FUTURE OF THE FRINGE: SCENARIOS FOR MELBOURNE'S PERI-URBAN GROWTH

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Introduction

The growth of Melbourne's peri-urban region has resulted in significant change to population, housing landscapes, farming systems and transport demands over several decades. Critical environmental consequences include increased fire risk for housing, the proliferation of housing in rural landscapes, decreased water yields in some locations and increased infrastructure demands in rural areas. Urban growth on the fringes of some towns has resulted in long-term social, economic and environmental impacts. The changes have largely appeared as incremental at a regional scale. The processes of land fragmentation, housing development, population growth and land use change are continuing.

Peri-urban regions of Melbourne have increased population and housing at rates in excess of those experienced in many parts of metropolitan Melbourne for over a decade. This development is spatially uneven, with high growth pressure on a number of localities, towns and landscapes where access to metropolitan employment, lower housing costs and the quality of local amenity has drawn inward migration. Population growth is also a feature of many locations where growth pressure is, nonetheless less intense. The peri-urban region is increasingly functionally aligned with social and economic trends in metropolitan Melbourne, with their local housing markets an expression of the broader housing markets of the city region.

This population and housing growth is generally incremental in nature, and its implications are inadequately considered in discussions of broader growth within the metropolitan area. The consequences for these communities and the broader city-region are extensive, including; infrastructure pressures, socio-cultural impacts in rural communities, dilution of agricultural systems, pressure on habitat and native vegetation and impacts on water catchments.

Developing a perspective on future change in this region offers an opportunity to consider the ways in which incremental change will continue to create pressure on environmental values and land use. This is contingent on a range of assumptions regarding trends and preferences for peri-urban living, pressures for urban growth and the consequences of policy decisions. This paper explores a process of scenario development and growth modelling undertaken for peri-urban Melbourne during 2010-2011 for the Peri-urban Group of Councils, a local government grouping of seven councils beyond Melbourne's fringe (see Figure 1). The modelling (Buxton et al, 2011a) shows continued pressure for growth and consequent threats to environmental values, agricultural viability and infrastructure provision in the region.

Melbourne's peri-urban area consists of inner and outer peri-urban zones. The inner zone is a conventional green belt defined at the inner or metropolitan edge by a legislated urban growth boundary (UGB) and at its outer edge by the outer rural boundaries of fringe area municipalities extending in an arc around Melbourne over 8,829 square kilometres. The outer peri-urban zone incorporates the next band of rural municipalities and their regional cities and townships extending up to 150 kilometres from central Melbourne. Within this outer zone, regional cities influence their own peri-urban areas.

Figure 1: Inner and Outer Peri-Urban Melbourne

This paper will explore the process of modelling growth and change across the outer peri-urban region and for specific localities and communities. It will introduce scenarios for change based on trends, planning policy options and future costs and preferences, and the results of spatial (GIS) modelling undertaken to explore the consequences of change within these scenarios. It will then identify the implications of these models for communities and environments in peri-urban Melbourne and adjoining regions.

Change in Peri-urban Melbourne

Peri-urban regions are those areas on the urban periphery into which cities expand (Burnley and Murphy, 1995) or which cities influence (Houston, 2005). Peri-urban areas can be defined in relation to a nearby metropolitan area on its inner boundary, a rural area on its outer boundary, or as the land in between. Peri-urban areas may be considered as the “invaded countryside” (Bourne et al., 2003, citing Walker, 1987), with the underlying cause of change in peri-urban areas being declining returns from agricultural activity (Bunce and Walker (1992). Alternatively, an urban perspective will define peri-urban areas in relation to the influence of a nearby metropolitan area. Often non-urban areas are considered to be in an impermanent state as the means to satisfy urban needs by providing a bank of land and resources (Friedberger, 2000) .

In Melbourne’s outer peri-urban region, since the 1970s, growth has resulted in not only a considerable expansion of the metropolitan area and the structure of the city, but also in changes to the function of landscapes and the socio-economic character of communities. Rates of population and housing growth have been greatest in areas with good access to Melbourne (Macedon Ranges, Mitchell, Baw Baw) and those areas with attributes such as coastal environments and hillscapes. Population and housing growth is far in excess of employment growth, with levels of commuting increasing since the 1990s (ABS, 2007). Melbourne-based employment represents over half of all employment destinations in some of the rapidly growing parts of this region – for example the Macedon Ranges – and concurrently, trends in suburbanisation of employment in metropolitan Melbourne appear to offer greater access to work for peri-urban communities.

In coming decades, new influences such as climate change, water shortages, the rising importance of localised food production, and the depletion of natural resources such as oil, will alter perceptions and values of peri-urban landscapes as communities and economies adjust to emerging food, farming and transport systems. This century, cities that relate to their peri-urban hinterlands by protecting natural resources for future adaption may prove to be the most resilient.

At present, however, the process of change in the peri-urban region of Melbourne appears to be limiting future adaptability and reducing the region’s utility as a land and environment resource. Buxton et al (2009) established a range of ways in which this is occurring including the fragmentation of land holding with consequent intensification of housing development, the polarisation of farming scale and systems into fewer large operations and the proliferation of small-scale sub-commercial farms, and an intensification of water use and extraction reducing yields in water catchments in the region. This process not only limits future adaptable land use outcomes, but also increases the vulnerability of system elements such as water supply, peri-urban agriculture and biodiversity. Future climate change increases risks to the peri-urban systems, and in the case of peri-urban Melbourne the consequences of the intensification in high-risk fire environments presents specific vulnerabilities (Buxton et al, 2011b).

Developing Scenarios for Future Change

The approach to regional planning adopted in this paper is part of a growing body of research that uses scenarios as a method to examine the impacts of current trends and practices on the future. A scenario can be defined as a story that can be told in words and numbers involving an internally consistent and plausible explanation of how events unfold over time (Swart et al 2004). Scenarios generally are not regarded as predictions but as statements of possible future states. They can be normative subjective narratives which explore plausible futures, or they can be quantified. Various scenario typologies have been proposed. Linear approaches explore a continuation of trends to varying extents, while systems approaches investigate the multiple and complex interactions of elements. Such elements can be physical and social. The concept of risk is central to complex system analyses. Scenarios can be forward looking or involve backcasting. In backcasting, scenarios "define a normative state in the future…then diagnose how to achieve that state over time" (Jones, 2010: 5).

It is clear from these definitions that a scenario is not simply a forecast, in the sense of a description of a relatively unsurprising future, rather a scenario can challenge and reveal the hidden consequences of taken for granted process, for example, the subdivision of land or the shift from grazing to cropping. Porter (1985), Schwartz (1991), Ringland (2002) and Shoemaker (1995) agree that scenarios are not simply random imaginings but that they are consistent, methodical and part of a tool kit for thinking strategically about the future.

The scenario process commonly identifies focal issues, driving forces and uncertainties, proposes options based on certainties and uncertainties, and develops such options into narratives. In the Borjenson et al (2006) typology of scenarios, three main categories of the future are identified: possible, probable and/or preferable futures. These futures are framed by three principal questions: What will happen? What can happen, and how can a specific target be reached?

Glenn and Gordon (1997) propose two types of scenarios, exploratory and normative. Exploratory scenarios follow a foresighting approach, projecting trends based on the question "What do you think the future might be?", while a backcasting approach is based on the normative question "What kind of future would you like to see". Back casting is an imaginative exercise. It requires "working backwards from a particular desired end point to the present in order to determine the feasibility of that future and what policy measures would be required to reach that point" (Robinson, 1990 p.823). Nordlund (2008), Beer (2006) and Jones (2010) also discuss this approach. Scenarios are significant tools to utilise in addressing these questions.

The comparative approach followed in this project uses both a forecasting approach, projecting current trends forward, and a backcasting approach in proposing an alternative future state and analysing how to achieve it.. This is. This study also uses a modified scenario approach by adopting a game workshop method that tests assumptions about regional futures, visualises outcomes associated with different futures and evaluates different policy and practical outcomes.

Two possible futures for the Melbourne outer peri-urban region were analysed. The first option describes the peri-urban landscape and the way it will function as it will appear in 2040 if current development trends and policy settings continue. The second imagines a different future, where the rural landscape management is strongly emphasised, productive agriculture is maintained, environmental assets and natural resources including biodiversity and water resources are protected, efficient communications infrastructure and regional employment are maintained, social and community services improved, and where population growth is diverted from rural areas to existing medium sized and larger towns.

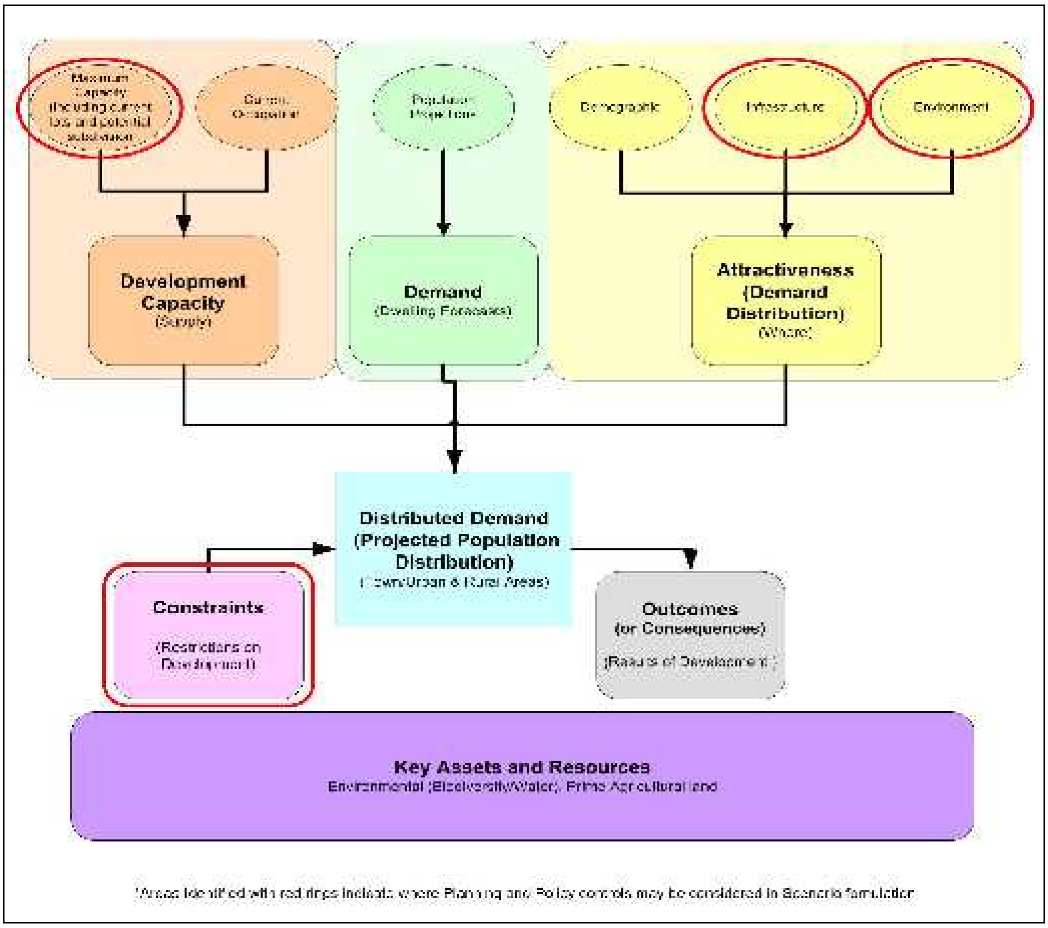
Conceptual Spatial Framework

The project involved the development of a spatial framework that utilised Statistical Local Area (SLA) population projections, individual cadastral land parcels to develop a spatial grid of development preferences at highly localised level. This framework supports a basic residential supply and demand analysis approach where the impacts of meeting demand are quantified in terms of parcel numbers and land area. The framework allowed high level scenarios and options to be explored for a geographically broad study area – while still presenting very localised modelling. Key spatial datasets used as the basis for housing development capacity estimates were; the existing planning controls, land parcels, and recent building approvals. Estimated demand in terms of projected population and dwelling growth on an SLA basis was sourced from the Victorian Department of Planning and Community Development (DPCD)'s "Victoria in Future" projections (VIF2008).

A concept of *attractiveness* for development was developed to distribute existing projections to the most probable settlement localities within each SLA. Additional considerations to be addressed included: how many dwellings are likely to be built in the urban/town environment compared to the rural landscapes; what is the capacity of these “attractive” regions in terms of how many parcels (or lots) exist; which are already occupied; and what are the current planning zones associated with these areas and what level of sub-division do they allow? This aspect of the approach was addressed through the development of an *Attractiveness Index* based on a range of infrastructure, environmental and demographic factors believed to influence preferences for development. This Attractiveness Index was calculated for a 1 sq. km grid surface and also for individual land parcels and has been used as the basis for evaluating likely take up of land parcels and impacts on an SLA basis. This was then used in conjunction with mapped layers and site specific features to identify where future development is likely to affect biodiversity, water resources, primary production and other rural land elements. Finer geographical resolution demographic projections were viewed as essential – hence the development of an attractiveness grid surface.

The elements of the conceptual framework are classified into six key groupings: **Demand** (forecast future population and dwelling growth to 2040); **Development Capacity** (supply of existing land parcels and subdivision potential); **Attractiveness** (distribution of likely demand based on infrastructure, past development trends and environmental attractiveness); **Distributed Population** (based on demand, attractiveness and development capacity); **Constraints** , and **Outcomes** (consequential and reciprocal impacts). The relationship between each of these groups is presented in Figure 2.

Figure 2: Spatial Modelling- Conceptual Flow Chart



This approach was applied to each scenario, providing a model for assessing the levels of projected development at the local level, timelines for ‘total’ development, its impact and the consequences of alternative approaches. It allowed iterations of development to provide an assessment of development in assumed higher and lower preference development sites and in those areas with fewer and more constraints for development.

Rural land supply was estimated by calculating the number of vacant rural lots, potential subdivision yields and current occupation of land. Estimated future population was distributed to Statistical Local Areas (SLAs) across the peri-urban area based on demand, attractiveness and the future development capacity. Estimates were then made of demand in relation to supply for the peri-urban area as a whole and for SLAs. Excess supply or capacity constraints could be estimated to 2040 for each SLA based on the distribution of demand to each geographic area and for the overall peri-urban area.

Development constraints can reduce estimated land supply. Policy can also constitute a restraint, such as by limiting dwelling construction in fire or flood prone areas. The study evaluated lot characteristics in relation to climate change considerations defined in terms of flood, sea level rise/surge and fire risk, native vegetation/biodiversity, productive agricultural land and the continuation of rural industries. These constraints were assigned to land and calculations made about their possible affects on land supply.

For the agriculture sector, the study examined implications for future production levels and product types from population and dwelling projections. Detailed implications were modelled for the wine industry. Similarly, the implications of dwelling demand forecasts in relation to development capacity and location of land parcels were examined for water management regions in the peri-urban area. Impacts such as effects of dwelling construction on farm dam capacity, rural water use, and stream flow were examined. For biodiversity, the relationship between forecast demand, rural lot location, and the location of remnant native vegetation was examined in terms of quality, extent and type. Parcels with significant biodiversity values were identified and estimates made of impacts across SLAs.

A range of methods available for use in achieving this back-casting scenario were developed, and the quantitative impacts from the use of three tools were modelled. The tools used were: preventing dwelling construction in proclaimed water supply catchments; the use of a tenement control to hold jointly owned land parcels together; and the transfer of demand from rural areas to towns (including determining urban land required to offset rural demand in townships at high, medium and low township densities).

Findings

If current trends continue in a linear manner, by 2040 the existing rural land supply and most of the potential future subdivided supply will be exhausted in most locations. Rural land supply will come under increasing pressure from 2020, with areas under most pressure those on major transport and infrastructure corridors closest to the Melbourne metropolitan fringe, as well as those on the coast. . Heavily fragmented landscapes will be progressively developed with housing radically changing the appearance and function of relatively open rural landscapes.

Within ten years (or even less) Planning Authorities will either need to provide additional supplies of rural land to cater for demand further altering landscapes or will be forced to shift supply to other locations such as townships by limiting or preventing further rural development in rural and coastal landscapes

Maintaining current peri-urban development trends will effectively remove agricultural production from the region. Water resources will be greatly reduced through the widespread construction of farm dams and the use of bores. Generally, stream flows will be substantially reduced. Extensive areas of remaining vegetation will be removed or degraded, with significant ‘edge effects’ from land fragmentation and development.

The main threat to these sectors is the fragmented pattern of land ownership. Over 53,000 rural lots already exist because of an historic pattern of ad-hoc, incremental subdivision. The vast majority of these are less than 4 hectares in size. Many of these are jointly owned and are being progressively developed. In addition, underdeveloped clusters of even smaller lots exist across rural landscapes. As 24,817 land parcels or almost half of this total do not contain dwellings, many landscapes which appear underdeveloped as extensive grazing or intensively farmed properties have actually been subdivided and will be fully developed by 2040. Existing subdivision rights, if acted upon, will add to the number of small rural lots and further change the appearance and functioning of landscapes. A further 6,881 land parcels could be created under existing planning schemes in the three rural zones. The total potential rural land supply of existing and future parcels under existing planning schemes is 31,708 parcels.

The increase in rural dwellings under the business-as-usual scenario of 25,706 dwellings almost exactly matches the number of existing parcels without dwellings. Adding the subdivision potential of 6,881 would provide the total capacity of 31,708 rural parcels, seemingly an excess in rural land supply. However, greatest land supply exists where demand is lowest with a potential rural capacity of only 8,750 to meet a demand of 18,207 rural dwellings in areas of high demand nearest Melbourne, along major transport corridors and coastal locations. Physical constraints on development will potentially further reduce substantially the supply of rural lots. Existing development capacity comprises a significant number of land parcels with factors affected by industry, biodiversity, water resource and climate change constraints that may reduce development capacity. Up to 31% or 7,995 parcels of development capacity used to meet projected demand by 2040, have significant environmental attributes, primary production values, and characteristics representing climate related risks.

If development proceeds on these sites large numbers of people will be living in areas of increasing risk from bushfires, flooding and sea level rise with the risk increasing from climate change. Moreover, scattered development has the potential to present future costs on communities and individuals if transport scenarios beyond peak oil are considered.

Reciprocal impacts are exerted between sectors. About 28 per cent of the rural peri-urban area remains in lots of 40 hectares or greater in area. These hold most of the remnant vegetation on private land. Based on the attractiveness ratings in the modelling, in the next 10 years, significant take up of parcels with high biodiversity value will occur in many SLAs. Rural dwelling construction has important implications for private farm dam construction, water capture and stream flow. Farm dam construction is largely unregulated. Many farm dams in this area are also used for other purposes than stock and domestic. Construction of a further 16,252 dwellings on rural lots in 14 peri-urban catchments will increase stock and domestic dam capacity by 32,506 ML or 17.13 per cent with increases as high as 76 per cent in the Maribyrnong river basin, 40 per cent in the Moorabool basin, 35 per cent in Lake Corangamite and the Barwon basin, and 34 per cent the Werribee basin. However, given that the volume of surface water intercepted is 1.1 times the capacity, an additional 35,756 ML will be captured each year. Ground water use is also relatively unregulated for stock and domestic use. If all new dwellings exercised their private right to groundwater for stock and domestic use, most of the groundwater management areas would be overcommitted.

Alternatively, a scenario based on meeting sustainability objectives drawn form existing broad policy statements and the vision developed in the project workshop (despite its relatively modest aims) would result in less land fragmentation and less impact on habitat and water resources. Additionally it would place less housing in scattered rural landscapes; potentially overcoming risks associated with wildfire and sea level rise and reduced capacity for agricultural systems to operate. Under this scenario however, “deflected” demand has the potential to stretch the capacity of infrastructure and social systems in towns within the region.

Maintaining agricultural landscapes requires broad policies to identify and support agricultural activities which can respond to trends in the future. However, without the use of stronger spatial planning techniques to prevent further land fragmentation, it is unlikely that other measures will prevent the continuing removal of agricultural land from production. Effective land use planning is an necessary though often not a sufficient tool for the maintenance of productive activities, employment and agricultural land markets. Key strategic and policy directions to achieve this include:

- Constructing certainty for ongoing agricultural investment in the face of risks to land markets and conflicting land use
- Supporting a critical scale for an agricultural network, a notion that relates not only to individual farm businesses but also to regional outcomes
- Policies that privilege agriculture and their application through the planning system, encouraging the emergence of entrepreneurial action, innovative investment and local and regional food production and distribution systems.
- Securing identified areas of high quality and highly versatile land resources for ongoing agricultural use.

Examples of policy and planning scheme measures which can support these directions include: preventing further fragmentation of holdings; limiting non-agricultural markets through appropriate and effective lot size minima, minimum lot sizes for dwelling construction; proscription of new development on small lots; the use of tenement controls; and the limitation of rural subdivision. In many places however, levels of fragmentation are extreme and the restructure of existing lots will be necessary. Other policy positions include the purchase or transfer of development rights, and land purchase. The state government has initiated a limited land purchase system for high fire prone lots, but the transfer or purchase of development rights has been practiced rarely in Australia.

To evaluate the potential impact of a tenement control, the number of existing lots can be compared to the number of properties (that is, a combination of lots under one ownership). Of the total of 53,629 parcels held as part of 35,348 properties, 24,827 parcels are currently unoccupied. A 25 or 40 hectare tenement control would prevent dwelling construction on most of these parcels.

A number of options for transferring demand from rural to township locations were modelled. By 2040, an excess demand for 9,458 land parcels will exist in rural landscapes for the most attractive SLAs, representing excess of projected rural dwelling growth over demand. Assuming that demand is not transferrable from highly attractive to less attractive locations where excess capacity exists, the transfer of this demand to townships will require 270.2 ha of land at a density of 35 dwellings/ha, 472 ha at 20 dwelling/ha or 756 ha at 12.5 dwellings/ha. If the amount of development capacity in SLAs which is projected to meet demand was withheld from development then a further 16,250 dwellings would have to be transferred to townships requiring about 464 additional ha of land at a density of 35 dwellings/ha. The land required for township expansions under these projections is a small proportion of the land required for rural residential development of existing or newly subdivided lots in rural locations. In some areas this represents a significant increase in urban land supply to be accommodated in existing towns and their fringes – itself suggesting impacts on infrastructure and community identity. .

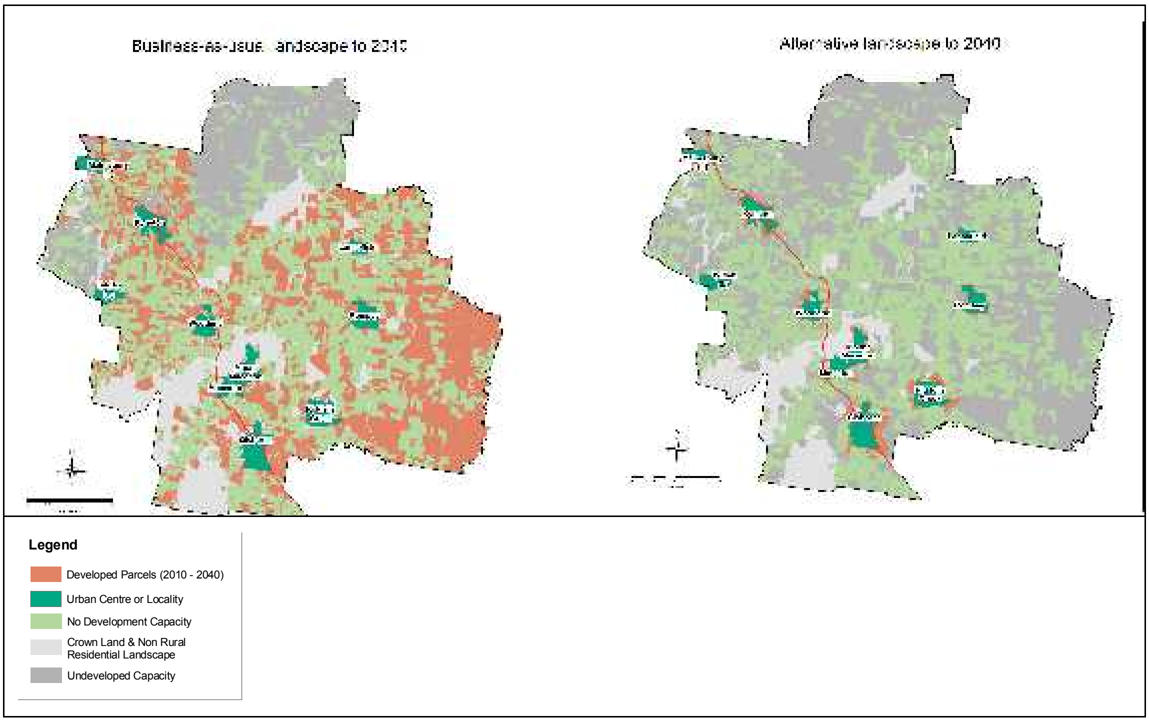
An visual example comparing the impacts of modelling for the two scenarios - business–as-usual and alternative - are included below for a typical localised area and at the broader sub-regional level.

Figure 3: Subdivision and development scenarios – selected locality

Business-as-usual development showing ad-hoc subdivision & dwelling construction	**Alternative scenario showing potential for subdivision control to limit development**

Figure 4: Landscape outcomes: Macedon Ranges Shire

Business-as-usual landscape	**Alternative scenario landscape**



Concluding comments

If recent trends continue, rural landscapes in this region will be developed to a point where impacts will become evident on natural and economic systems, as well as increasing risk to natural systems locally and regionally. It is clear from the study that the communities of the peri-urban region do not want to lose the environmental, agricultural and social attributes of the region. More broadly there is a growing understanding of the value and importance of retaining agricultural land near large urban areas for future food security. Larsen et al (2011:73) highlights the importance of land close to urban areas: 'as tensions around energy, food, greenhouse gas emissions, population and urban development increase, the difficulty in managing land to meet these multiple objectives will also intensify.

The contribution of this research on regional sustainability using scenario methods is two fold. First, the approach builds its own methods for analysing a number of possible futures and their outcomes. The use of the concepts of supply and demand and 'attractiveness' to identify where and why populations are likely to move, and how these movements are affected by transport infrastructure, oil prices and biodiversity, is applicable to other regions. This approach provides a framework for scenario work at the local and state planning level. Second, the fine grain detail of the data underpins strategic options and conclusions. Lindgren & Banhold (2005) argue that scenario thinking is by nature strategic. This paper contributes to strategic peri-urban planning and the relationship of the region to the cities it borders (Melbourne, Geelong, Bendigo), and comparisons with other peri-urban regions by providing sectoral detail which identifies the impacts of incremental change at the local level of households and individual lots. Working at this level allows research to reveal where change is occurring and the impacts on elements as diverse as wildlife, landscapes, catchments and roads of such developments. Fragmented governance arrangements are leading to the long term effective functioning of peri-urban communities. Integrated or cross-sectoral governance must replace sectoral decision making if the alternative scenario is to be achieved. To be able to identify key areas of pressure and areas that have reached their capacity for growth, along with methods of responding to these pressures, confronts the policy maker with challenging decisions and the urgent need for integrated governance.

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