Strategic Planning for Climate Change
and Regional Development in Victoria, Australia

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ABSTRACT: This paper explores the vital role that strategic spatial planning can play to confront climate change. Strategic spatial planning is the application of the generic strategic planning process to the planning of geographic space, or territory. It is a public-sector led process through which a vision, actions and means for implementation are formulated that shape what a territory is and may become.

The paper outlines a multi-methodology for assessing climate change impacts on, and formulating adaptation options for, regional systems. Since 2001, the methodology has been applied (and progressively refined) in several regions and primary industries of Victoria, Australia. Two of its phases – ‘Climate change projections’ (Phase 2) and ‘Biophysical impact assessment’ (Phase 3) – are explained by their development and application in a peri-urban region: the Westernport Green Wedge (WPGW) in Metropolitan Melbourne.

The WPGW occupies an area of 75,000 ha; approximately 85% of which is used by diverse agricultural activities and about 10% is used for other rural uses such as rural living, hobby farms and nature conservation. Land Suitability Analysis modelling is at the core of the approach to assess the climate change impacts on key agricultural commodities produced in the study region and new commodities that could be introduced while accounting for the likely climatic condition, as well as identifying the ‘agricultural land versatility’. The assessment is an important input into the WPGW Management Plan being prepared by the Victorian Department of Planning and Community Development, Cardinia Shire Council and Casey City Council. The paper concludes with some reflections on future prospects for a strategic spatial planning response to climate change and regional development. These include comments on the relationships of science, knowledge and expertise to the public and decision makers, planning as learning, long-term planning horizons, acceptance of uncertainty, and governance transformations.

Key words: climate change, strategic spatial planning, multi-methodology, Land Suitability Analysis modelling, agricultural land versatility, green wedge, peri-urban.
INTRODUCTION

Strategic and regional planning has enjoyed a strong revival in recent years, especially in the UK and Europe. Several powerful drivers of change have generated the renewed interest, including globalisation and structural adjustment of economies, concerns about climate change and food security, and rapid advances in communication and information technologies (Salet and Faludi, 2000; Albrechts et al., 2003; Pugliese and Spaziante, 2003). In particular, climate change represents an extraordinary challenge to us all as societies and individuals. The broad scope of spatial planning makes it very compatible with the generic process of strategic planning (Bryson and Einsweiler, 1988; Dimitriou and Thompson, 2007). At its simplest, strategic planning is a systematic approach to policy making that takes full account of context, resources and likely futures.

This paper explores the significant role that strategic spatial planning can play in addressing the causes and the impacts of climate change. The role requires a reframing of strategic planned intervention with a renewed holistic interpretation of regional development. The paper first discusses key elements for a new construct on the subject matter, then introduces our conception of a generic multi-methodological strategic approach for understanding climate change impacts at the regional level, and finally explains how some of the main elements of the approach are being applied in the State of Victoria, Australia, by reference to a case study. Particular attention is given to the policy context at State and Local Government spheres. The paper concludes with some reflections on future prospects for a strategic spatial planning response to climate change and regional development.

CLIMATE CHANGE, STRATEGIC SPATIAL PLANNING AND REGIONAL DEVELOPMENT

Climate Change – a Diabolical Policy Issue

There is now extensive scientific evidence that the observed rapid warming of the Earth is caused by human-induced climatological phenomena interacting with natural climate processes. The enhanced (anthropogenic) greenhouse effect is the result of modifications to the Earth’s atmosphere from gases emitted by industrial, transportation and agricultural activities, and variations in the land surface reflectivity caused by deforestation, cropping and irrigation. The impacts are predicted to become more serious over the coming decades as global warming accelerates, with an increasing risk of drastic changes to the coupled natural/human/climate systems (Millennium Ecosystem Assessment, 2005; Intergovernmental Panel on Climate Change – IPCC, 2007a, 2007b; Garnaut, 2008, 2011).

Reducing the vulnerability of natural and human systems (including human settlements, land and water resources and economic activities) to the impacts of climate change by means of adaptation is critical. Planned adaptation to climate change is the result of a deliberate policy decision to return to, maintain, or achieve a desired state of the system of interest. Adaptation aims at moderating the risks and damage, or capitalising upon potential benefits from current and likely future conditions. It can encompass national or regional/local strategies, practical steps taken by communities or actions by individuals. Adaptation is a
crucial policy response, along with mitigation, to responding to climate change (IPCC, 2007b; United Nations Development Programme, 2004).

Garnaut (2008) describes climate change as a ‘diabolical’ policy issue because it is uncertain in its form and extent, insidious rather than (as yet) confrontational, long-term rather than immediate, international as well as national, and, in the absence of effective mitigation and adaptation carries a risk of dangerous consequences. Other dimensions of the diabolical nature of climate change include its great complexity, the urgent need for action and the (present and future) inequities of its causes and effects. Climate change is thus a quintessential example of a ‘wicked’ problem. This term was coined by Rittel and Webber (1973), both urban planners working at the University of California, USA. The original focus of the ‘wicked’ problem literature was on systems design at a ‘micro’ level, but the concept has been gradually applied to broader societal problems (Australian Government, 2007). Climate change is therefore a most suitable problem domain for applying systems thinking concepts, methodologies and methods (Pearman and Härter, 2010; Sposito and Faggian, 2009).

Australia is likely to be one of the most adversely affected developed countries in the world with respect to potential climate change impacts on socio-economic activities, especially likely declines in agricultural production (Jubb et al., 2010; Stokes and Howden, 2010). Agricultural production must nevertheless continue to increase in the future to feed and clothe a growing Earth’s population - the world population is expected to increase from approximately 6.9 billion people to over 9 billion by 2100 (based on United Nations 2004 medium world population forecasts). However, without major adaptations to the unfolding climatic changes, agriculture in Australia will struggle to even maintain current production levels.

**Strategic Spatial Planning – Regional Planning**

Strategic planning has its origins in ancient times in military decision making, whilst in recent times it was initially developed more rigorously in the corporate (private) sector than in public sector planning. Strategic planning is composed of two main elements: the planning process (i.e. the activities included in ‘the planning’) and the substantive information regarding the context(s) and objectives(s) of ‘the planning’ (Steiner, 1997). It is however sometimes difficult to disentangle the two since one is the product of the other.

As a process, strategic planning is a systematic effort to formulate fundamental decisions (Etzioni, 1968) and actions that shape and guide what a system is, what it does, and why it does it. A system can be a public or corporate organisation, a country, a region, a city, or a function such as transport or education. It is designed to assist decision makers to think and act strategically (Bryson and Roering, 1988).

Strategic spatial planning is the application of the generic strategic planning process to the planning of geographic space, or territory: cities, city-regions and regions. As defined by Albrechts (2004, p. 747): “strategic spatial planning is a public-sector led socio-spatial process through which a vision, actions and means for implementation are produced that shape and frame what a place is and may become”. He also explains (p. 743) that “solutions

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1 The word strategy derives from the Greek word *stratego* a combination of *stratos*, or army, and *ego*, general or leader. The term ‘strategy’ thus literally means ‘the art of the general’ and, in this sense, strategies may be viewed as establishing “directional decisions [that] provide purpose and missions to planned actions” (Steiner, 1997, p. 348).
to complex problems (such as regional development challenges) depend on the ability to combine the creation of strategies (long-term) with short-term actions." Further, Albrechts sees spatial plans as strategic frameworks and visions for territorial development that complement and provide a context for specific development projects (Albrechts, et al., 2003). Implied in this, however, is the presumption that government (or public sector organisations acting on its behalf) has the capacity to identify, design and deliver 'shared futures' that are capable of expression in spatial forms and broadly agreed by stakeholders and the community (Healey, 2006; Dimitriou, 2007).

A significant characteristic is that strategic planning has to focus on a selected number of key issues (Bryson and Roering, 1988). As it is impossible to do everything that needs to be done, 'strategic' implies that some decisions and actions are considered more important than others for the purpose of formulating and implementing responses to problems and opportunities.

Drawing on the above mentioned concepts, we consider regional (including rural) planning as a particular complex form of strategic spatial planning that focuses on the geographic space between the national and local levels. It intends to influence the future distribution of activities in geographic space through the adoption of a strategic planning process. Its main features are:

- **spatial** – dealing with the unique characteristics and needs of territories (cities, city-regions and regions);
- **sustainable** – examining short, medium and long-term issues and options (see also below);
- **integrative** – in terms of knowledge, objectives and the implementation actions involved;
- **inclusive** – recognising the wide range of people and stakeholders involved in, and affected by, the planning process and the decisions taken.

### Implications for Sustainable Regional Development

Strategic spatial planning for regional development is strongly associated with schools of thought concerned with sustainable development, sustainability and the need to think in a more holistic fashion.

Sustainability is a normative and contested concept. The understanding adopted here is based on two well known definitions of sustainability. The Brundtland Report's definition of sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, Section 2.1). That from the conservation movement is "improving the quality of life whilst living within the carrying capacity of supporting eco-systems" (Munro and Holdgate, 1991). Key principles embodied in the notion hence include *futurity* - long-term thinking and owing a duty to future generations, *equity* - for current generations, *community engagement* – in these processes, and *quality of life* – within environmental carrying capacities (Wilson and Piper, 2010). As discussed in Sposito and Faggian (2009), sustainable development takes place in four interconnected topological spaces or dimensions: biophysical (geographic), economic, socio-cultural and organisational, whilst the development process manifests itself in its spatial (i.e. geographic) dimension. The regional planning process, although focused
on a territory (i.e. geographic space), must then consider the relevant aspects of the systems of interest in the other three spaces. Therefore, in addition to the four characteristics, mentioned above, it is also holistic, or systems-like. Regional planning thus embraces territorial policy making for a much wider range of activities than does land use planning.

As the concept of sustainable development in the 1990s provided a rationale and a new lease of life for planning, climate change provides a further and significant justification for its deployment. Spatial planning has experience with futures, strategies and plans, with options design and evaluation, with community engagement and public participation, with accommodating trade-off among diverse viewpoints, objectives and actions. Consequently, it offers considerable scope for an integrated approach to mitigation and adaptation to climate change that can be ‘mainstreamed’ into sustainable regional development (Agrawala, 2005).

MULTI-METHODOLOGICAL STRATEGIC APPROACH

Multi-methodology refers to combining together more than one methodology (in whole or in part) and mixing methods from other methodologies within a particular planned intervention into the system of interest (Mingers and Gill, 1997; Midgley, 2000).

The multi-methodological strategic approach that we developed for assessing the potential climate change impacts on, and adaptation options in, territories at the regional level combines elements from three methodologies. They are: (i) world-recognised climate change assessment frameworks (United Nations Development Programme, 2004; UK Climate Impacts Programme, Willows and Connell, 2003; see also Jones, 2001; Jäger et al., 2008); (ii) a model of decision-making in the public realm (Sposito, 2008); and (iii) Systems Thinking approaches especially those developed in the ‘soft’ systems field by Checkland (1981, 1999) and Midgley (2000).

Figure 1 shows the simplest version of our multi-methodology for assessing climate change impacts, vulnerability and adaptation (hereafter referred to as the ‘methodology’). An essential feature is the integration of ‘Biophysical Impact Assessment’, in Phase 3, and ‘Adaptation Assessment’, in Phase 4. That is, the methodology combines a climate scenario-driven approach with a planning horizon of decades (Phase 3) and a vulnerability-driven approach with a time frame of years (Phase 4). Feedback loops link the various phases. Figure 1 depicts the complete process to be undertaken; in its application in practice, however, variations can be introduced into the process. A contextual understanding of scientific findings is difficult without a complementary analysis of the socio-cultural/historical setting that gives purpose and meaning to the development and adoption of new knowledge (Häjer and Wagenaar, 2003). A significant component of the methodology is therefore a stakeholder engagement process which, in practice, commences in Phase 1 and is extensively used in Phase 4.

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2 Methodology is defined as a structured set of principles, or activities, that have to be adapted in a way that suits the specific nature of each situation in which it will be used. It often consists of various methods – including different models, techniques and tools - not all which need to be used every time (Checkland, 1981; Jackson, 2003). Methodologies are based, implicitly or explicitly, on particular assumptions concerning the nature of the world and phenomena under study and the appropriateness of various forms of action. The set of assumptions form a particular view of the world that is called a ‘paradigm’ (Kuhn, 1970). As methodology is essentially theoretical, we can accept a plurality of theories flowing into methodology and, hence, a wide variety of methods can also be seen as legitimate. The great merit of allowing methods to be detached from their associated methodologies, and employed flexibly, is that it allows practitioners the maximum freedom to respond to the particulars of the problem situation as well as to the turns and twists taken by the planned intervention.
The methodology has been applied since 2001 in various regions and primary industries of Victoria and, based on the learning from practice, it has been progressively refined. Applications in rural regions include North West Victoria (Sposito et al., 2007), South West Victoria (Sposito et al., 2008) and Goulburn Broken (Sposito et al., 2010b, c; Romeijn et al., 2011, 2012b). A full explanation of the methodology, a set of methods for possible deployment in the various phases and their application, is in Sposito et al. (2011a); see also Benke and Pelizaro (2010); Benke et al. (2011). Information on Organisational Analysis and the Viable System Model, mentioned in Figure 1, can be found in Jackson (2003) and Beer (1985). Information of robust strategies and their evaluation can be seen in Lempert et al., (2003). In this paper, Phase 2, ‘Climate Change Projections’ and Phase 3, ‘Biophysical Impact Assessment’ of the methodology will be illustrated by their application in a peri-urban region.
STRATEGIC SPATIAL PLANNING IN PRACTICE IN VICTORIA, AUSTRALIA

A multiplicity of policy instruments to guide planning as well as actions to address the challenge of climate change exist at national (e.g. Council of Australian Governments, 2007), state (e.g. The State of Victoria, 2002), regional (e.g. DoI, 2002) and local levels. In this section we are particularly interested in those that also encourage the protection of Victoria’s prime agricultural land for agricultural uses. For illustration purposes, these will be analysed at State Government and Local Government spheres in Victoria with a focus on a green wedge - a peri-urban area in Metropolitan Melbourne (Port Phillip and Westernport - PPW - Region).

State Policy Context – DPI Regional Development Program

In 2011, the Victorian Department of Primary Industries (DPI) expanded its 'Regional Policy Program' to influence and respond to the State Government’s regional development agenda and policy. Analysis of the eight Regional Strategic Plans covering the state (developed by Regional Development Committees - RDCs) found that the key primary industry policy issues in the Victorian regions relate to water and food security, climate change adaptation and renewable energy development. Each region has prioritised these issues differently and has adopted different strategies and actions for resolution. It was also concluded that “productive and potentially productive agricultural land is not readily identifiable, clearly defined, or mapped to assist decision making”.

The Government’s regional development policy, and other policies, has provided Local Government and regional communities, in particular, RDCs, with more authority to make decisions on issues impacting primary industries. For instance, the Government, through its election planning policy, “fully supports the need to protect Victoria’s prime agricultural land for agricultural purposes” and is “allowing regional councils the flexibility to alter land use within farming zones to protect prime farmland for agriculture while respecting the rights of landholders”. It also acknowledged that such land first needs to be identified before decisions (policy and delivery) can be made.

The protection of land for agricultural purposes should thus ensure a productive resource base that underpins opportunities for both production and productivity growth in agriculture, including diversification and intensification. Therefore, efforts to protect farmland through land use planning policy should not inadvertently constrict opportunities for farming enterprises to rapidly adapt to changing circumstance, but provide the flexibility necessary for farmers to rapidly adjust their operations (changed management practices and/or technologies).

The State (land use) policy context for the WPGW is noted in Melbourne 2030 (State of Victoria, 2002) as Initiative 2.4.1 that local government areas are to implement new planning scheme provisions to secure the protection of metropolitan green wedges in the planning system.

Local Government Policy Context - Cardinia Shire Council

The WPGW occupies part of the City of Casey and Cardinia Shire Council, though most of the existing agricultural activities are located in the latter. Cardinia has some of Australia’s most fertile and valuable rural land that plays an increasingly vital role in providing
agricultural commodities for domestic and international markets. The Shire has water, a temperate climate, a variety of soils, a diversity of farming enterprises, access to a large regional labour force and is in close proximity to large ports. Agriculture contributes nearly 10% of all jobs in Cardinia with a total estimated annual value of about $300 million. In terms of outputs, the top five sectors are ‘other agriculture’ (including production of vegetables and fruit orchards), beef cattle, services to agriculture and poultry (Cardinia, 2009). The Cardinia Shire Council Plan 2009-2013 endorses diverse rural activities within the Shire, in particular to: (i) support the agricultural industry in adapting to the changing economy and climate, (ii) identify innovative ways to value add to the region’s primary production, and (iii) advocate for the development of roads and infrastructure required for primary production (Cardinia, 2011a).

The Cardinia Shire Municipal Strategic Statement (Cause 21.01-5) sets out the general pattern for land use and development responding to key drivers and issues to achieve the strategic vision for the municipality. The framework plan provides an overview of land use in Cardinia and identifies locations where specific land use outcomes are supported and promoted. The strategic directions include the identification of major landscape features in the southern area of the Council’s jurisdiction: (i) Western Port, (ii) locations of areas primarily used for general agriculture, (iii) locations of areas having high quality soils for agriculture (Cardinia, 2011b).

Within the WPGW, the Cardinia Shire Council is developing, in partnership with several stakeholders, the “Bunyip Food Belt” project. This is a large-scale irrigation and infrastructure project to supply Class A recycle water from the Eastern Treatment Plant in Carrum, Metropolitan Melbourne. It aims to reinvigorate, productive agricultural areas of the lower reaches of the Bunyip Basin, enhance the region’s food production industries and protect versatile soils from inappropriate urban growth (Cardinia, 2011b). The study mentioned in the following section is a major input into this project.

**Case Study: Peri-urban Region – Westernport Green Wedge in Metropolitan Melbourne, Victoria**

The green wedges in Metropolitan Melbourne are large areas of land that have been earmarked in metropolitan planning, primarily for non-urban uses. Metropolitan planning has also long confined urban development to specific growth areas. Green wedges are the open landscapes that were set aside, more than 30 years ago, to conserve rural activities and significant natural features and resources between the growth areas of metropolitan Melbourne as they spread out along major road and rail links (SoV, 2002). The urban growth areas are bounded by an ‘Urban Growth Boundary’, which cannot be altered without the consent of both Houses of Parliament. The activities (land uses) and values in the green wedges include agriculture and forestry, conservation, landscape and amenity, infrastructure (e.g. water treatment plants and airports), tourism and mineral resources (e.g. quarries). Agriculture is a significant activity in the green wedges because the land is highly productive – the highest per hectare in Victoria – with a gross production value for the Port Phillip and Westernport Region of more than $1 billion (or 11% of Victoria’s total value). The location of the green wedges results in a major tension between Melbourne’s land supply needs versus securing fertile land to provide a nationally significant source of food supply. There are 12
designated green wedges in Metropolitan Melbourne, each overseen by a steering committee charged with the preparation of a Management Plan, to establish a vision and strategy.

The Westernport Green Wedge (WPGW) occupies an area of approximately 75,000 hectares. About 85% of the study region is dedicated to diverse agricultural uses, whilst about 10% is utilised for other rural uses such as rural living, hobby farms and nature conservation (Department of Planning and Community Development – DPCD, 2011).

As part of the process of preparing the WPGW Management Plan, its steering committee – comprising senior representatives of the DPCD, Casey City Council and Cardinia Shire Council – decided to undertake Biophysical Land Suitability Analysis (LSA) modelling and, based on the results, identify the biophysical ‘agricultural land versatility’ in a 10 to 40 year planning horizon. Consequently, the aim of this study was: “the assessment of the climate change impacts on key agricultural commodities currently grown in the region and new commodities that could be introduced while accounting for the likely future climatic
conditions in the WPGW”. This study was carried out by DPI according to Phases 2 and 3 of the multi-methodology referred to above. Phase 1 was a component of the overall process for the preparation of the Management Plan. Figure 2 depicts in detail the process adopted by DPI, including the eight agricultural commodities analysed, as well as other major components, such as flood risk and native vegetation (Ecological Vegetation Classes), that need to be taken into account in the formulation of the WPGW Management Plan.

Regional climate change scenarios (projections) for the WPGW were derived from the Special Report on Emissions Scenarios – SRES (Nakicenovic and Swart, 2000) and scaled down to the local level using the CSIRO Mark3.5 model (CSIRO and Bureau of Meteorology, 2007; Clarke 2010; Sposito et al., 2011b). Based on the IPCC A1FI (high global warming) ‘marker’ scenario, projections for the study region point towards: (a) an increase of between 1°C and 1.5°C in maximum temperatures between each successive time period (2030, 2050 and 2070) with a maximum of 4°C between now and 2070, (b) an increase in mean temperature by an average of 1.5°C between each successive time period with a maximum of 3.5°C between now and 2070, (c) an increase in minimum temperatures by an average of 1°C in each successive future time period with a maximum of 3°C between now and 2070, and (d) a decrease in total rainfall of around 150-300mm between now and 2070.

Regional Land Suitability Analysis (LSA) is at the core of the approach and, hence, a succinct description is provided below – comprehensive explanations of this method can be seen in Sposito et al. (2009, 2010a) and Pelizaro et al. (2010).

Biophysical land suitability is defined as a measure of how well the characteristics of a parcel of land match the requirements of a particular type of land use (FAO, 1993; Steiner, 2008). Each agricultural commodity has specific growth requirements that can be characterised through a combination of soil, landscape and climate (i.e. biophysical) attributes / factors. We developed a semi-quantitative approach to map and assess regional agricultural land suitability by using a Multi-Criteria Analysis (MCA) method – the Analytic Hierarchy Process (Saaty, 2000) - in a GIS environment (see also Malczewski, 2006). Soil, landscape and climate characteristics are represented as criteria that form the basis of a decision on the suitability of the land to be appraised. Weights indicate the relative importance of each criterion in terms of their contribution to an overall evaluation index. Expert judgement is incorporated into the process of selecting the criteria/factors and in assigning weights and ratings to each criterion for inclusion in the LSA models. Modifications in agriculture land suitability caused by climate change can be assessed by comparing future suitability maps with current suitability maps. For illustration purposes, Figure 3 shows the results of the LSA modelling of Brassicas and Artichokes (a group that includes broccoli, Brussels sprout, cabbage, cauliflower, Chinese broccoli, kale, mustard and Jerusalem artichoke) in the baseline year, noted as Year 2000 (the average of climatic conditions between 1996 and 2005) and Year 2050. In the figure, the darkest green colours depict the areas ranked as having a ‘high’ biophysical suitability (index in the range 80-100%).
The modelled biophysical suitability of the eight (8) commodities analysed in the WPGW varied as follows.

- The two fruits - **apples** and **kiwifruit** – showed a possible decline in suitability from a ‘high’ ranking suitability (index in the 80-100% range) in the baseline year to moderate suitability (index in the 50-70% range) in 2030 and beyond.
• **Asparagus** showed the least change in suitability from the baseline into future year projections.

• **Brassicas** and **artichokes** are likely to decline from highly suitable in the baseline into moderately suitable in future year projections.

• **Celery**’s suitability had initially a minor increase into 2030, beyond which steady declines would occur in the higher suitability ratings.

• **Culinary herbs** are likely to decline steadily over time from highly suitable into moderate ratings.

• Suitability for **leeks** had initially a minor decline into 2030, after which a large decrease is likely.

• **Pasture** suitability showed an initial increase into 2030 but, with further increases in temperature and concomitant decreases in rainfall, is likely to decrease towards 2050 and beyond.

The modelling suggests that all commodities analysed in the WPGW would be affected to varying degrees by unfolding climatic conditions without appropriate changes in policy and management practices. In general, the areas in the study region which are currently most suited for agricultural production would shrink over time. However, the likely decline for each commodity is not linear (e.g. the green wedge may actually become more suitable for pasture production and celery by 2030 before a likely decline by 2050). As noted, the possible decline does not account for any adaptation measures that could be implemented by farmers.

A key assumption underpinning the modelling is that for an agriculturally-based region to have a substantial capacity to flexibly respond to changing conditions (e.g. climatic, market), significant areas of the land available for production needs to be able to sustain multiple agricultural uses. Further, that those areas capable of growing, in a sustainable way, many agricultural commodities (albeit not necessarily all at the same time) could be considered as highly valuable (see, also, National Research Council of the National Academies, 2010). In terms of the LSA modelling, this refers to land which has been categorised as suitable for agricultural purposes, especially in the higher ranks (index in the 80-100% range). The identification process thus required a combination of the resultant LSA for each of the eight agricultural commodities, taking into account their individual rankings. **Figure 4** shows the Agricultural Biophysical Land Suitability for the baseline year (2000) and the likely situation by 2050 under the IPCC A1FI climate change scenario.
Figure 4. Agricultural biophysical land versatility in the WPGW - baseline (Year 2000) and Year 2050, IPCC A1FI climate scenario. Source: Romeijn et al., 2012a.

The agricultural biophysical land versatility map for the Year 2000 shows that several areas in the WPGW have a high rating of versatility (90% or above); these areas are in the north east of the Koo Wee Rup rural settlement, in proximity to Pearcedale in the west, and to the south-east around Lang Lang. The Year 2050 map indicates a potential decline in agricultural land versatility rankings from a higher category into a lower category across the WPGW. Nevertheless, the study region could be categorised as having high agricultural land
versatility with large areas in the upper levels of the suitability rankings even after the likely impacts of unfolding climatic changes are considered.

REMARKS ON THE USE OF THE PLANNING APPROACH BY MAJOR STAKEHOLDERS

The Cardinia Shire Council recognises that the future of agricultural industry is dependant on innovative and strategic spatial planning. According to this, Council considers the WPGW, which may appear today as the Vegetable Belt of South East Metropolitan Melbourne, could become the Green Grocer of Victoria’s future. A key factor to local Agribusiness is the export market, and the emerging product presence of the WPGW commodities overseas (Cardinia, 2004). The Cardinia Shire Council has also indicated that the LSA study is the cornerstone for drafting the WPGW Management Plan and should become a much needed tool and benchmark for future strategic planning in peri-urban Metropolitan Melbourne and cities around Australia.

DPI considers that the application of the multi-methodological approach discussed in this paper enables a greater understanding of the potential climate change impacts on land suitability for a range of (soil based) agricultural commodities and the associated implications for rural and regional development. The approach is a very valuable tool to inform land use planning policy development. However, it is also recognised that there are alternative forms of agriculture, such as intensive animal industries that are not as dependent on soil, rainfall or land versatility but are reliant on other criteria such as access to roads, power, water, processing and feed supply. These agricultural industries may also contribute to the productive potential of land in the WPGW.

The growers that were consulted during the development and application of this methodology were primarily interested in the outputs (maps) for their own business planning purposes, and secondarily in how the information would be used by planners at the regional level. During initial conversations, growers expressed consternation at their crops being ‘mapped’ to ‘suitable’ geographical areas because of the potential for this information to result in bureaucratic interference in their agribusinesses. However, they soon recognised the exercise as a major opportunity to influence the outcome of the overall study and to introduce some of the practical realities of food production into the models. For instance, growers tended to weigh practical considerations more heavily than soil-suitability. A specific example was the ability to produce asparagus crops year-round on sub-optimal soil types, versus production on optimal soil types where machinery access during wet winter months may be hampered due to excessive mud. Once growers accepted that the outputs reflected reality, they were keen to use the maps as decision-support tools to identify potential new farm sites further away from the urban growth boundary.

CONCLUSIONS

The process of applying the methodology, and the resultant outputs, has proved to be a vital underpinning component in the development of the Green Wedge Management Plan, and also to the ongoing future strategic spatial planning for non-urban (rural) land uses in the face of urban growth pressure in the South East Melbourne region. In addition, local Councils and other stakeholders have indicated they will use the data (qualitative, modelled and ABS) and mapping to inform the local agricultural industry about climate change and its
likely impacts. Having early access to this information will improve planning for rural areas and agricultural production, and will help rural land users to adapt to the changing environment of agricultural and biodiversity practices in the green wedge.

**PROSPECTS**

The speed of development and innovation in the new field of enquiry and action around climate change, strategic spatial planning and regional development means that any article on the subject is at risk of being overtaken by the events and new studies. However, we wanted in this article to report on the significant progress made in these areas on which we have been working for the last ten years. It is in order therefore to conclude it with some reflections on future prospects for a strategic spatial planning response to climate change and regional development. The following considerations are based not only in our learning but also on relevant comments about the subject matter by researchers and practitioners cited in this article. It has to be recognised from the outset, however, that spatial planning is only one of many key interventions by government to address climate change and important synergies exist, or can be developed, with other domains of government action.

**Relationship of science, scientific knowledge and expertise to the public and political decision makers** – The complexity of both climate change and regional development do not lend themselves to simple, one-off solutions. The transition to a low carbon society and a new space economy will be contested, continuous and difficult. The relationship between science, scientific knowledge and public attitudes and behaviour is crucial if strategic spatial planning is to play a role in the needed movement towards a sustainable future for humankind (Wilson and Piper, 2010).

**Key features from practice** – The best practical examples of strategic spatial planning demonstrate effective, focused information gathering and analysis; extensive communication among, and participation by, key decision makers, opinion leaders and stakeholders; the accommodation of diverse worldviews and values; the formulation and evaluation of alternatives; an emphasis on the future implications of present decisions and actions; focused, systematic, analytic decision making; and successful implementation (Bryson and Einsweiler, 1988; Dimitriou and Thompson, 2007; Wilson and Piper, 2010).

**Planning as learning** – There would be great benefit in a shift towards strategic spatial planning as a form of ongoing learning rather than as a cycle of plan production. The speed of change is now so rapid and continuous that both planning and policy responses need to be adaptive (Jackson, 2003; Dimitriou and Thompson, 2007).

**Long-term planning horizons** – Many of the challenges facing strategic spatial planning are long-term or have their roots in long-term changes, especially climate change and demands for energy, other resources and infrastructure. The time horizons over which we look and plan ahead and our commitment to future generations will necessarily extend. Spatial planning will, of necessity, adopt a more strategic and long-term approach.

**Acceptance of uncertainty** – There is a need to bring uncertainty into the realm of strategic planning and policy making for climate change and regional development. The strength and volatility of the key drivers of regional change means that strategic planning (and any
subsequent land use planning policy or tools) for territories must incorporate flexibility and the capacity to reappraise and change direction and implementation actions.

**Governance transformations** – The renewed interest into a strategic orientation within which to articulate particular government interventions is now well established in Europe. This has highlighted the importance of the governance capacity on the development of the territories of cities and regions. The issue of governance capacity relates not only to the articulation of the vertical and horizontal government relations but also to the relations between government, the economy and the wider society, especially given the magnitude of the societal changes experienced in recent decades which will probably accelerate in the future (Healey, 2006).

The public and societal response to climate change present many opportunities. Strategic spatial planning has an important role to play in actions to mitigate the causes of climate change and adapt to the impacts of unavoidable climate change. It helps define the problem by identifying the extent, location and size of change, to which policy responses are required. This new role involves a reframing of spatial planning interventions with a renewed, holistic interpretation of sustainable regional development. This is a defining challenge for the present age and time, and planners and the planning system must respond to this challenge.
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NOTE

Westernport (single word) is used when discussing Land Use planning.

Western Port (two words) is use when discussing Coastal / Marine planning.