Fifth Annual Pacific-Rim Real Estate Society Conference
Kuala Lumpur, Malaysia, 26-30 January 1999

Linking Primary Production to Regional Economic Development in the South Central Region of South Australia

Geoff Page

Head
School of International Business
University of South Australia, Australia
Email: geoff.page@unisa.edu.au

Keywords: Primary Production, Regional Economic Development, Primary Industry Development, Land Use Planning.

Abstract: Primary production should be linked to the economic development of a region. A comprehensive but transparent approach was designed to assist in planning decisions as well as provide a guide to intending primary producers. Rather than consider profitability (or viability) alone, each enterprise (potential development, new industry, industry innovation, etc.) has been assessed against a range of criteria.

Three main steps are involved in the process:

1. Develop a set of criteria to assess the potential primary industry developments. The criteria cover the agronomic suitability of the area for production, including the efficiency of water use, profitability and market criteria to assess current and long term financial viability, criteria which assess the impact on regional objectives such as landscape, tourism and employment, and assessment of the relative riskiness of each enterprise, an important consideration for long term viability and regional stability. This also includes an environmental risk which is important for long-term sustainability.

2. Develop a list of enterprises (potential developments, new industries, industry innovations, etc.) that have the potential to contribute to regional economic development.

3. Apply the criteria developed under step 1 to the list of enterprises compiled under step 2, to generate a set of possible developments which will be consistent with regional economic development objectives and provide a focus for directing the limited development resources available to the region.

The tasks involved in undertaking this process are described in this paper and the results of the process applied to the Mt Lofty Ranges of South Australia are reported.

Introduction

The Primary Industries Department in South Australia (PIRSA), is changing its focus from technical farm advice to economic development and natural resource management. This shift has left PIRSA without an appropriate framework to provide input into state and local planning. The analysis outlined here was developed as part of a consultancy in developing a planning framework for the economic development of the Mt Lofty Ranges.

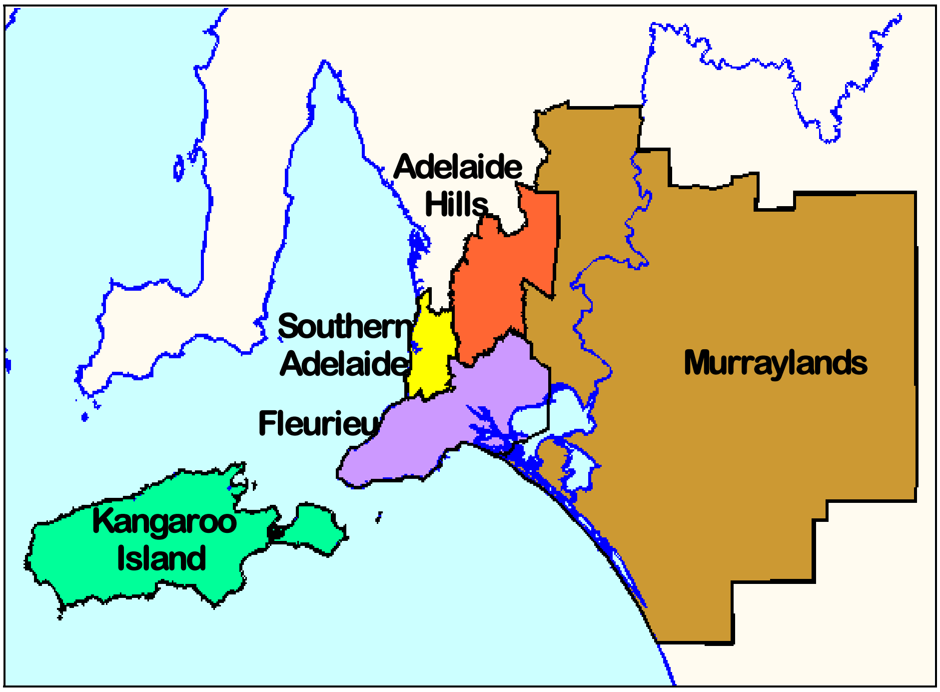

Figure 1: South Central Region

In conjunction with the resource efficiency analysis outlined in the case study to identify industries that should be protected/enhanced through government initiatives were economic input/output tables to identify the employment and economic multipliers from agriculture. It was believed that these would assist in fighting urban expansion plans by both private developers and other government agencies. It is anticipated that this would assist in providing better evidence to planning appeal tribunals on why agricultural land should not be converted to residential use.

Literature Review on Land Use Planning

It is generally agreed that Australia's rural environment is being endangered by farming practices and is in urgent need of protection. Sustainability[1] has become the catch-word of the decade as governments, interest groups, land managers and others, attempt to come to terms with the degradation of resources. Australia is not an isolated case – other parts of the developed world devote considerable attention to this problem.

Some of the difficulties with addressing this issue lie with deciding exactly what should be done, who should do it and who should finance it. In Australia, the Federal Government has been involved, for almost three decades, in attempting to solve land degradation and related problems. Arguably, the first meaningful outcome was the National Land Management Program (NLMP) in 1989. A direct result of the NLMP was, among other things, the introduction in 1991 of the Decade of Landcare. This devolved responsibility, for matters relating to sustainability of resources, to local and community groups, the number of which mushroomed between 1989 (200) and 1994 (2200) (Martin and Woodhill, 1995).

[1] Bradsen (1994) asks what is meant by 'sustainability'? He prefers to think in terms of the broader issue of sustaining bio-diversity, a term 'so all-encompassing that it is difficult to comprehend' (p 175).

Landcare has had considerable localised grassroots success in developing sustainable farming systems (Walters and Rovira, 1994). However, it has come under fire for its failure to deal with broader macro issues of sustainability[2] such as the extent of degradation, with dryland salinity and with conservation issues which may be in conflict with the productivity needs of members of Landcare groups (Task Force for the Review of Natural Resource Management and Viability of Agriculture in Western Australia, 1996; Martin and Woodhill, 1995). State Governments have entered the arena and are now dealing with matters relating to environmental sustainability. The South Australian State Government legislation - *Soil Conservation and Land Care Act 1989, Pastoral Management and Conservation Act 1989, Native Vegetation Act 1991* - which addresses both the catchment and the district and which takes into account also particular problems and individual properties, was regarded as best practice by Bradsen (1994)[3].

If it is accepted that governments must deal with macro issues then policy guidance is needed for decision- makers. Spatial decision support systems, many using Geographical Information Systems (GIS), are being used for decision-making in this area[4]. Watson and Wadsworth (1996) describe UK research into a spatial decision support system (DSS), incorporating models from agricultural economics, ecology and hydrology, being used to assess the impact of policy changes on rural land use at both the regional and farm levels. Farm level economic modelling, using the UK NELUP[5] river catchment management-environment-vegetation-ecology modelling framework, is described by Ogelthorpe and O'Callaghan (1995). The primary objectives are twofold:

1) to address how farm-level incomes and resource employment are likely to change under different conditions…; and

2) to identify and model the relationship between the different land use and management practices arising from those external conditions and the associated farm-level ecological characteristics (Oglethorpe and O'Callaghan, 1995: 93).

One of the notable features of this modelling framework was the inclusion of socio-economic variables where farmers were regarded not purely in economic terms as profit maximisers.

Models such as this address some of the problems identified by Lowe, Ward and Munton (1992) who argue that social factors have been neglected when assessing farm-level decision making. Agricultural economics' models, for example, because of their level of aggregation, cannot account for variability between farmers while other social science research has tended towards exploring certain variables independently of the wider social relations of agricultural production. Walker and Young (1997) favour integrating in decision-making systems, economic, ecological and socio-economic variables across space and through time. They point out that the failure to combine this information in a coherent framework has led to resource mismanagement. Strategic policy analysis

---

[2] Martin and Woodhill (1995) point to problems with Landcare. For example, they point to research showing that certain types of people are members of Landcare groups. Those landholders with more time and higher incomes tend to become members. Members of Landcare groups, they suggest, 'have access to State resources and influence on the management of local environments' (Martin and Woodhill, 1995: 178).

[3] The Western Australian State Government established a Task Force for the Review of Natural Resource Management and Viability of Agriculture in Western Australia (1996) which stated, in its discussion document, the importance of primary producers managing their land in a sustainable way. The Task force was to recommend to the Minister 'measures to improve the ability of individual primary producers to manage the adoption of best management practices' (p 2).

[4] Costanza, Wainger and Bockstael (1996) warn against the misuse of models. They should be used to inform policy decisions and not to legitimise policy decisions already taken.

[5] NELUP is an acronym for NERC/ESRC Land Use Programme. NELUP assists with non-recurring strategic-type decisions about land planning problems by bringing 'together the results of research in the fields of agricultural economics, hydrology, and ecology that are relevant to decisions about land use, and to make them accessible to decision-makers in a form that would allow them to examine, at the planning stage, the likely long-term consequences of their proposals' (O'Callaghan, 1992: 79).

needs to use data generated by GIS rather than rely, as in the past, almost solely on the advice of economists whose models cannot build in ecological or social factors, they suggest. Walker and Young describe a State-wide Resource Information and Accounting System (SRIAS) developed in 1991 by the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO) which was used to address policy questions about sustainability and bio-diversity.

SRIAS is the focus of research on land degradation associated with sheet and rill soil erosion in farmlands in the Lachlan catchment in New South Wales, conducted by Mallaarachchi, Walker, Young, Smyth, Lynch and Dudgeon (1996). SRIAS, which uses GIS methodology, is capable of addressing broad-scale resource, environmental and economic policy questions through transdisciplinay modelling. The GIS uses economic and physical data, as well as date on land tenure, vegetation, geology, soils, land form, population and the state of degradation in a four-step mapping process: the development of land use maps, the development of a value of production map, the computation of soil erosion estimates and the estimation of the value of foregone productivity.

The rural/urban land use conflict in rapid growth areas was the focus of research in China conducted by Yeh and Xia (1998). Using a concept of sustainable development they developed a model using GIS methodology and applied it to Dongguan in southern China. A number of criteria - sustainable development, land supply, spatial efficiency, competing land use and fragmentation- were components of the model. When the model was applied to Dongguan it was found that ‘the actual development pattern lacks proper land use planning and the cost is greater than it should be’ (Yeh and Xia, 1998: 185)[6].

The US Patuxent Landscape Model (PLM), described by Costanza, Wainger and Bockstael (1996: 265), is an integrated model which attempts to incorporate ‘ecological and economic modeling and analysis in order to improve…understanding of regional systems, assess potential future impacts of various land-use, development, and agricultural policy options, and better assess the value of ecological systems’. Ecological processess are modelled spatially using a GIS. A unique feature of the PLM lies in its attempt to model land use decisions interactively with features of the local ecosystem by examining micro level changes over time[7].

Effective regional management and long-term sustainability depends, in large part, on developing models linking ecology, economics, hydrology and other disciplinary areas. The use of GIS in decision making has proven to be of benefit because of its ability to handle multiple data sets from a number of disciplinary areas and then map the results spatially. However, the GIS discussed here are not yet addressing adequately broad issues of sustainability. Haines-Young and Watkins (1996: 40), for instance, argue that ‘we are still a long way from generalising from landscape responses to different policy measures within catchments to landscapes at regional and national level’.

---

[6] Land use conflicts such as that between rural residential versus agricultural land versus extractive industries versus conservation areas and water catchments have also been considered. See, for example, Regional Planning Advisory Group (1993) (Queensland) and Rural Planning Review (1994) (Victoria).
[7] Costanza et al (1996) argue that economists tend to model land use decisions in a static context.

Table 1:

Central Hills																												
Industry	Markets		Profitability			Infra-structure		Industry			Production			Offsite effects								Regional				Risk		Total
	developed	market outlook	capital requirements	land price competitive	profits	storage & processing	transport	established structure	united industry	research/development	total water	water efficiency	land suitable	chemicals	noise	smell	urban compatability	water table/salinity	disease contamination	erosion/structural decline	biodiversity	employment	landscape	n.l. tourism considerations	community acceptance	water quality	market risk	climate risk	
milk	5	3	3	3	3	4	4	4	4	3	2	2	3	4	3	3	3	3	4	3	4	2	4	2	4	3	4	4	100
cherries	4	4	2	4	4	5	4	4	5	4	3	4	5	3	5	5	4	3	4	4	3	3	3	3	4	4	3	3	118
apples/pears	4	4	3	4	4	5	4	4	4	4	3	4	5	3	5	5	4	3	4	4	4	3	4	3	4	4	3	3	120
farm forestry	3	4	4	4	4	2	4	2	2	4	5	4	3	4	5	5	5	5	4	4	3	1	4	2	3	4	3	4	113
beef	5	3	5	2	2	4	4	4	3	3	5	4	5	4	4	4	3	4	4	4	4	2	4	2	4	3	3	4	116
intensive vegetables	4	4	1	5	5	4	4	3	2	3	3	5	4	2	3	3	4	3	3	4	1	4	2	2	2	2	2	4	100
field vegetables	4	3	4	4	4	4	4	3	2	3	2	2	3	3	3	3	4	2	3	2	3	3	3	2	3	3	2	3	91
grain & fodder	4	3	4	3	3	3	4	4	3	3	4	4	4	4	4	4	4	4	3	4	5	2	4	2	4	5	4	4	115
lamb meat	3	3	5	3	2	4	4	3	3	3	5	4	4	4	4	4	2	4	3	4	4	2	4	2	4	3	3	4	110
flowers - field	3	3	4	4	4	4	3	3	2	3	3	4	4	3	4	4	4	4	4	4	3	3	4	4	4	4	3	4	111
flowers - housed	4	4	1	5	5	4	3	3	2	3	3	5	4	2	3	4	3	4	3	4	1	4	2	3	2	2	2	4	101
olives	3	4	3	4	4	3	3	3	3	4	3	4	4	4	4	4	4	3	4	4	3	2	4	4	3	4	4	4	111
aquaculture	3	4	3	4	3	4	3	3	3	3	3	4	3	4	4	4	3	2	4	5	3	3	3	4	3	3	3	4	105
viticulture	4	3	2	4	4	4	4	5	4	4	3	4	4	3	3	4	4	3	4	4	4	5	4	5	4	4	4	4	119
wool	4	1	5	1	1	4	4	4	3	3	5	4	4	5	4	4	2	4	3	4	4	2	4	2	4	4	3	4	109

Resource Matrix

The resource matrix has been undertaken to identify the relevant planning issues and to identify the best industries from a broader community perspective. It should be remembered that many private investors will only be concerned with markets and profits, rather than community benefits or long term sustainability.

The matrix has been prepared for the eight identified subregions. Fifteen landuses have been scored against 28 criteria which were identified by the steering committee. The 28 criteria are within 9 main categories.

The 28 criteria are equally considered with the exception of the items in the production category which are given a higher weight. The landuses were identified on the basis of current production levels and trends and analysis of potential new industries.

General assumptions

(i) Matrix is scored on scale of 1 to 5 with 5 being top score and 1 lowest. Some items are reverse scored to achieve this.

(ii) The scores are relativities. These are judgemental with scores an interpretation of published information.

(iii) The scores are based on current average management rather than best or worse practice.

(i) Nature of development opportunity/market potential

Developed market: a measure to extent that the markets are already established for the output

***Market outlook*:** what is the medium term market outlook (5 years) for this enterprise?

(ii) Infrastructure

Storage and processing: extent that storage and processing facilities are available in the region or close by

Transport: the availability of transport services and the relative cost of transport to deliver the products to markets

(iii) Industry

Established structure: the extent that the industry has an established structure and structures that cover the sub-region

United industry: the extent that industry is working together to expand the industries

Research/development: the extent that research and development is being directed towards expanding and supporting the industry

(iv) Production

These items reflect the physical characteristics which affect production. Because of their importance they have been given a higher weight.

Total water: a relative measure of the water requirements of the industry. There is currently no identified surplus of water supply available in the regions, though some expensive water maybe imported. As new enterprises have to replace existing enterprises using water, the score of 1 reflects very high water use and 5 no water use.

Water efficiency: the relative efficiency of irrigation practices or crop management to utilise available water. Drier areas requiring additional water will have lower scores than when the enterprise only requires small amounts of supplementary water.

Land suitable: the extent that land of suitable slope, soils, arability and climate are available in the region

(v) Offsite effects

The extent that these can create a nuisance and that the community will lobby against them. All these variables are reversed, scored with 5 indicating no problems and 1 as high problems.

Chemicals: the extent that chemicals are used in the industry and the extent to which it is visable.

Noise: the extent of noise and in particular the incidence of noise between 10.00 pm and 8.00 am.

Smell: the extent that bad smells are given off by enterprises and the extent of such incidences

Urban compatibility: the relative ability of enterprises to live within a region that has many rural residential/living properties. This includes the problems created with dogs and kids.

(vi) Landcare considerations

There are a series of factors that are important for long-term sustainability. Again, these are reversed scored.

Rising water tables/salinity: the extent that the water table is likely to rise with this enterprise or salinity levels increase from using poor quality water

Structure decline/erosion: the extent that soil structure could decline under this enterprise or the likelihood of erosion occurring

Disease contamination: the extent that soil-borne diseases will build up to prevent long-term landuse

Biodiversity: the relative extent that biodiversity is maintained under these enterprises

(vii) Regional

These are factors that regions would consider in their planning.

Employment: the relative extent that the enterprise would create employment opportunities. Regional input/output tables were created to assist in the development of appropriate scores

Landscape: the relative acceptance of visual amenity of enterprises which is of importance in a tourism context

Non-landscape tourism considerations: the relative extent that festivals and activities associated with industry will bring people to the area other than for visual reasons

Community acceptance: the relative extent that communities will support the existence of expansion of a particular enterprise

(viii) Risk

This group includes community income effects and risks to communities water supplies. These are again reversed scored.

Quality water: the relative extent of industry having adverse effects on either surface or sub-surface water

Market risk: the relative extent that enterprise faces stable prices, rather than oscillating dramatically between high and low prices

Climate risk: the relative extent that climactic factors will affect yields and quality

(ix) Profitability

These variables reflect the viability of enterprises.

Capital requirements: the relative extent that capital is required for the enterprise. This variable is reversed scored.

Land-price competitiveness: the relative extent that industry can compete against high urban/rural living land prices

Profits: relative profits from an established enterprise

Results

The results of the analysis are shown in Table 2:

	E Hills	C Hills	S Fleurieu	Barossa	Virginia	S Plains	Kangaroo Island	Willunga
milk	96	100	103	100	97	98	93	100
cherries	105	118	114	111	105	106	106	111
apples/pears	109	120	117	115	110	109	110	113
farm forestry	113	113	113	113	113	109	113	113
beef	114	116	114	113	111	113	111	113
intensive vegetables	96	100	96	97	107	98	95	96
field vegetables	84	91	91	92	103	91	89	91
grain & fodder	113	115	114	113	113	116	116	113
lamb meat	109	110	110	109	107	109	111	109
flowers - field	105	111	109	110	111	110	108	109
flowers - housed	100	101	98	101	106	100	98	100
olives	111	111	113	111	111	111	112	112
aquaculture	104	105	107	107	107	107	107	107
viticulture	110	118	120	126	118	122	111	122
wool	112	113	109	109	109	109	111	109
top enterprises	beef	apples	vines	vines	vines	vines	grain/ fodder	vines
	forestry	cherries	apples	apples	grain/ fodder	grain/ fodder	forestry	apples
	grain/ fodder	vines	cherries	forestry	forestry	beef	olives	beef
	wool	beef	fodder	grain/ fodder	flowers	olives	beef	forestry
	olives	grain/ fodder	beef	beef	olives	flowers-field	wool	grain/ fodder

These were given a partial validity/credibility test by the steering committee and by allowing industry people to comment on scores these then provided a focus for the review of planning legislation with the main industries identified. The advantage of this analysis is that it removes some of the biases in perceptions of industry and allows more open decision-making.

Conclusion

The future will show the appropriateness of this approach.

Bibliography

Agriculture and Resource Management Council of Australia and New Zealand and Australian and New Zealand Environment and Conservation Council (1996), *Draft Rural Land Uses and Water Quality, A Community Resource Document*, National Water Quality management Strategy, Canberra: Commonwealth of Australia.

Bradsen, John (1994), 'Alternatives for Achieving Sustainable Land Use', in Laurie Cosgrove, David G Evans and David Yencken (eds), *Restoring the Land: Environmental Values, Knowledge and Action*, Melbourne: Melbourne University Press.

Budge, Trevor and Associates and the Department of Conservation and Natural resources, Office of the Environment (1994), *Rural Planning Review*.

Clewett, JF, WR Kininmonth and BJ White (1995), 'Sustainable Agriculture: A Framework for Improving Management of Climatic Risks and Opportunities', in Prime Minister's Science and Engineering Council, *Sustaining the Agricultural Resource Base*, Canberra: Australian Government Publishing Service.

Costanza, Robert, Lisa Wainger and Nancy Bockstael (1996), 'Integrating Spatially Explicit Ecological and economic Models', in Robert Costanza, Olman Segura and Juan Martinez-Alier (eds), *Getting Down to Earth: Practical Applications of Ecological Economics*, Washington, DC: Island Press.

Egan, Adrian and David Connor (1994), 'Productivity and Sustainability of Agricultural Land', in Laurie Cosgrove, David G Evans and David Yencken (eds), *Restoring the Land: Environmental Values, Knowledge and Action*, Melbourne: Melbourne University Press.

Gar-On Yeh, Anthony and Xia Li (1998), 'Sustainable land development model for rapid growth areas using GIS', *International Journal of Geographical Information Systems*, Vol 12, No 2, pp 169-189.

Haines-Young, Roy and Charles Watkins (1996), 'The rural data infrastructure', *International Journal of Geographical Information Systems*, Vol 10, No 1, pp 21-46.

Hallett, SH, RJA Jones and CA Keay (1996), 'Environmental information systems developments for planning sustainable land use', *International Journal for Geographical Information Systems*, Vol 10, No 1, pp 47-64.

Jones, CA, PT Dyke, JR Williams, JR Kiniry, VW Benson and RH Griggs (1991), 'EPIC: An Operational Model for Evaluation of Agricultural Sustainability', *Agricultural Systems*, Vol 37, pp 341-350.

Lowe, P, N Ward and RJC Munton (1992), 'Social analysis of land use change: the role of the farmer', in Whitby, MC (ed), *Land use changes: the causes and consequences*, ITE Symposium No 27, London: HMSO.

Mallawaarachchi, T, PA Walker, MD Young, RE Smyth, HS Lynch and G Dudgeon (1996), 'GIS_based Integrated Modelling Systems for Natural Resource Management', *Agricultural Systems*, Vol 50, pp 169-189.

Martin, Peter and James Woodhill (1995), '"Landcare in the Balance": Government Roles and Policy Issues in Sustaining Rural Environments', *Australian Journal of Environmental Management*, Vol 2/3, pp 173-183.

O'Callaghan, JR (1992), 'NERC/ESRC Land Use Programme (NELUP)', in Whitby (ed), *Land use change: the causes and consequences*, ITE Symposium No 27, London: HMSO.

Oglethorpe, DR and JR O'Callaghan (1996), *Journal of Environmental Planning and Management*, Vol 38, No 1, pp 93-106.

Task Force for the Review of Natural Resource Management and Viability of Agriculture in Western Australia (1996), *Review of Natural Resource Management and Viability of Agriculture in Western Australia, A Discussion Document*, Perth: Information Services, Agriculture Western Australia.

The Regional Planning Advisory Group (1993), *Rural Residential*, A Policy Paper of the SEQ2001 Project.

Ventura, SJ, BJ Niemann and DD Moyer (1988), 'A multipurpose land information system for rural resource planning', *Journal of Soil and Water Conservation*, Vol 43, No 3, pp 226-229.

Wadsworth, RA (1992), 'Software implementation of a decision support system for land use planning', in Whitby, MC (ed), *Land use change: the Causes and consequences*, ITE Symposium No 27, London: HMSO.

Walker, Paul A and Michael D Young (1997), 'Using integrated economic and ecological information to improve government policy', *International Journal of Geographical Information Science*, Vol 11, No 7, pp 619-632.

Walters, Leigh and Albert Rovira (1994), 'Turning Research into Action on the Farm', in Laurie Cosgrove, David G Evans and David Yencken (eds), *Restoring the Land: Environmental Values, Knowledge and Action*, Melbourne: Melbourne University Press.

Watson, Philip M and Richard A Wadsworth (1996), 'A computerised decision support system for rural policy formulation', *International Journal of Geographical Information Systems*, Vol 10, No 4, pp 425-440.

Wilson, Glen (1994), 'Farm Landscaping', *Landscape Australia*, Vol 4, pp 319-323.

Wyatt, Peter J (1997), 'The development of a GIS-based property information system for real estate valuation', *International Journal of Geographical Information Science*, Vol 11, No 5, pp 435-450.