Integrating landscape architecture in environmental planning for sustainable growth management

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Abstract: - As South east Queensland grows rapidly, a sustainable approach to development requires that the values of open space (including natural resources, habitat, landscape character, green belts and recreation) are protected. The sciences of conservation biology, landscape ecology, opportunity analysis and terrain evaluation can provide objective base data for determining significance (rarity, representativeness, sensitivity etc), and can inform the wider public, but cannot per se represent landscape quality and other values attributed to open space by the community. Effective land use planning needs transparent information regarding both objective and subjective significance of landscape and other environmental values.

Environmental planning approaches which combine rigorous data survey and analysis with community involvement and review have been developed in South-east Queensland over the past 10 – 12 years, for both landscape and biodiversity. The paper presents regional assessment case studies of relative conservation significance (biodiversity, bushland and wetland habitat) and coastal landscapes (scenic quality) using reliable and flexible techniques for integrating scientific data with community values. The most successful approaches use 1st stage GIS mapping based on selected available data, reviewed by local or regional expert panels with community participation, to assign State, regional and local significance to mapping units, with a ‘toolbox’ of statutory and non-statutory measures to protect valued assets and control development in sensitive areas.

Key-Words: - Environmental planning techniques, South east Queensland, significance, biodiversity, landscape.

1 Introduction
Environmental planning holds the key to determining the pattern and extent of urban growth. It identifies the environmental values at risk from development, land which can and cannot be developed, the type and scale of environmental changes and the manner in which any such changes should be undertaken, consistent with ecologically sustainable development (ESD) as required by Queensland’s Integrated Planning Act 1997 (IPA). Among the multiple inputs and data layers required for land use planning, the environmental components form a critical and easily-recognisable ‘package’ of information covering:

- natural resources (flora and fauna, ecology, water, soil and air quality),
- amenity and heritage values (landscape character, scenic quality and cultural heritage) and
- open space opportunities (especially outdoor recreation).

Most of the above can be expressed as spatial data, and can be categorised and mapped in terms of relative significance for conservation.

However ‘objective’ significance assessments, based on scientific measurement and internationally-accepted criteria, may not adequately take into account the values and issues of local communities. The concept of significance involves value judgments, especially regarding landscape character and scenic amenity, and new approaches are needed to incorporate subjective community inputs into significance assessment.

Methods for evaluating significance have been developed by the author and colleagues over the past decade as inputs to planning, and the following Queensland case studies document an evolving approach to the balance between science, expert opinions and community values.
2 Identifying ‘Significant’ Values

2.1 Rapid Urban Growth
South-east Queensland (SEQ) is a highly bio-diverse and attractive subtropical region experiencing rapid urban growth. This has given rise to concerns regarding the sustainability of development patterns, impacts on natural resources and landscape settings, and potential changes to our casual outdoor lifestyle. Growth management through the SEQ Regional Plan has imposed an urban footprint and density targets to reduce the impacts of greenfield development, with multiple sustainability objectives and criteria. Regional and local land use planning relies on initial identification of significant natural values for protection, management and development controls.

2.2 Tests of Significant
The assessment of significance should, if it is to be both valid and widely accepted, meet the following criteria [1]:

A: Methodology & Database
The preferred option should be:
- Authoritative & Defensible
- Relevant & Integral
- Consistent & Reliable
- Accessible & Expandable

B: Community Acceptability
- Simple & Legible
- Open & Educative

C: Feasibility
- Achievable within a planning cycle
- Justifiable in terms of costs & benefits
- Minimise physical access to private land

D: Applicability
- Transparent
- Adaptable & widely applicable
- Capable of providing immediate protection to significant features

E: Relationship To Land Use Planning
- Planning-based & Unambiguous
- Integrative & Guiding
- Flexible and Robust

‘Objective’ significance assessments based on scientific measurement and internationally-accepted criteria meet these standards, but may not adequately take into account the values and issues of local communities. The concept of significance is per se a value judgment, especially where issues of landscape character and scenic amenity are involved, and new approaches are needed to incorporate subjective community inputs into significance assessment.

Methods for evaluating significance have been developed by the author and colleagues over the past decade as inputs to planning, and the following Queensland case studies document an evolving approach to the balance between science, expert opinions and community values.

3 Case Studies

3.1 Coastal Landscapes of Queensland
The Coastal Landscape Assessment (CLA) Methodology developed for Queensland Department of Environment and Heritage Coastal Management Branch [2], assessed a range of scenic and cultural landscape values associated with coastal settings, and identified significant landscapes as an input to coastal land use planning, then applied the techniques to the coastlines of four regions (South-east Queensland, Wide Bay-Burnett, Mackay-Whitsundays and Wet Tropics).

Previous techniques of visual analysis and scenic evaluation had focused mainly on aesthetic attributes of the visible landscape, and had not adequately incorporated community perceptions of landscape values, nor the cultural and social significance of places. However the CLA Methodology includes cultural associations, recognising that the landscape has meaning and values which extend beyond visible characteristics, and which influence the perception of landscape significance.

Key concepts and guiding principles in development of the CLA Methodology are:

*Hierarchical Assessments* - a State-wide assessment of scenic landscape resources [3], cultural themes and heritage values of the coastline was followed by regional analysis of broadscale landform structure and landscape identity, which provide a framework to evaluate smaller units and describe local landscape character.

*Cultural Themes and Associations* - key themes of Queensland coastal history, a review of places listed on cultural heritage registers and focus group consultations in each region, identified cultural values and associations which influence community perception of landscape.
Landscape Setting Units - the mapping units are identifiable places (Landscape Settings) generally bounded by viewsheds, rather than land units with homogeneity of character, landform or landscape type, and these are the basis for assessment, GIS data storage and access, planning and management.

Scenic Quality Indicators – six standard indicators of scenic quality (Naturalness, Pattern, Built Form & Activity, plus diversity and contrast of Landform, Vegetation & Wildlife and Water & Shoreline) were based on the US Forest Service Scenic Management System [4], but adapted for mapping units more appropriate for coastlines subject to change and development pressure (see below), and to incorporate community values as expressed through regional focus groups.

Landscape Character and Identity - Landscape Settings and elements may be distinctive or typical attributes of character types, and contribute strongly or weakly to regional landscape identity.

Land Types - at local scale, Landscape Settings are further subdivided into Land Types (such as Foreshore, Island, Foothills, Plain etc.) and evaluated for:
- Landscape Sensitivity (combining Visual Absorption Capacity, viewing distance and receptor level);
- Scenic Integrity (the degree to which land cover resembles its original or long-established pattern);
- Elements that contribute positively or negatively to quality or character; and
- Sites of cultural heritage significance.

Expert Assessment – for each Landscape Setting, the six Scenic Quality indicators are rated from various viewpoints on a 5-point scale (Very High, High, Medium, Medium-Low, Low), using a table of descriptive criteria. Although the criteria had been validated and amended by community focus groups in each region, field assessment is multi-factorial and complex, requiring experienced landscape professionals. The subjective component of landscape evaluation is minimised by assessment procedures which are codified and repeatable, especially if calibrated across assessment teams.

Significance - landscapes are valued for their quality, cultural associations and character, rather than the usual heritage significance criteria of rarity and representativeness. The CLA methodology combines scenic quality, character contribution to regional identity, scenic integrity, landscape sensitivity and cultural significance.

Rules of Combination – relative ratings (Very High to Low) are not given arithmetic values nor are they averaged to yield composite ratings for each Setting. Instead, rules of combination are adopted whereby Settings with many indicators rating Very High scenic quality, and none of Low quality, are rated very highly overall; and conversely Settings with many “Lows” and no “Very High’s” are rated overall as “Low”; and various combinations in between.

Validation by Consultation - perceptions of landscape values and cultural significance are likely to vary between regional communities, and the CLA Methodology recommends a comprehensive consultation process. Although the four regional applications in 1997 included only focus group workshops, even this level of consultation can provide a useful “first scan” of community values, identify significant coastal landscapes and modify the criteria used in expert assessment.

Information Layers - for each Landscape Setting, assessment data regarding scenic and cultural values are aggregated by non-numeric combinations to indicate overall scenic significance, but are also accessible as separate GIS layers of information for various purposes.

The end product of the CLA Methodology is a series of maps of Landscape Settings ranked according to their scenic significance (State, regional, local – see attached extract Figure 1) with additional data on cultural significance, sensitivity and landscape elements which contribute to scenic quality and/or to regional identity. The data layers allow planners, landowners and the community to ‘drill down’ beneath the simple mapped categories to the reasons for ranking of each Landscape Setting, and this underlying information (usually linked to Land Type) is useful for development assessment and management decisions. It is also readily translated into Landscape Management Zones with graded tables of development constraints, density of built form, controls on vegetation clearing and visual intrusion, setbacks and buffers, and design guidelines.

The effectiveness of the CLA Methodology as inputs to planning has been demonstrated in Whitsunday Shire, which incorporated the mapping and Scenic Management Zones from an earlier trial.
of the techniques [5] into the 1995 Planning Scheme and especially into a Bushland-Sensitive Development designation. A more recent application has been in a landscape study of the Capricorn Coast in Central Queensland [6], where the Landscape Management Zones (see attached extract Figure 5) have been incorporated into a new IPA Planning Scheme for Livingstone Shire, and are proving effective in controlling development on visually prominent skylines and forested slopes.

The procedure is credible, repeatable and capable of yielding maps, data and recommendations for planning measures to conserve, enhance and manage landscape values. While the CLA Methodology has been developed for coastal landscapes at regional and district scale, the procedure is equally valid and adaptable for use in other landscapes and at other scales, with minor modifications.

However the CLA Methodology is not a direct tool for development assessment, and is not intended to be so. The layers of information, the need for expert interpretation and the non-numeric data combinations are impediments to any user attempting to compare the before-development ‘score’ of a Landscape Setting with a projected post-development ‘score’. While a ranking of Regional Scenic Significance (or inclusion in Landscape Management Zone A) represents a constraint on development and a trigger for detailed visual impact assessment, it is not intended to be a baseline ‘score’ against which a proposed development can be compared. In this respect the CLA Methodology is less ambitious, and correspondingly more focussed, than the Scenic Amenity Methodology currently being trialled in South-east Queensland [7].

### 3.2 Common Nature Conservation Classification System

Local governments in SEQ commissioned a more uniform approach to determining nature conservation priorities, to meet their legislative requirements to identify features of ecological significance.

The ‘Common System for Nature Conservation Classification’, as developed through literature review, workshops with government agencies, researchers and environmental consultants, and assessments of available data, represented a further development of a previous approach developed by the author [8], based on mapped polygons of remnant vegetation. Various criteria and GIS data queries are applied to these polygons to prepare ‘First Cut’ maps of relative conservation significance, followed by a second stage expert panel review using additional criteria.

The criteria adopted for conservation significance cover three broad ‘themes’ of conservation values (rarity, general habitat and ecosystem processes) and achieve a balance between a reductionist (based on site-specific and species-focused data) and a more holistic approach (oriented towards systems and processes). The Common System takes into account not only the various individual components of ecosystems, but also how they interact and affect other parts of the environment.

Differences in the uniformity and reliability of data require a two-stage process:

**Stage 1:** Mappable criteria using data that are sufficiently consistent of being reliable and available in database format, to be queried and combined to automatically generate mapped significance classes:
- Essential Habitat for ‘At Risk’ Species;
- Ecosystem Value;
- Remnant Size;
- Relative Size of Ecosystem; Integrity;
- Community Diversity; and
- Context & Connection.

These seven criteria contribute to a “First cut” classification of remnants as State, Regional, or Local conservation significance.

**Stage 2:** Other Desirable criteria are an additional six parameters which require expert interpretation of non-uniform data to modify the ‘1st cut’ rankings:
- Other Habitat for ‘At Risk’ Species;
- Habitat for Other Species;
- Localised Contribution to Biodiversity; Corridor Links;
- Geomorphological Variation; and
- Other Ecosystem Values.

Application of both the Stage 1 and Stage 2 criteria requires a consistent approach to mapping of remnant units based on vegetation polygons, and to data collection.

Important improvements and refinements introduced for the Common System included:

- Three levels of data input (Basic, Intermediate and Advanced) recognise that some local governments would rely on the
available State Government 1:100,000 vegetation and Regional Ecosystem mapping, while others had the capacity to fund surveys and mapping at a more suitable scale (1:25,000);

- Criteria relating to ecosystem rarity are considered at several scales - first assessed in regional context, then in sub-regional context, then at a local scale;
- ‘At Risk’ species are mapped separately as overlay circles centred on their recorded locations;
- The criterion of remnant size is considered at several scales – as part of a broad tract of bushland, as the absolute size of mapped polygons, and as the relative size of each ecosystem (e.g. a 40 ha patch of eucalypt forest might be relatively small, but a 40 ha patch of vine forest might be large);
- Ecosystem diversity is measured by a formula that combines richness and evenness within each polygon and also within a surrounding buffer area;
- The ratings for each Stage 1 criterion (Low, Medium, High or Very High) are combined through database combination filtering eg. if Criterion 1 is Very High, then the remnant is of State significance; if not then Criterion 2 is considered, and so on;
- The Stage 2 expert panels provided opportunities for community input; and
- Field trials were undertaken in several parts of SEQ to validate and refine the system.

The Common Nature Conservation Classification System classifies the significance of mapped remnant vegetation units for nature conservation, with standardised criteria and levels of data collection, that can be consistently applied throughout the region.

The final output is a simple legible map of relative conservation significance in three categories with consistency throughout the region (see for example Caloundra Conservation Significance map attached, one of a series of maps used as a basis for Codes in Caloundra City Plan 2004)[9]. Despite this simplicity, the accompanying GIS database will allow users to examine all the data and values that contribute to classification of each land parcel and mapping unit. These layers of information can be effectively utilised for a wide range of land use planning, development assessment and conservation management.

The Common System has subsequently been adopted as the preferred approach in SEQ, and has been adapted by the Environmental Protection Agency as a Queensland-wide Biodiversity Assessment and Mapping Methodology [10].

3.3 Principles
The above approaches have the following elements in common:

- They are based on mapping units and exploit GIS capabilities to associate, combine and interrogate data linked to each unit;
- Information is incorporated at several scales to ensure that site-specific data and criteria are balanced by ‘big picture’ regional and district context and system processes;
- A two stage process is involved, whereby an initial set of expert-generated data was used to generate 1st cut maps, which were then subject to review by a wider group;
- The assessment criteria are initially derived from a literature review of relevant research and theory, then culled according to available data and modified in group workshops or community-based focus groups;
- The assessment criteria are applied in the field by experienced professional assessors, and their results were reviewed, validated and if appropriate amended by a wider group (expert panel or a community focus group);
- Mapped units are assessed against specified criteria on a simple 4 or 5 point scale (High to Low), and the ratings for all criteria are aggregated to form a composite significance ranking (State, regional, local), using formulae or filtering combinations which avoid numeric values;
- Relative significance is a statement of values, independent of tenure, zoning, Strategic Plan designation or development threat; and
- The outcomes are simple legible maps which provide a clear indication to planners and the community of places and features of importance for conservation, but the multiple layers of associated information can be updated, or disaggregated and recombined for various purposes.
4 Conclusion

The planning response to population growth and development pressure in South-east Queensland requires flexible tools to identify, protect and manage all environmental resources valued by the community. This has required methods which integrate science and subjective values across all components of the landscape, including scenic quality and biodiversity. The significance assessment techniques developed through the Coastal Landscapes and Common System studies are robust, flexible, transparent and reliable, they are based on relevant theory and can withstand community and legal scrutiny.

Although these techniques incorporate and are responsive to community values, they are most effectively applied by experienced professionals and can be calibrated so as to yield repeatable results.

Application to a range of situations indicates that these approaches are suitable for either ‘objective’ data or more value-based attributes. Although the number of options and the database queries appear initially complex, these can be automated and readily updated, and the data-combination rules can be adjusted at any time. The outputs are legible maps with simple categories, but with data layers capable of recombinations for a wide range of planning and conservation management at regional and local levels.

Figures

Extract Figure 1 from Coastal Landscapes of Queensland [2]
Extract Figure 5 from Capricorn Coast Landscape Study [6]
Extract Map 7.5 from Caloundra City Plan [9]

References:


[9] Caloundra City Council Caloundra City Plan Section 7 Codes and Maps. 2004

[10] Environmental Protection Agency. Biodiversity Assessment and Mapping Methodology (BAMM - Ver 2.1) Biodiversity Planning Branch. 2002