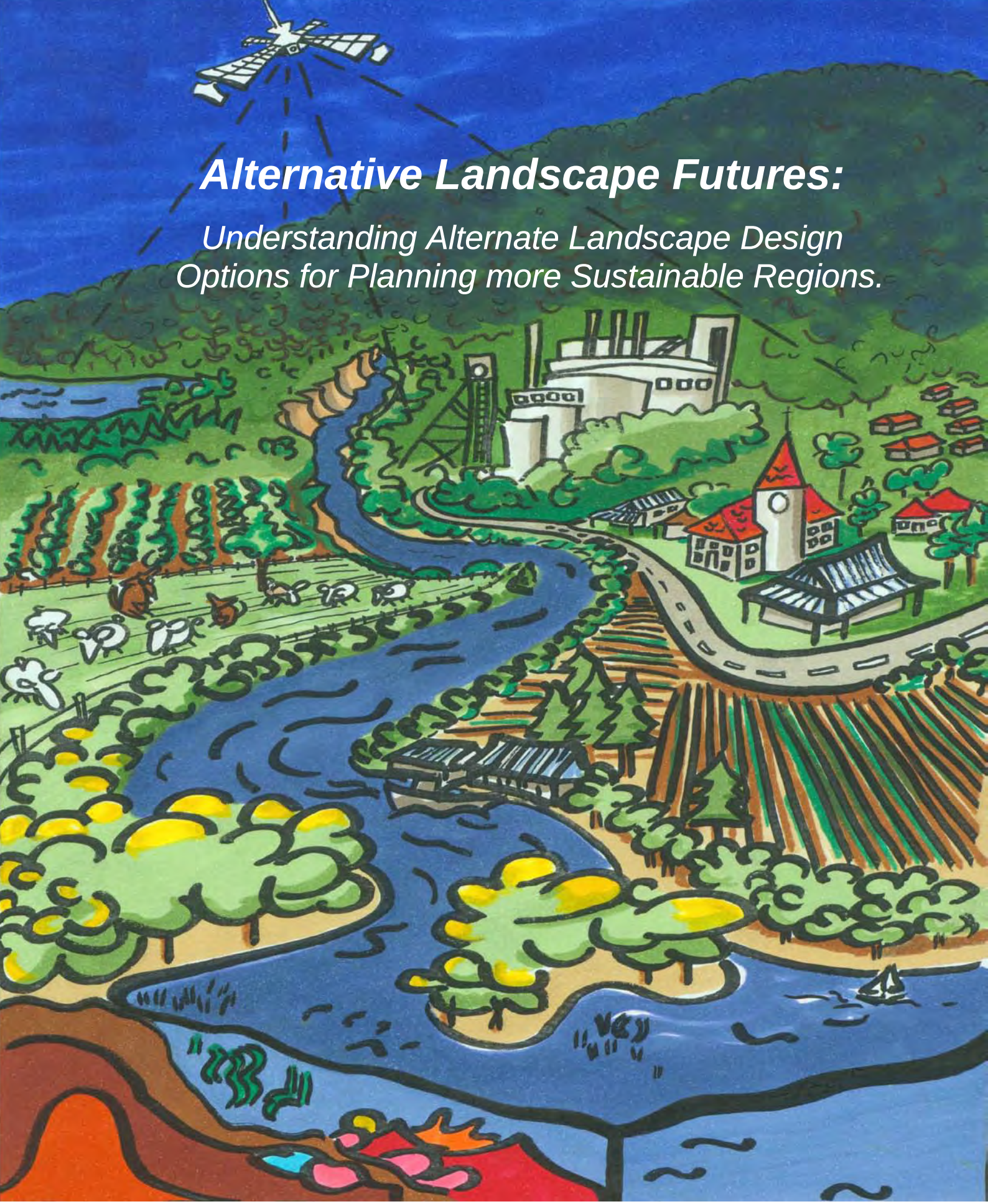

Alternative Landscape Futures:

Understanding Alternate Landscape Design Options for Planning more Sustainable Regions.

Land and Water Australia, Project: UNE 54

Australian Government
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Institute for Rural Futures

CBRM Centre for Bioregional Resource Management

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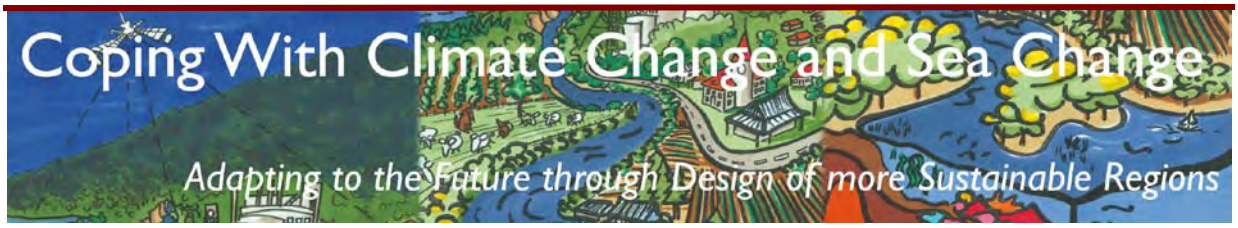


Alternative Landscape Futures:

Understanding Alternate Landscape Design Options for Planning more Sustainable Regions.

David Brunckhorst Phil Morley

Contents

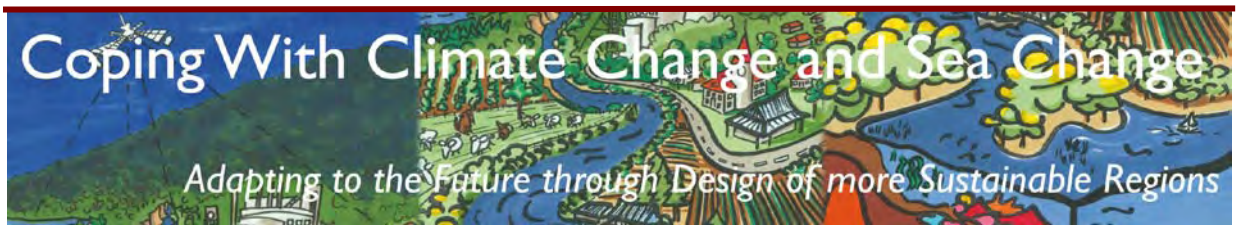
Executive Summary v

Project Report: *'Alternative Landscape Futures'* 1
- Project Information 1
- Contact details 1
- Acknowledgements 2

Project Objectives 3

The Project 3
- Introduction 3
- Framework and Procedure 6
- Context for Case Study Application 8
- Methodological Application to Case Study Region 9
- Results 12
- Discussion 15

Summary of Communication and Adoption Activities 19
- Communication Activities Summary 19
- List of appendices and technical reports (on DVD) 20
- List of Digital Spatial Data and other Outputs 20


Coping With Climate Change and Sea Change
Adapting to the Future through Design of more Sustainable Regions

Executive Summary

Alternative Landscape Futures (ALF) analysis is a long-term, large area, land and environment assessment approach for assisting communities and policy makers make decisions about planning the future of that area. It provides a spatially explicit, regional scale perspective on the combined effects of the multiple policies, plans, population and land use pressures affecting the availability of natural resources and ecosystem services for a geographic area.

The Alternative Landscape Futures approach presented here contributes new tools, knowledge and, potentially a wide range of applications to guide policy and planning of future sustainable landscapes across rural and regional Australia. These are demonstrated through an, in itself useful and practical, case study of north-eastern NSW – an area facing enormous "*Sea Change*" development, urbanisation and consequent land use and landscape change.

Which future is most desirable, most sustainable? By capturing the essential elements of a very complex debate about regional development and sustainability, including the regional context specific views of communities (in the current study from several past, highly consultative regional strategies), a relatively small number of geographically meaningful future scenarios can be generated. These can then be objectively assessed in terms of the consequences of each choice in changing the regional landscapes in the medium to long term. The outcomes provide a much clearer picture of the future for communities, planners and policy makers to move towards a common understanding, possible resolution, and decisive action towards more sustainable futures.

The approach and methodology developed through this project contributes timely, Australia specific approach and design principles for:

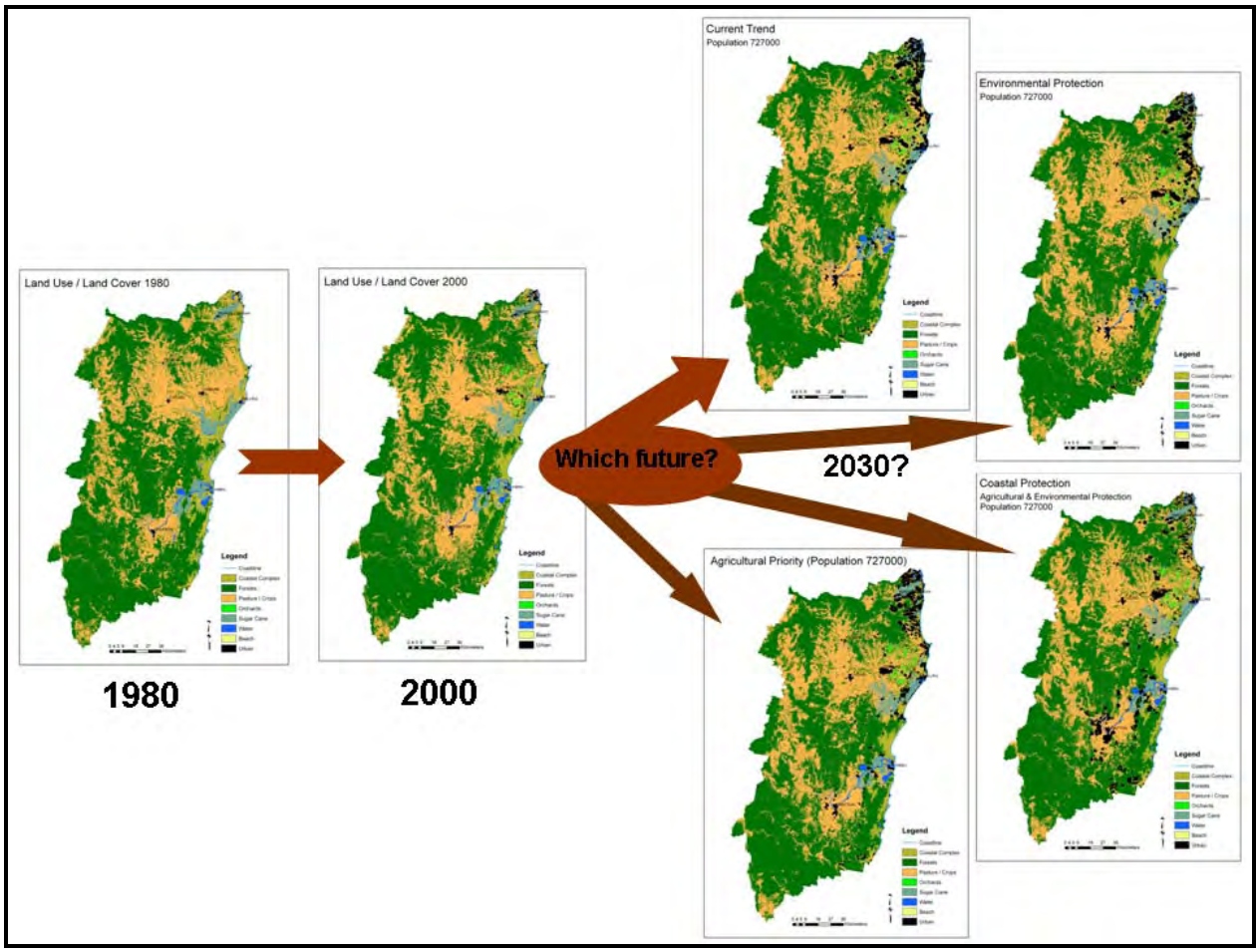
1. Understanding past change and current trends and the relationship to future probable trajectories for regional landscapes;
2. Developing alternative landscape futures scenarios designed to meet different community expectations;
3. Spatially explicit visualisation of future trajectories of likely land use change and (plausible) designed alternative landscape futures;
4. Evaluation of the resultant landscape change of current trends and alternatives likely to take place over the next 20-40 years and, the long-term effects of design elements on future landscape change (including current trends and policy directions and alternative landscape designs).

The landscape future scenarios for coastal northern NSW examined four population growth endpoints which are likely to be arrived at over the next 20 to 40 years, if not sooner. In current trends and in all scenarios, population growth is the major driver of landscape change through urbanisation (and subsequent displacement of agriculture and environmental services). For each population, landscape futures scenarios were generated and evaluated as follows.

1. *Current Trend* of land use change from population growth and urbanisation, unconstrained by other factors.

2. *Coastal Protection* that pushes future population growth and related urbanisation inland; either unconstrained by other land use, or constrained by protection of agricultural values and environmental services and values.
3. *Agricultural Priority* for protection of good agricultural land and soils (and avoid potential acid soil risk areas).
4. *Environment Priority* for protection of various environmental systems and services.
5. *Agriculture and Environment* for protection of both important agricultural lands and various environmental systems/services; with two options for settlement density.

These seven sets of drivers and social-ecological variables or constraints, together with four future population levels, produced 28 scenarios. In addition, an overlay of possible climate change storm surge and flooding of coastal area and eastuary vulnerability is provided as an overlay.



Local to regional communities of these areas, and higher levels of governance, need to responsibly consider the long-term public good in deciding which future they desire. Nevertheless, it is imperative that such thoughtful consideration and adaptive action is taken very soon if the current trends are thought inappropriate and unsustainable. Either through decisive adaptive action, or by inaction, society is choosing its future now.

David Brunckhorst and Phil Morley

Institute for Rural Futures, and
UNESCO Centre for Bioregional Resource Management
University of New England

Landscape Futures – Understanding Current Trends and Alternative Scenarios for the Future of Regions

Project Information

Australian Government
Land & Water Australia

Land &Water Australia Project Ref: UNE 54

Project Title: *Understanding Alternative Landscape Design Options for Planning more Sustainable Regions.*

Short title: *Alternative Landscape Futures*

Date of report preparation: 2 July 2008

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Acknowledgements

The principal research officer and GIS modeller for this project was Phil Morley and much of the excellent results and outputs of this project are due to Phil's untiring efforts for both accuracy and reality in his contextually relevant analyses, algorithms, cellular automata and other modelling.

Karl Bock assisted in the initial stages of the project, particularly with satellite image analysis, field work and training of the classifications for the historical trends of land use and the analysis of socio-economic change.

We are particularly grateful for the interest, advice, guidance and more direct contributions of Dr Scott Bassett, a Senior Research Fellow with the Desert Research Institute (DRI), University of Nevada. Dr Bassett along with one of his students, Jamie Trammel, greatly assisted Karl in early stages of the project, in particular image classification and change analyses. These set an accurate scene of past and present pressures of change to guide the understanding of 'scenarios' of the future.

Professor Mike Scott (USGS / University of Idaho), Dr Gina Wilson (USGS / University of Idaho), Professor David Hulse (University of Oregon), Professor Carl Steinitz (Harvard), Dr Denis White (US EPA / Oregon State University), Dr Margaret Shannon (University of Freiburg), Dr Dave Mouat (also DRI, U. Nevada), along with Dr Bassett made up an 'ad hoc', but very valuable, scientific steering committee and their advice and guidance has been greatly appreciated through out all stages of this project. Several of these people have been involved in Carl Steinitz' "Alternative Landscape Futures" projects around the world.

The project was funded by Land & Water Australia. Through out the project Drs Stuart Pearson (LWA) and Nick Schofield (formerly LWA) have provided excellent feedback, advice and guidance for which we are particularly grateful.

We also gratefully appreciated discussions, data and other in-kind support provided by Shires and Local Councils, and the NSW Departments for Planning, Primary Industries, Environment and Climate Change, and Lands. The NSW Lands Department, Spatial Data Infrastructure (SDI) is a valuable current and future resource for planning sustainable futures.

Literature Review, References and Bibliography

A comprehensive literature review was prepared as a component of this study and is a separate document. References for all citations in this report, the literature review and attachments, and additional reading, are also collated in a separate document as an attachment to this report, referred to as the bibliography.

Project Objectives

1. To contribute knowledge to guide development of future sustainable landscapes, enterprises and industries in rural and regional Australia.
2. To contribute further design principles for processes and evaluation of landscape redesign alternatives.
3. To contribute a transferable methodological tool (approach and process).
4. Postgraduate research training and capacity building; and communications.

Specific:

i) Adaptation, development and application of an alternative landscape futures, scenario analysis and design approach, different to any used in Australia to date.

ii) A small scale trial on north-eastern NSW — Through case study application with regional stakeholders, trial the methodology in a local regional context.

iii) Provide a product that is useful to regional Shire/Council areas, in a regional context, for making better long-term decisions on agriculture, environmental protection, and local and regional development, services, and DA, LEP / REP processes.

iv) Evaluate the approach and methodology, its practical application and transferability (particularly for areas of regional Australia experiencing complex interacting pressures of change on land use and natural resources).

v) Provide a product that is useful to an LWA 'Redesign' toolbox, with potential broader communication of the application of the approach for other regions and contexts.

The Project

Introduction

Landscapes are a social construct, but they are also inherently diverse and embody a multitude of values for their inhabitants. Landscapes include people and communities, resource production and related industries, economies and political institutions, biodiversity and ecological systems (Figure 1). These components operate at various scales and interact at a variety of levels. Constant change is the normal state. However, the pressures of change on economies, ecological services and resources and towns and communities are increasing – all components are struggling. The effects of various social and ecological interactions, pressures and changes are entwined. Single issue or narrowly focused approaches to solutions are unlikely to have lasting benefits, therefore more holistic, multi-scale and long-term understanding is required to work towards more resilient, sustainable and adaptable futures.

Human activity is a major change force shaping landscapes. Past change (time minus) has provided us with our present starting point – there is no point 'winding back the clock'. Using past lessons and new information, there is a pressing need to attempt to influence, in a more 'holistic' and sustainable manner, change towards future (time plus) sustainable regional landscapes and compatible industries (Figure 2).

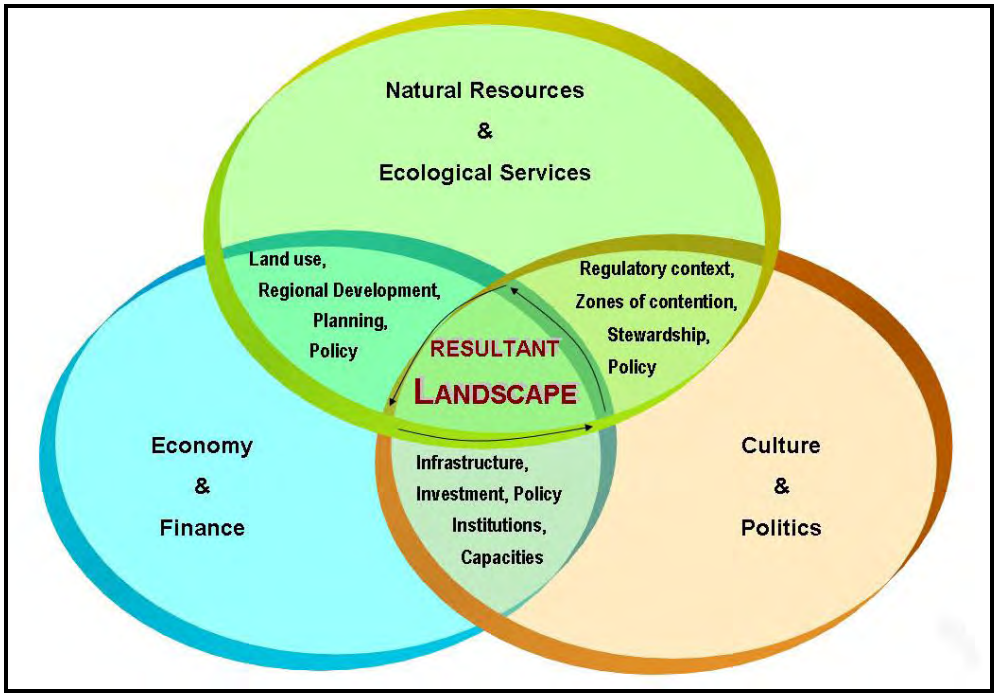

Figure 1. Landscapes change constantly and new patterns and properties emerge through constant interaction and dependencies of social and ecological system components (from Brunckhorst 2002).

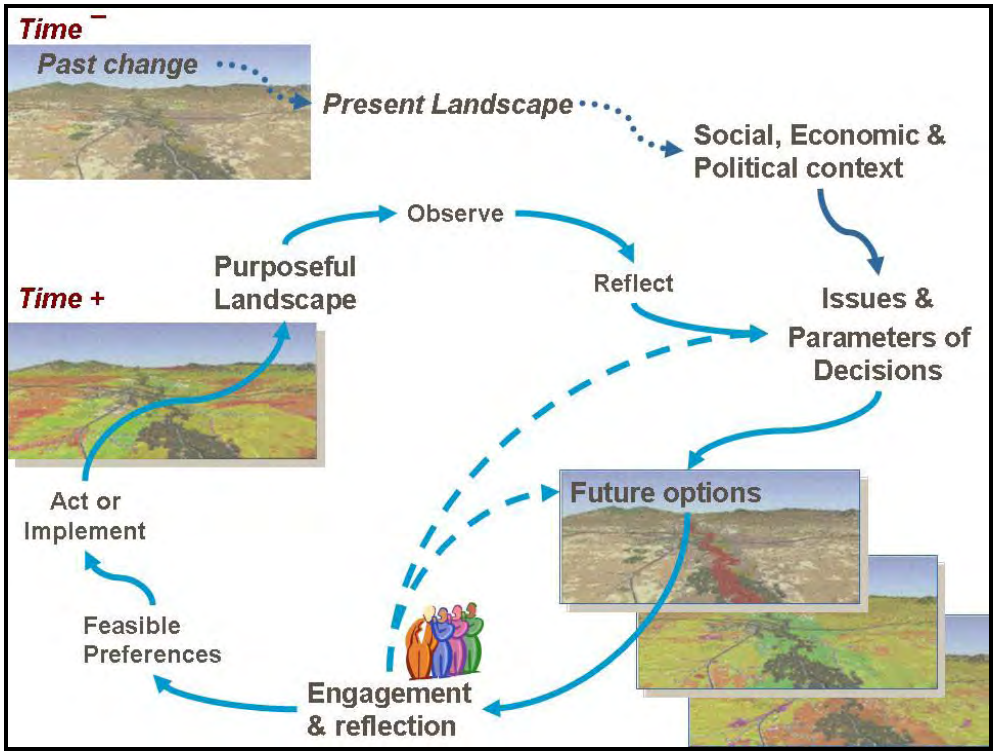

Figure 2. Diagrammatic representation of influence of past change on future change or decisions to "re-design" the direction of the cycles of future change (adapted after Brunckhorst 2002). These cycles could represent adaptive implementation of ALF scenarios by local to regional communities and policy makers over time.

A whole systems understanding is required — not necessarily detailed knowledge about every variable — but rather, an integrated view about how key drivers might create emergent patterns or properties (such as expansion and contraction of urban areas, productive land, civic institutions and ecosystem services).

Geographically explicit landscape evaluations are a key component of research examining interacting relationships between social and ecological systems that produce change in those systems. Anticipatory assessments with a long time horizon, such as Alternative Landscape Futures (ALF) analysis, are designed to inform stakeholders and government decisions on the impacts of different options for future land and other resource allocations (Steinitz et al., 2003; Hulse et al., 2004; Figure 3). The major advantage of this approach is the integrative process for linking scientific understanding of landscape change to the value laden planning and public policy making processes that ultimately shape the future of places (Steinitz 1990).

Alternative Landscape Futures (ALF) analysis provides a geographic synthesis of the multiple policies, plans and regulations affecting the longer term biogeography of resilience in social-ecological systems (Brunckhorst 2002, 2005). The procedure evaluates trends and alternative scenarios for designed futures that are likely to be plausible and practical to plan and implement.

This project contributes an advanced approach and adaptable method for Alternative Landscape Futures analysis to the 'toolbox' for regional assessments. The approach is demonstrated through application to a large region of the north-eastern NSW coast currently experiencing rapid development and landscape change. This regional and community-based method to the design and evaluation of future sustainable landscapes, incorporating a new approach to perceiving alternative future landscape scenarios, the biophysical, social and economic constraints or trade-offs and potential emerging new industries and integrated regional development. This will become the 'preferred' future landscape for 'triple bottom-line' sustainability.

Governments, planners and policy makers, community leaders and residents will need to decide for themselves if they want to implement action towards that desired future (time plus). If they do, and over the course of time, that landscape will become a present landscape, and eventually a past landscape (time minus). The cycle of observation, analysis (with new information), design of future scenarios, reflection on a preferred future/s, and adaptive change should continue (Figures 2, 3).

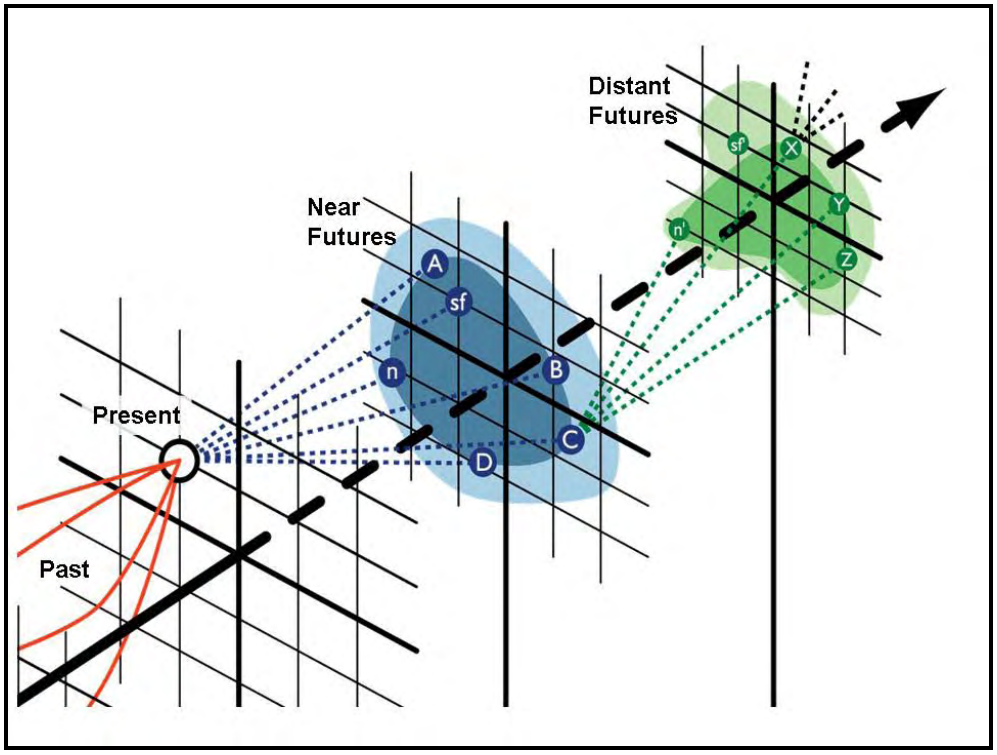

Figure 3. Past change through the lens of the present helps us to project, understand and evaluate preferences and decisions for near and distant futures (diagram adapted after Steinitz et al. 2003).

Framework and Procedure

The project's underlying tenet for deriving, depicting and understanding multiple, plausible landscape futures is consideration of 'design' as an active and adaptive process (Steinitz 1990). Practical models based on valid theory (landscape ecology, planning, policy, landscape design theory, bioregional planning, social policy) are used to produce transferable and real applications for communities and government.

The project methodology builds on the scenario analysis and design approach of Professor Carl Steinitz (1990, 1993, 1996, 2000, 2001, Steinitz et al, 2003, Shearer et al., 2004), and David Hulse and colleagues (2001, 2002, 2004), which is different to any developed or tried in Australia to date. The Steinitz procedure (Figure 4) frames the context and issues that will inevitably arise. The framework identifies several different questions (Figure 4). Please refer to literature review and bibliography for further details.

The procedural path initially starts from the top passing down through each series of questions required of each theory driven model (Figure 4 boxes). This 'first pass' specifies the context, content and scope and defines specific questions (within each of six major questions) specific to the context of the study area. In summary, landscape futures designs are analysed to distil the most plausible, practical and 'sustainable' alternative/s. The framework with these questions contributes to the stakeholder feedback process and analytical methodology. After recognising and describing the context and scope of purposeful landscape change, we need a means of deciding on whether to, or what to, change and a way to compare alternatives or evaluate the

changes that would be imposed on the present landscape by the future landscape scenario/s. Therefore the procedure iteratively goes back through the steps to model and assess change on the regional landscape. To increase robustness and transferability, our approach in this project has included an examination of past change and trends that contribute to future likely trajectories. Please refer to literature review and bibliography for further details.

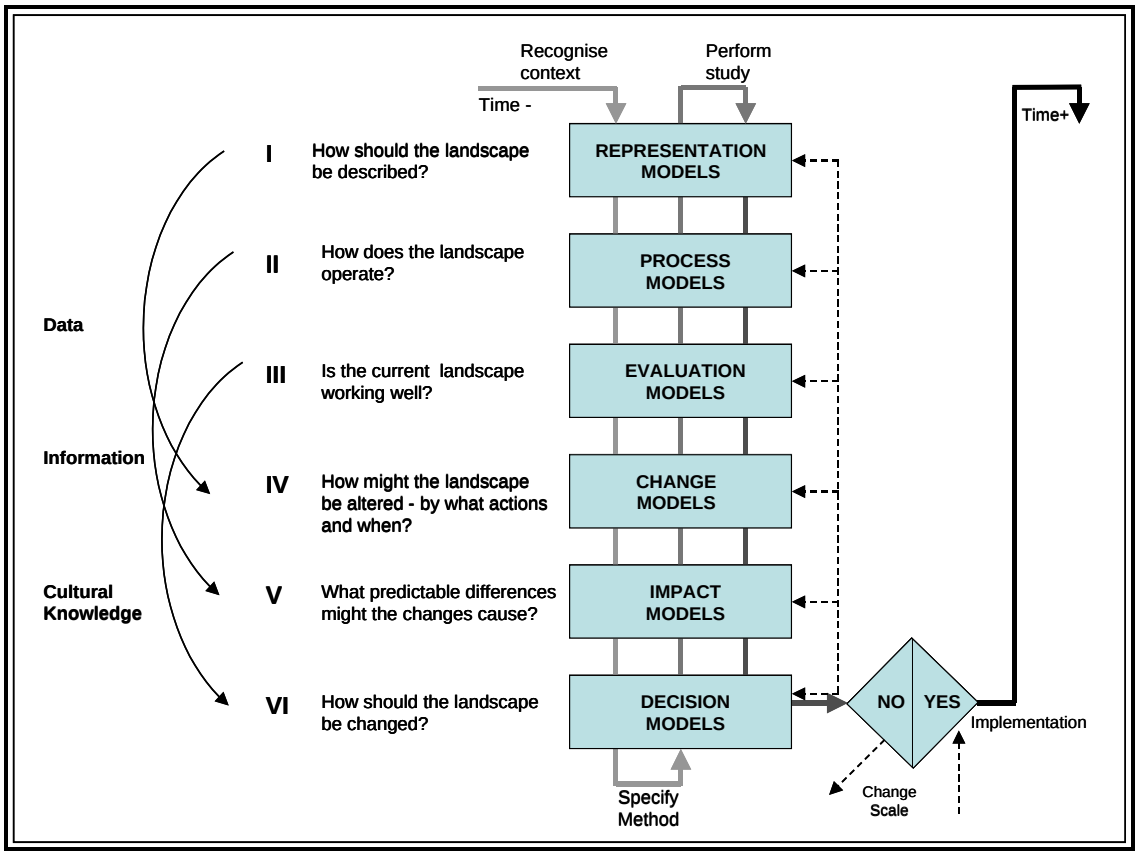

Figure 4. Carl Steinitz's (1990, 1993) approach to the basic framing and procedure of alternative futures studies (refer to literature review for further details).

The Steinitz framework has been used in numerous landscape and regional future scenario evaluations for regions of North and South America, Europe and the Middle East. This project is significant in being the first adaptation and application in Australia, of the Steinitz approach for a Alternative Landscape Futures analysis.

This project developed an Australian relevant methodology for Alternative Landscape Futures (ALF) assessments. Our adaptations include socio-economic and demographic data and change analysis and a regional landscape ecological approach (c.f. single species)The project combined a regional landscape ecology approach with urban and regional planning to develop a methodology to examine the design, analytical derivation and assessment of alternative, planned scenarios for regional Australia. The methodological design and adaptation followed a 'Learning Laboratories' approach based application to a major case study. Therefore the approach and methodology we have taken has, in application, been a considerable variation to Steinitz approach in many respects – primarily in combining past change trajectories and trends with a

scenario based approach; inclusion of a greater degree of socio-economic change data and modelling modifications because of the very large regional case study area (because different trends/drivers such as population growth/movement, have greater/lesser influence in different places/ landscapes); incorporation of different kinds of Australian context relevant designs; and, inclusion of a preliminary climate change (storm surge / flooding) vulnerability assessment of scenarios.

Context for Case Study Application

Through out the world and notably Australia, increasing urbanisation along the coast and loss of agricultural land are major challenges to long term sustainability. The few areas of Australia with mild climate, relatively good rainfall, soils, transport and communications are increasingly under competing demands for their land resources.

Parts of Australia's coastline are under enormous pressure. More than 50% per cent of the Australian population live within 7 km of the beach, with more than 6 million people living less than 2km from the high water mark. On some parts of coastal Australia, the 'Sea Change' phenomenon is reflected in 50% annual population growth rates. On the coast, 70% of sandy beaches have been retreating over the last century. Urbanisation is the major pressure effecting change on coastal landscapes and directing their future (Shearer et al., 2006). Such growth is not sustainable. Nevertheless, development of land and water resources continues in a generally haphazard way, resulting in loss of good agricultural land, reduced water quality and supply, urban sprawl, and natural resource degradation. Such fragmented planning and its lack of landscape ecology design principles increases the environmental, economic and social costs for communities now, and into the future. Innovative regional planning methods which consider longer term design options to integrate, adapt for and direct the environmental, economic, and social aspects of 'Sea Change' pressures are needed.

This project, funded by Land and Water Australia, combined a regional landscape ecology approach with urban and regional planning to investigate the design, analysis, and implementation of alternative planned scenarios for 'Sea Change' regions. The methodology was applied to a large region of north-eastern New South Wales, more or less coinciding (though a little larger) with the region generally referred to as the "Northern Rivers" of NSW (Figure 5). The case study region is approximately 250km in length (North to South) and 130km in breadth (East to West).

The final section of the appended (on DVD) literature review (section 7) contains a description of the case study region and review of recent community regional development fora and reports.

Figure 5. New South Wales Department of Lands (2000) map with the large regional area of the case study depicted by white background.

Methodological Application to Case Study Region

The case study application of the methodology was applied to a large region — the Northern Rivers — of coastal NSW which has been experiencing accelerating land use change, including "Sea Change" migration and associated development. This region is currently experiencing a complex array of pressures and rapid change (Details of recent historical socio-economic change and landscape change are detailed in the appended reports (on CD). Complex systems interactions of various landscape elements are interacting and creating pressures which effect change on each other, or cascade effects, creating other change or vulnerability. A generalised representation of the major interactions and influences is depicted in Figure 6.

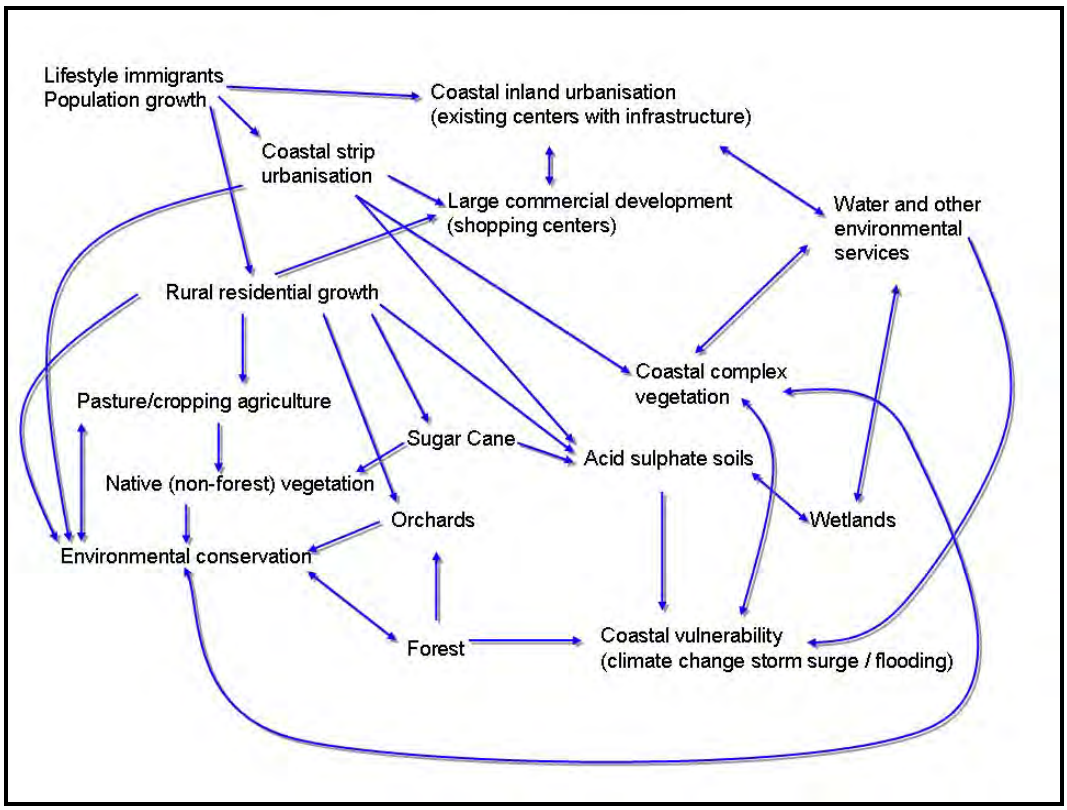

Figure 6. A generalised representation of the major landscape interactions influencing future landscapes and alternative futures for the northern New South Wales coast. Arrows indicate the main direction of influence on other landscape elements.

Our methodological application combined historical land use and land cover (LULC) change with historical socio-economic and demographic change, and current trends that influence pathways or trajectories into the future (details of these analyses and results are contained in the appended reports on accompanying CD). This history of change and emergent trajectories provides understanding of where the northern rivers region is currently headed in the future and what plausible alternative future scenarios might be planned. Current or developing information or policies (e.g., priority agricultural lands mapping) were used in scenarios as well as landscape design elements (e.g., coastal protection; conservation corridors). A geographically attributed socio-economic change analysis for the 1980 – 2004 (past) change period. Along with input from local governments, local community agencies, planning department and regional development strategies, the sociao-economic change analysis assisted understanding of past trajectories and future trends. A survey of local government planners, councillors and other community based professionals was also undertaken to elicit further input to scenarios. A considerable amount of time and effort went into making sure past change trajectories, which are different in different places, are reflected in the same places in the future; that is, that there was 'appropriate' and realistic spatial application of models and cellular automata algorithms, in order to generate plausible futures in terms of options for policy makers and planners.

The effects of different futures can then be compared. After analysing 24 years of past landscape change (up to 2004) from satellite imagery and socio-economic change from census data, future trajectories were examined and plausible alternative scenarios developed to better understand the potential design of more sustainable regional futures.

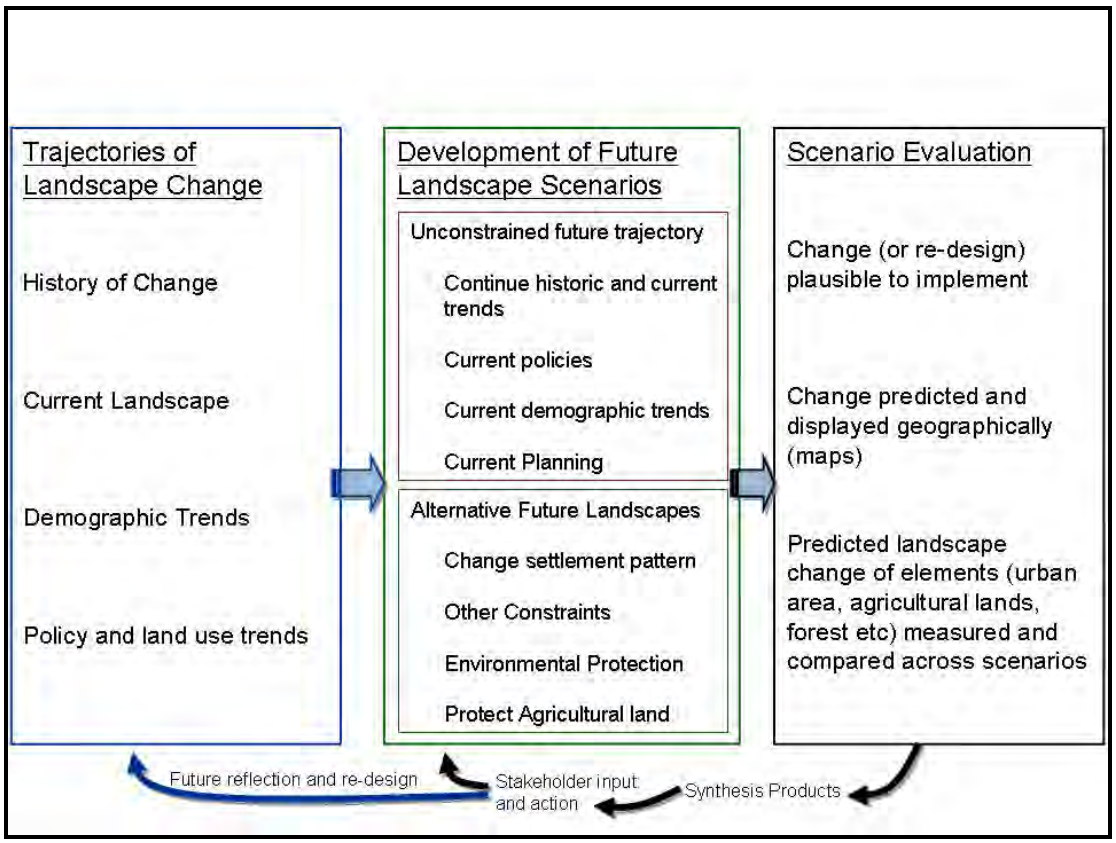

Figure 7. Generalised procedure of trajectories of change and alternative landscape futures modelling for the north coast region of New South Wales, Australia.

The landscape future scenarios examined each included 4 different population growth endpoints which could plausibly be arrived at over the next 20 to 40 years. In all scenarios, population growth is the major driver of landscape change through urbanisation (and subsequent displacement of agriculture and environmental services). For each population, scenarios were designed and evaluated as follows.

1. *Current Trend*. The trajectories of land use change from past/current trends of population growth and urbanisation, unconstrained by other factors.
2. *Coastal Protection*. Constraints to future development along the coastal strip – pushing future population growth and related urbanisation inland;
   a. based on historic and current trends unconstrained by other land use priorities, or,
   b. with constraints imposed to protect good agricultural land (and avoid acid soil risk areas) and protect various environmental systems/services.
3. *Agricultural Priority*. Design constraints imposed to protect good agricultural land (and avoid potential acid soil risk areas).
4. *Environment Priority*. Design constraints imposed to protect various environmental systems/services and increase biodiversity conservation and restoration.
5. *Agriculture and Environment*. Design constraints imposed to protect various environmental systems/services in addition to protecting good agricultural land, with two options for settlement density;
   a. 'normal' urban spread (= current trend) or,
   b. higher (medium) population density.

The above seven sets of drivers and social-ecological variables or constraints produced 28 scenarios. In addition, an overlay of probable orchard expansion in the southern part of the region was modelled separately as an overlay to any of the above scenarios. A fuller description of the approach to modelling, individual descriptions of scenarios, and full page maps of scenarios and resultant landscape change evaluations of landscape elements (area change and comparative change table) are contained in the appended report on accompanying CD.

The first scenario is based on historical\current trajectories of land use change with historical\current trends of population growth. Analysis of the population growth trends with the historical land use land cover (LULC) change, between 1980 and 2004, showed that 50% population growth per decade corresponded to a 180% increase in the area of urbanised land. With population growth starting to trend from linear growth to exponential, the current trajectory of population of the north east NSW suggests that it will reach 1 million by or before 2051. The remaining 4 scenarios provide spatially explicit and plausible, alternative landscape futures, whose designs are based on various preferred futures for land and other natural resource and/or with alternative population caps.

While climate change vulnerability modelling was not originally proposed for the project, a simple climate change, storm surge / flooding, vulnerability map is provided to indicate potentially vulnerable areas as an overlay to each scenario. Based on A 10m above current mean sea-level, the coastal vulnerability line can be used as an additional evaluation tool of scenarios to assess potentially vulnerable urban settlements, agriculture or biodiversity in different scenarios.

Results

Maps of the scenarios and land use / landscape change (LULC) tables were produced for visualisation and comparative purposes for the entire region and for two large sub-sections of the coast — namely Tweed Heads to Ballina (inland to Murwillimbah and Lismore), and Evans Head to Yamba and Corindi (and inland to Grafton).

Three examples are provided in the following figures of past change, trajectories of continued unconstrained urbanisation (current demographic trend) and just two examples of alternative landscape futures scenarios (note these much reduced figures lack the detail of the full spatial data and fine scale maps – please refer to full page maps and descriptions in appendices). A sample of a few scenarios are provided as maps herein at Figures 8 and 9. Full page maps of each scenario, variations, and landscape change tables for evaluation in the appended report on accompanying CD.

Complete scenario descriptions, full page maps and tables of LULC change (e.g., loss or gain of area of land use/land cover such as agricultural land, native vegetation etc) to evaluate and compare effects of change between scenarios are provided in the accompanying appendices.

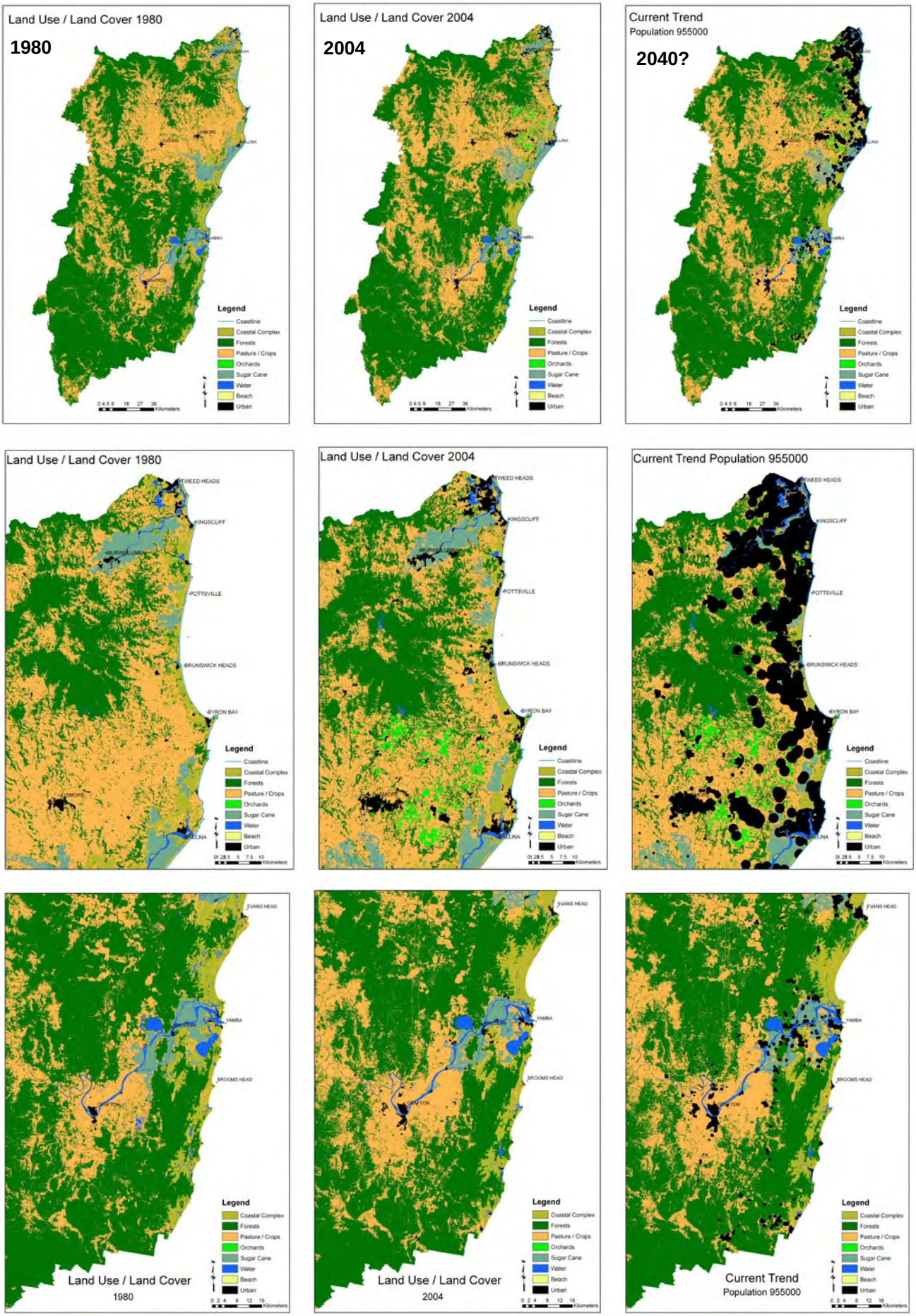

Figure 8. North-east NSW — 1980 to decade begining 2040 based on current demographic and LULC trends (top to bottom: whole study region; north coastal portion of study area; south coastal portion of study area).

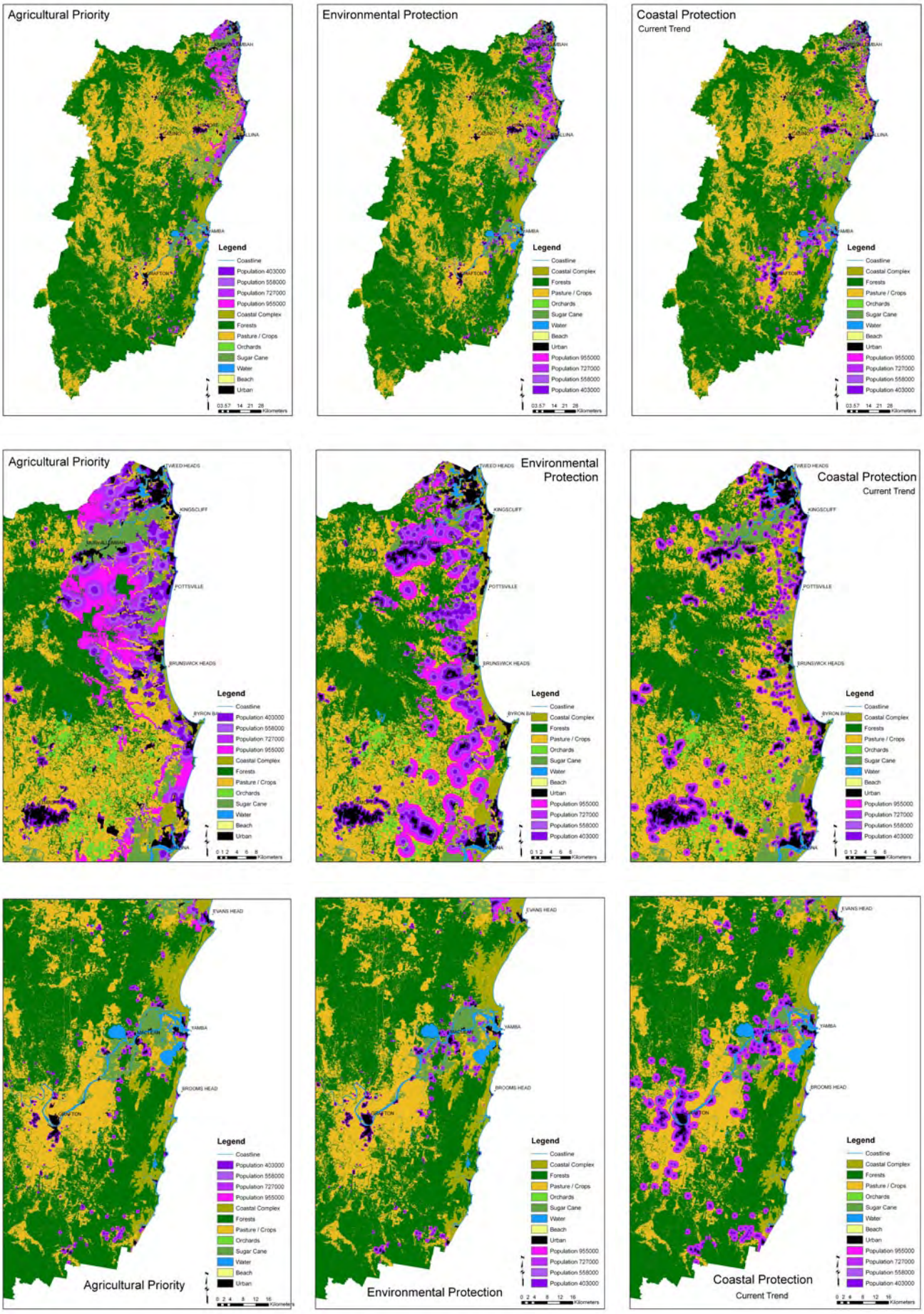

Figure 9. Alternative Landscape Future Scenarios for population growth (pink shades) with design constraints focusing on protection of; a) agricultural land, b) natural environment, and c) immediate coast line only.

Discussion.

The suite of feasible and plausible landscape future scenarios and alternative (planned) scenarios we have produced are only a subset of all possible futures. It is for the stakeholders of communities and policy makers of the NSW Northern Rivers to decide which future, if any, is most desirable and worth working towards. Our land use, demographic and socio-economic change analyses however suggest a very likely scenario of close to half a million population increase (doubling of population) for the region to about 2025. Over such a large region there is very large spatial variation however – some areas will be effected very little while in others linear growth is turning into exponential growth; this in turn with accelerated spatial ramifications of some considerable proportions [i.e., based on current trends of even only linear population increase being reflected spatially in 180% increase in urban area (over planned) continues in some coastal strips]. Without actively re-designing and influencing their future, it is most likely the current trends will continue to the unconstrained urbanisation for 1 million people being reached in or around 2040 and effect major loss of agricultural land and related industries, ecosystems, coastal wetlands and heath and other areas important to climate change storm surge resilience.

One surprising but clear message which emerged early in the study, in relation to population growth induced landscape change is that water is not at all the limiting factor we (scientists) often perceive it to be. The research team questioned this apparent anomaly with our international colleagues who, being less surprised, confirmed the same finding in all of their landscape futures studies elsewhere in the world, even in deserts such as found in Saudi Arabia, Israel and Nevada. On reflection, Brisbane and South east Queensland's massive population increase (up to +1500 / week) and housing development have been sustained over the past six years or more despite very severe drought, extreme water shortages and severe domestic water use restrictions. Local governments and planning departments in their incremental land release 'strategies' over time appear to consider water supply (as infrastructure item to be provided) but ignore water availability.

The short term view of such incremental planning, often spanning only 1 or 2 years, builds only on the past (hence, past trajectories = current trend). While this gives credence to the plausibility the generated scenarios which follow trajectories from past and current trends, it also means very little previous policy or planning forethought given to the long term results, spatial influences, or design of (plausible and achievable) alternative futures that might provide greater degrees of long term social-ecological systems resilience along with sustaining viable agricultural productivity and other ecosystem services (for example see summary spatial effects in Table 1). The results of our attempts in this study to engage, through both dialogue and survey (surveys appended on accompanying DVD), local government (and State) planners in thinking in a more integrated way for the long term and outside the 'box' of current 'land release' plans, or to provide more vision oriented feedback also reflected this very contained and short term incremental development culture.

For ease of general comparision, Table 1 summarises the land-cover / land use change for the 6 main scenarios and two population levels (for details, please refer to Table 3 change analysis in the accompanying summary report on scenario generation and spatial analysis). Policy makers and planners need to consider long-term futures of limited (or not) levels of population growth and urbanisation (and associated efficiencies in infrastructure provision), along with the most desirable, agriculturally sustainable and ecologically resilient future landscapes for the region.

Table 1. Summary table of spatial change (% area change) compared to 2004 land-cover / land use for natural ecosystems (environment), agricultural land uses (see Table 3) and urban areas.

Future Landscape Scenario	**Natural Ecosystems**	**Agriculture**	**Urban**
Current trend – 558k Popn (2020s)	-11%	-21%	+237%
Current trend – 955k Popn (2040s)	-20%	-55%	+466%
Trend + Coastal protect – 558k Popn (2020s)	-8%	-18%	+252%
Trend + Coastal protect – 955k Popn (2040s)	-15%	-41%	+527%
Agricultural priority – 558k Popn (2020s)	-12%	-7%	+237%
Agricultural priority – 955k Popn (2040s)	-19%	-13%	+466%
Environmental priority – 558k Popn (2020s)	-5%	-31%	+237%
Environmental priority – 955k Popn (2040s)	-9%	-73%	+466%
Agricultural & Environment priority; med. density – 558k Popn (2020s)	-5%	-8%	+178%
Agricultural & Environment priority; med. density – 955k Popn (2040s)	-8%	-15%	+396%
Protect Coast, Agricultural land & Environment – 558k Popn (2020s)	-5%	-9%	+252%
Protect Coast, Agricultural land & Environment – 955k Popn (2040s)	-9%	-16%	+527%

So which future?

It will take visionary community leaders and planners, along with a large scale regional approach to change current trajectories to the future (Figure 10). When local government and other planners and community representatives reflect on the visualisation (maps trends and alternative landscape futures), there might be increased awareness and will to thoughtfully re-design pathways towards a more sustainable future.

The resulting methodological development from this project contributes several new techniques, including a transferable design and planning approach, applicable across different Australian regional contexts and pressures of change. With slight modification the approach would be very appropriate for developing understanding of future scenarios and adaptation options for other landscapes or regional contexts undergoing other kinds of key uncertainties or pressures of change. For example, coastal vulnerability from climate change storm surge, drought and fire risks, other environmental or land use changes, or other human migration pressures.

The Alternative Landscape Futures process helps community members and leaders, along with planners and policy makers, visualise probable futures for their region, and then articulate priorities and goals (e.g., Figure 10). The alternative "visions" of the future are expressed as maps, of spatially explicit land use and land cover changes, which reflect the likely outcomes of different decisions.

The results of this study demonstrate a very useful methodology for understanding current pathways of resource use, in particular land use allocation. The application of the approach also demonstrably produces very practical designs of alternative landscape futures which can be planned for (e.g., Figure 10). Nevertheless, it is up to the local to regional communities of these areas and the higher levels of governance responsibly considering the long-term public good to decide which future they desire; however it is imperative such thoughtful consideration and adaptive action is taken very soon if the current trends are thought inappropriate and unsustainable.

Either through decisive, adaptive action or by inaction, society is deciding today where we are headed in the future.

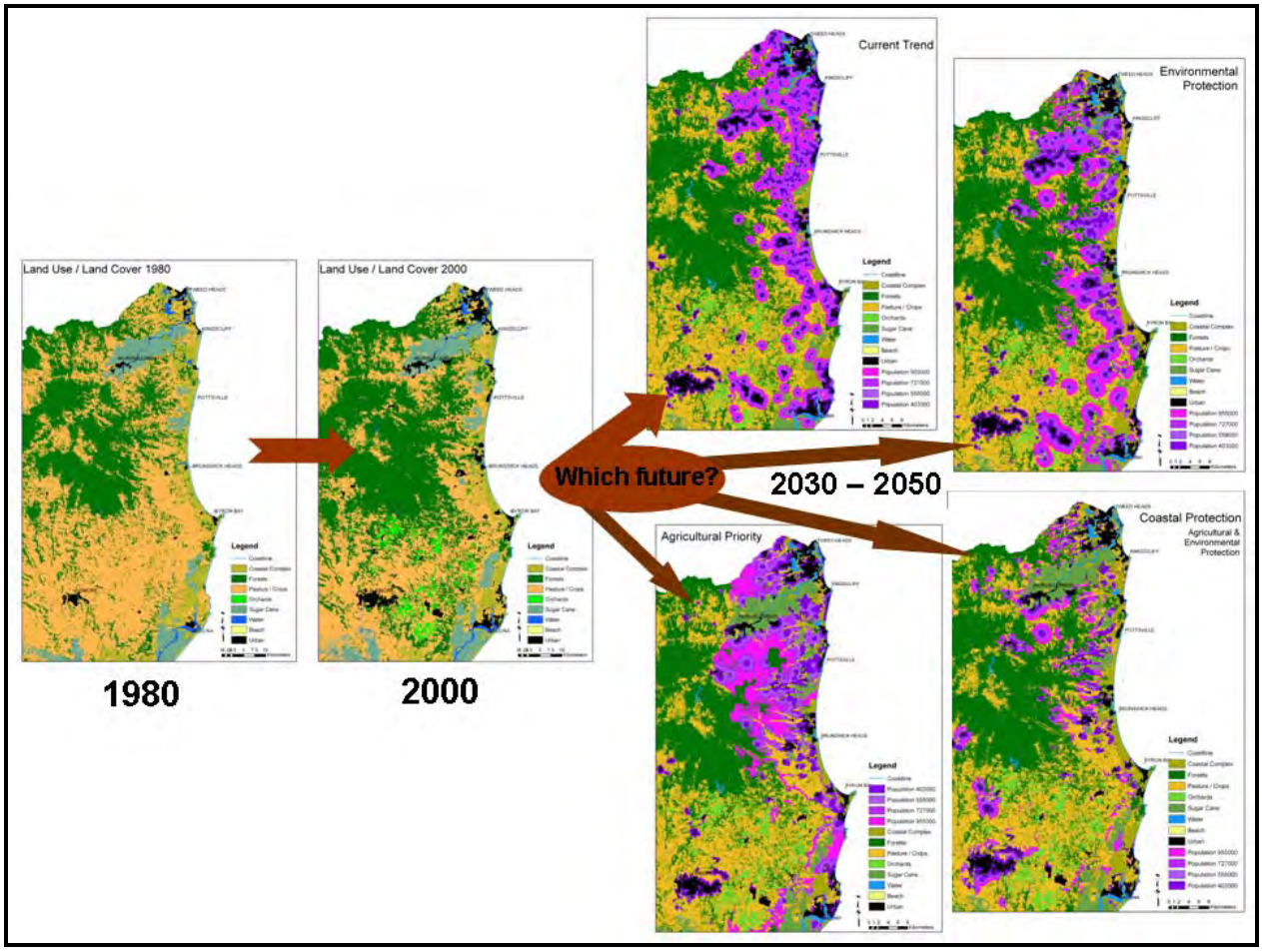

Figure 10. Which Future for far north NSW coast? Each total population (pink shades) equates a population level that will be reached within each of the next four decades – 2020, 2030, 2040 and 2050 respectively.

Summary of Communication and Adoption Activities

Communication Activities Summary

Project Brochures available from website and delivered during consultations with Planning Department, other Government departments, to local government officers (including planners, Managers, and Councillors) in all Shires and Councils in the case study region, and other interested stakeholders. On-going dialogue established with National Sea Change Taskforce and attended National Sea Change Summit.

A survey distributed in February 2007 to 90 councillor, planners and related professionals in the study region to gain perceptions on where they thought future population and urbanisation would go and/or what areas should be protected from such development.

Presentations to 6 community groups (including 2 U3A groups) of the trend analysis and its futer trajectories.

Several media communications on radio, TV News and newspaper articles thought out northern NSW, including the study region raised awareness, interest and profile of the project.

A workshop facilitated at the "People & Place: Spatial Models for Natural Resource Management and Planning" international conference, Bendigo Victoria, May 2007.
A paper presented at above conference.

Paper presented at VegFutures '08 Conference, Toowoomba.

Students: A masters thesis (complete) and a forthcoming PhD.

Further formal Journal and other publications are planned, and the possibility of a book is being investigated.

Appendices and other outputs from this project are available on DVD (provided to LWA), including copies of various communication outputs. Most of these outputs are available on the Institute for Rural Futures website. Spatial data (ARC GIS, GDA94 format) can be made available on request.

Project Website
http://www.ruralfutures.une.edu.au/projects/3.php?nav=Landscape%20Mosaics&page=49
The web pages will be updated in late 2008 with final map outputs and project summary.

List of appendices and technical reports

1. Comprehensive Literature Review and Bibliography
    - The Literature Review includes context, description and background to Case Study Region – North-Eastern New South Wales
    - The separate bibliography includes all references referred to in this report and accompanying appendices, and literature review.
2. Past Landscape Change – The Recent Spatial History of Landscape and Land Use Change (LULC) in North-Eastern NSW (1980-2004).
3. A Landscape View of Recent History of Socio-Economic Change in North-Eastern NSW
4. Scenario descriptions for North-Eastern NSW
    - Landscape Trajectories from the Past – Trends to the Future Maps
    - Alternative Landscape Futures descriptions and full page maps
    - Land Use Land Cover (LULC) change analysis table (a comparision and evaluation of scenarios)
5. Communication, Knowledge and Adoption activities / products
6. Masters in GIS Thesis (Karl Bock completed as part of this project). A PhD thesis (Phil Morley) from the project is expected to be completed by the end of the year (much of the content and outputs of this report are components of that work.

Appendices and other outputs from this project are available on DVD (provided to LWA), including copies of various communication outputs. Most of these outputs are available on the Institute for Rural Futures website. Spatial data (ARC GIS, GDA94 format) can be made available on request.

List of Digital spatial data and other outputs

Spatial layers for scenarios in Grid ARC GIS format (GDA94) and accompanying metadata for spatial data layers is contained on DVD (scenario images sub-folder) provided to LWA together with meta data.

- This can be made available to LGAs, planning Depts or other interested stakeholders by LWA or the authors.

Some other spatial data, models and algorithms, and details of methodological advances may not be available until after completion of PhD thesis.