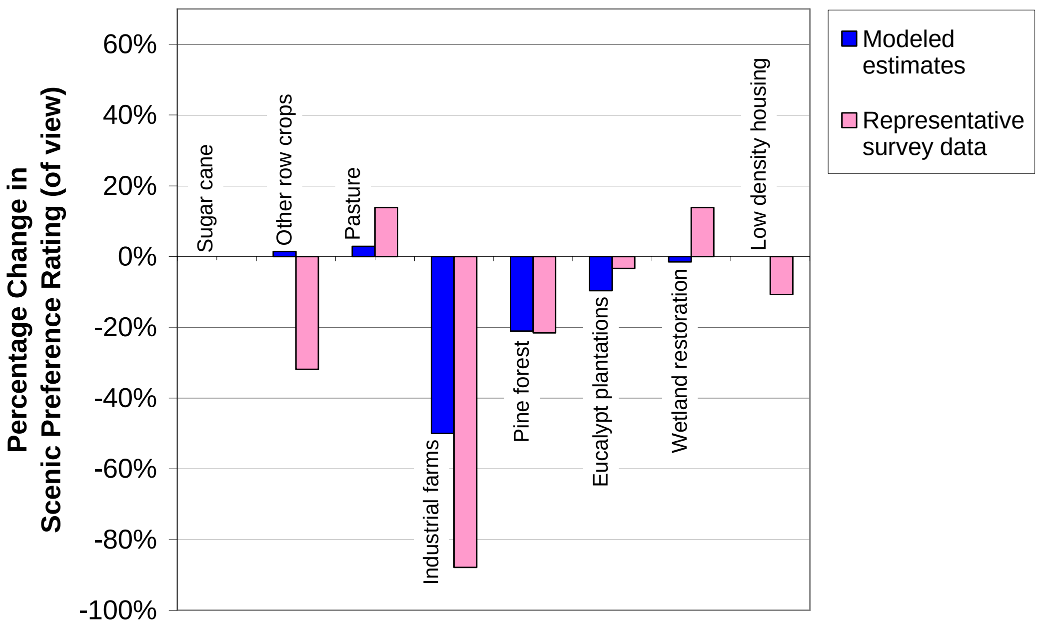


Figure 31. Estimated changes in Scenic Preference Rating (of views) for alternative rural land use

It is likely that the difference between modelled results and representative survey data for 'Other row crops' in partly due to the low proportion of Eucalypt forest from the Bush Visual Domain in representative survey images (refer Figure 24). Modelled estimates for crops may be overestimated, and estimates for pastures may be underestimated since the Scenic SEQ Scenic Preference Model does not differentiate between crops and pasture.

Impact on Scenic Amenity

Expected changes in Scenic Amenity for each land use can be deduced by considering estimated changes in Visual Exposure and Scenic Preference as summarised in **Table 22**.

Table 22. *Changes in Scenic Amenity for alternative land uses*

Land Use	*Change in Visual Exposure*		*Change in Scenic Preference*	*Change in Scenic Amenity*	
	Foreground Land Use	*Distant views to hills and mountains*			
Sugar cane	Base condition	Base condition	Base condition	Base condition	Base condition
Other row crops	x Negligible	+ Increase	x Negligible	Inconclusive	Due to model imprecision
Pasture	x Negligible	+ Increase	x Negligible	+ Slight increase	Due to increased scenic preference and distant exposure
Industrial farming	+ Increase	- Reduction	- Reduction	- Major decrease	Reduction of preference and distant exposure
Pine forest	+ Increase	- Reduction	- Reduction	- Major decrease	Reduction of preference and distant exposure
Native tree plantations	+ Increase	- Reduction	x Negligible	x Negligible	
Wetland restoration	+ Increase	- Reduction	x Negligible	x Negligible	
Low density rural housing	+ Increase	- Reduction	x Negligible	x Negligible	

Major conclusions of this investigation are:

- Adoption of industrial farming or pine plantation will lead to a major decrease in scenic amenity compared to use of land for sugar cane.
- Adoption of pasture will lead to a slight increase in scenic amenity.
- Adoption of native tree plantations, wetland restoration or low density rural housing are likely to result in negligible change in scenic amenity.
- Data and models are insufficient to provide a conclusive interpretation regarding planting of other row crops.

Implications for Future Land Use Management

While the sugar cane areas themselves provide only moderate direct benefits, the relatively low height and density of this crop affords views of inspiring mountains, bushland, rocky outcrops and waterways that have very high appeal.

Maintaining sugar cane areas, or replacing them with other low crops or pastures would allow people travelling through the areas to continue their enjoyment of these inspiring and tranquil landscapes.

Rural land uses such as Industrial Farming or establishment of Pine Forests would however detract from these aesthetic values. In locations where substantial economic benefits would be derived from these types of land use, detailed planning of site design would be required to minimise impacts on important view corridors from important public viewing locations to key visual features in the study area such as rocky outcrops, forested hills, and waterways. Some particular planning strategies that may help to achieve protection of scenic amenity in the study area are outlined below.

Protecting high scenic amenity areas

Protecting the scenic assets of the study area could be achieved by introduction of measurable performance criteria as proposed by the interim scenic amenity study (South East Queensland Regional Scenic Amenity Study 2004). Such criteria would limit levels of evident development of scenic locations (**Table 7**). This form of asset protection for areas of high scenic amenity areas has recently been adopted by the Caboolture Shire Council (Caboolture Shire Council 2003).

Protecting important views and view corridors

In addition to protecting these landscapes of high value, it will also be necessary to protect the views of these areas from popular viewpoints including important travel routes which include sections of the Pacific Highway from the northern end to the southern end of the study area, the sunshine motorway from Mt Collum to (and including) the Maroochy River) and the road from Nambour to Bli Bli and Maroochydore.

This could be achieved by the designation of visual management areas of 200m to 400m either side of major scenic travel routes as advocated by the Lockyer Scenic Amenity Study (Gatton Shire Council 2002).

Conclusions

This assessment scenic amenity and the impact of alternative land use in canelands of the Moreton Mill area has highlighted the significant aesthetic values of this location, and ecosystem services that people derive from these places in the form of health benefits.

Special management of these resources are required to ensure these resources are maintained for future generations. Options available to land managers include introduction of performance-based regulation of development to protect natural scenic assets, and designation of visual management areas along scenic travel routes to protect important viewpoints and view corridors.

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