

Publication Details

To be cited as: “Campbell, Andrew (2009) *Paddock to Plate: policy propositions for sustaining food & farming systems*. The Future Food and Farm Project Propositions Paper. Australian Conservation Foundation, Melbourne.”

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ISBN

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Acknowledgments

This report was developed under contract to the Australian Conservation Foundation (ACF), with funding from the William Buckland Foundation. The project was managed on behalf of the ACF by Corey Watts, who provided considerable enthusiasm and direction. Valuable input to this document and/or the companion background paper was received from Reference Panel members (Appendix A) and discussions with Tim Ada, Karen Alexander, Graeme Anderson, Snow Barlow, Patten Bridge, Julian Cribb, Richard Eckard, Liam Egerton, Christine Forster, Emma Greenhatch, Phil Haines, Ron Harris, John Langford, Kirsten Larsen, Stephen Mills, Andrew Monk, Henry O’Clery, Deb Peterson, Cathy Phelps, Robert Poole, Ron Prestidge, Tim Reeves, Gioia Small and Corey Watts. Those inputs are gratefully acknowledged, however responsibility for all content remains with the author.

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Queanbeyan, April 2009.

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Executive summary

Healthy environments, healthy farming systems, healthy foods and healthy people are intricately intertwined.

This paper culminates a project for the Australian Conservation Foundation that explores the future of the Victorian food and farming system in a rapidly changing and more demanding world, focusing on the period to 2020. It tries to anticipate and imagine the sorts of activities and investments that will be needed if Victoria is to equip its food and farming system to produce more healthy foods, more sustainably, in a much more difficult climate, while consuming less water, nutrients, energy, soil and biodiversity.

The focus here is unashamedly on the public policy challenges inherent in designing and delivering healthier, more sustainable and more resilient food and farming systems. Many of the objectives are about public goods, many of the costs of the currently unsustainable and unhealthy pathway fall on the public purse, and many of the systemic drivers of unsustainability are symptomatic of market failure.

The food system is a heavy component of the human environmental footprint on the planet. If current trends in human population and consumption patterns continue, the world will need to produce about twice as much food by 2050, in a rapidly changing climate, with declining production of oil and rising prices for energy, water, fertilisers, and soon, carbon. The era of abundant, cheap fossil fuels is over. Traditional avenues of expanding production through clearing, irrigating and cultivating more land are narrowing, and food is now competing with energy for land and water resources.

Consumers in developed countries are increasingly concerned about the quality, safety, environmental impact, human health and animal welfare aspects of their food. Governments in developed countries are increasingly concerned about levels of obesity and associated chronic diseases and escalating health costs, which are driven in part by increasing consumption of processed foods high in sugars, salts and saturated fats. The role of modern industrial food systems in human health is under question.

How can we improve the performance and resilience of the Victorian food and farming system?

This propositions paper outlines policy suggestions that would substantially assist the Victorian food system in delivering healthier foods, healthier profits and healthier landscapes. We can do this while making much better use of energy, water and nutrients, substantially reducing greenhouse gas emissions, minimising waste and pollution, improving wildlife habitat, producing renewable energy, reducing reliance on food imports, and reconnecting both rural and urban communities with the production of healthy, safe, delicious food.

The policy propositions posited here encompass food system leadership and governance; the evidence base, research capacity and education systems required to underpin food system renovation; farming system transformations; the sustainability of the food value chain beyond the farm gate; urban food production and exploitation of waste streams; the planning, design and infrastructure reforms needed to improve the performance and resilience of the food system; and management of the trade-offs between food, water and energy in a warming, drying climate in southern Australia.

Leadership is needed at all levels across the food and farming system and along the food value chain. Not just leadership in a representative sense, but leadership that imagines new possibilities, that challenges perceptions about what is possible, and that attracts people and gives them the confidence to try new pathways. This needs to start at the highest political levels, and it needs to be reflected within industry and the community. We need broad-based leadership to drive the necessary improvements in our food system.

A clear conclusion from this project is that Victoria needs a comprehensive healthy sustainable food strategy. This paper identifies many of the elements that such a strategy could contain, without purporting to write it. It presents the issues and potential responses with constructive intent, in the hope that organisations and people within the Victorian food and farming system will find a spark here that could make a difference.

Victoria can lead the world in designing sustainable food and farming systems for a warming, drying climate, generating significant know-how, innovation, regional development and export income along the way.

Summary of propositions

Joined-up governance and leadership on sustainable food and farming	
1	Government needs to develop an integrated sustainable food and farming strategy, with clear targets based on measures of environmental, social and economic progress.
2	Robust standards, measures and indicators of sustainable food and farming are needed to assess performance, identify areas for improvement and measure progress.
3	A thorough assessment of food system resilience and vulnerabilities is essential, taking into account climate change and rising input costs.
4	Government should lead the way with a ‘green, healthy and fair’ food procurement policy, such that public sector food meets progressively higher standards and drives investment and innovation for sustainability.
Victorian farming transformed, so that it is productive within ecological limits and adapts to global change.	
5	A sustainable food system is underpinned by healthy working rivers. Action to deal with the over-allocation of water should be strategic, prompt and sufficient to recover river systems, minimise social dislocation and realise alternative development pathways.
6	The food and farm sector needs to become much more active in the effort to avoid dangerous climate change. The full suite of policy tools will be needed to help the sector adjust to a low-carbon economy, harness opportunities, and adapt to changes already underway.
7	Reversing the decline of biodiversity in production landscapes needs to be seen as a high priority in food and farm policy. It will mean real whole-of-government support, stronger engagement along the food value chain, and a smarter policy mix of ‘carrots and sticks’.
8	Drought policy, and related business subsidies and concessions, should be overhauled to better reflect the reality of rapid climate change and to build resilient communities and landscapes.
9	Victoria, and Australia as a whole, needs a new soil policy framework to redress soil loss, improve soil management and maximise the services provided by soils, especially carbon sequestration.
10	Ecological, low-input and ‘regenerative’ farming systems have the potential to improve resilience, and to deliver multiple social and environmental benefits. They should be given commensurate research, extension and policy support.
Embedding sustainability through the food value chain	
11	Businesses along the entire food value chain can and must play a stronger role in shaping supply and demand to meet sustainability goals. Government should use the full mix of policy tools to mobilise the private sector to transform food and farming.
12	Government and industry need to invest substantially more in education and training for sustainable food and farming to tackle skills gaps, recruit new people, and prepare for a more demanding, interconnected world.
13	A transformation to sustainable food and farming will require major investment in innovation and knowledge, as well as new interdisciplinary research and development networks.
14	A world centre of excellence in sustainable food systems in Melbourne would provide a focus for innovation and leadership, attracting talent and sustaining the energy for reform.

Food system leadership and engaged communities	
15	A long-term investment in leaders and champions of sustainable food and farming is a high priority.
16	Sustainable and healthy food systems would promote and enable a diet rich in fresh and minimally-processed foods – predominantly fruits and vegetables – as the mainstream choice.
17	Innovative community and commercial enterprises that promote resilient and sustainable food systems, and that re-connect consumers and producers, should be actively encouraged.
18	The new approach to food and farming needs to be owned by the community, implying a more innovative and extensive community engagement effort on the part of government, industry and NGOs.
Planning and design for sustainable, healthy food systems	
19	The principles of Food Sensitive Urban Design need to be embedded into planning, policy and regulation.
20	The potential for significant and sustainable food production in urban areas should be thoroughly explored and tapped.
21	Planning strategy should secure peri-urban zones for sustainable agriculture and resilient food systems.
22	Major investment, research and policy attention in energy farming is needed to reduce dependence on fossil fuels, build resilience and reduce net greenhouse emissions.
23	The transition to sustainable food and farming rests on a transformation in distribution and major investment in sustainable transport infrastructure.
24	Looming resource constraints require government and industry to work together and more proactively to close the loop between food and waste.

Introduction

This report represents the second and final phase of the Future Food and Farming project commissioned by the Australian Conservation Foundation (ACF) and funded by the William Buckland Foundation.

The propositions herein are derived from a comprehensive desktop analysis that produced a background paper called *Paddock to Plate: Food, Farming & Victoria's Progress to Sustainability*. It was written by Andrew Campbell and published electronically by the ACF on 27 October 2008 at <http://www.acfonline.org.au/futurefoodfarm>.¹ The *Paddock to Plate* report informed a participative workshop in Melbourne on 3 October 2008, attended by a broad cross-section of people from across the Victorian food and farming system. The workshop, feedback on the background paper, other recent work and subsequent discussions with members of the reference group, have all shaped this document.

The nexus of food, environment, farming, health and society is a rapidly moving feast.

Since the first *Paddock to Plate* document was released in October 2008, we have witnessed a flurry of activity with a bearing on the future of food and farming in Victoria and Australia. For instance, the Australian Government released its White Paper on emissions trading and its 2009-10 business plan for conservation and land management. The Victorian Government has announced a new multi-billion dollar transport infrastructure package. The Victorian Sustainability Commissioner released its State of the Environment Report. The Productivity Commission is nearing completion of its review of national drought policy. The Public Health Association of Australia has called for a national integrated food policy, and the National Preventative Health Taskforce has released a paper calling for a turnaround in the country's rising rates of obesity and other diet-related diseases.

Internationally, we have seen the oil price drop as demand has eased. Much of the world is in recession. Envoys have met to debate next steps on climate change, and food prices and the legions of the hungry have continued to rise. Moreover, a succession of new food and farm sustainability studies and initiatives have emerged in a torrent of information that made researching this work like sipping from a fire hydrant. Media and community interest in the sustainability dimensions of food have intensified. Regardless of how protracted the economic downturn, food will continue to matter.

The resource constraints on this project make it impossible to develop an exhaustive set of potential solutions. That would require specialists in several fields. The food and sustainability debate in Australia is just beginning. It is important that this debate is framed broadly, leavened by the input of specialists, but engaging as many people as possible from as many different sectors as possible. We all have to eat, and the systems that provide our food make up a huge proportion of our environmental footprint. A debate about sustainable food systems is a terrific introduction to the broader challenges of sustainability and resilience facing humanity.

The propositions, vision, goals, milestones and indicators sketched here are far from the final word on sustainable food and farming. Rather, this paper is intended to frame further discussion and debate leading to a strategic approach to rendering the whole food value chain more sustainable – in every sense – in a rapidly changing world. A successful sustainable food system strategy will entail government, business, consumers and civil society all working collaboratively.

While the focus of this study is on the Victorian food and farming system, its findings are equally applicable across southern Australia and along the eastern seaboard, and its policy implications are relevant nationally. Few of the propositions developed in this document apply to Victoria exclusively or could not be tweaked slightly to add value elsewhere.

The Future Food and Farming project was overseen by a Reference Group comprising the people listed in Appendix A, and was managed by Corey Watts of the ACF.

¹ The background paper informs virtually every paragraph of this paper and thus is not cited further. Where particular insights or recommendations draw on other work, those references are cited.

‘Business as usual’ is not a smart option

Substantial changes need to be made within the next decade to prepare the Victorian food and farming system to be competitive, sustainable, healthy and profitable in a carbon, water, energy and nutrient-constrained world.

At a time of global financial crisis and seemingly unending drought, is this the best time to be imposing further change on a stressed food and farming system? The underlying premise of this report is yes – now is the right time to be carefully thinking through the sorts of steps we need to take in order to have a high quality, resilient food system in a much more demanding world. This is a perfect opportunity to renovate our food and farming systems, which in turn will hasten economic recovery.

Healthy environments, healthy farming systems, healthy foods and healthy people are intricately intertwined. From a human health, environmental health and economic health perspective, there are very strong imperatives to improve the performance of the Victorian food and farming system right now. Business as usual is not a viable option, especially when the challenges of the decades ahead are considered.

World demand for food will double by about 2050. Food prices are likely to continue to increase, although the shape of the supply and price curves is less predictable than that of the demand curve. There are immense opportunities for the industries, sectors and regions able to meet these demands.

However food production is becoming more difficult in many parts of the world, not least in Victoria.

Climate change is here already. In Victoria it is driving radical reductions in run off and water resource availability, hotter and drier conditions, less reliable seasonality, shorter growing seasons and increased risk of losses due to bushfires, pests, weeds and diseases. Many farmers are already relying on ‘exceptional circumstances’ assistance measures to survive, and the social costs and environmental damage arising from the failure of existing farming systems are substantial.

In order to thrive in a more difficult environment – in which what we now call drought will no longer be exceptional – Victorian farming systems will need to manage climate risk markedly better than we have to date. Doing so will open up further significant export opportunities, not just for the products of the farming systems, but for the expertise and technologies behind them.

While the prices of oil and some fertilisers have fallen, this reprieve is likely to be short-lived. The era of abundant cheap fossil fuels is drawing to a close. Supply constraints on oil and phosphate, coupled with increasing demand, will lead to on-going increases in real prices for farm inputs.

The fundamental challenge is the need to develop food and farming systems that are more intrinsically Australian, that:

- are resilient in the face of extreme weather and extreme seasonal variability;
- are miserly with water and conserving of energy;
- maintain groundcover and are kind to the soil;
- sit lightly on the landscape and don’t displace native wildlife or habitat;
- are highly profitable in good seasons and don’t lose money in bad seasons;
- preserve and build their natural, human and financial capital;
- recover quickly from shocks and stress;
- attract and retain young, talented people on the land;
- generate jobs and income in regional communities; and
- produce high quality, healthy foods in high demand, for good prices.

Looking beyond the farm gate, there are significant opportunities to improve the carbon, water and energy efficiencies of the Victorian food system, requiring systemic changes to policies, planning and infrastructure. This is not just about farmers. Retailers, processors, distributors and wholesalers all have a stake in the problems facing the Victorian food system and must be part of the solutions.

More could be done to improve the linkages between the food system and the health system, to make healthier, fresh local produce more accessible, to reduce the carbon pollution associated with its consumption, and to reduce the prevalence of obesity and its enormous cost burden on society.

The commencement of the Carbon Pollution Reduction Scheme, and in particular the possible entry of agriculture into the scheme sometime after 2013, represents a critical juncture for agriculture and food. An enormous amount of work needs to be done between now and then to help farmers and other food businesses to capture opportunities arising from the carbon market while minimising the risks of being squeezed by the carbon price, and setting course for a low-carbon future in which agriculture will play its part.

The performance, sustainability and quality of the food system is a core indicator of the health of any society. The contemporary food system has a huge environmental footprint, and is fundamentally dependent on natural resources and environmental services. Food is Victoria's largest manufacturing sector and a very large component of export revenue. The food and farming system is a very significant employer of Victorians throughout the state, especially in the regions.

As things stand, governance and policy related to food and farming is fragmented. Victoria – as does Australia – needs a comprehensive, integrated sustainable food and agriculture strategy. It should have ambitious goals, it should be long term in its focus, but within reasonable planning horizons (say to 2020) its development should involve many players across the sector, and it should be bipartisan, at least at a strategic level. This would sit well with the government's innovation and regional development priorities, it is very consistent with Victoria's proud history of innovation in natural resource management, and it bridges the crucial health and sustainability agendas.

Vision

A vision for the Victorian food and farming system in 2020 might read something like:

Victorian food and farming's clean, green credentials are world-class and enjoy broad support in the community.

Victoria is recognised as a world leader in the production, processing, distribution and consumption of healthy and sustainably-produced foods in a highly challenging and changing climate.

Melbourne is seen as the epicentre of innovation and knowledge in resilient food systems and the healthy foods capital of the southern hemisphere.

The Victorian food system is superbly led at all levels, in all sectors and along the entire food chain, with a fruitful combination of senior experienced leaders and diverse young talent.

Talented young people are attracted from all over the world to work in the Victorian food and farming system and to take advantage of the world's best education and training system for food system sustainability.

The ecological footprint of the mainstream diet is steadily shrinking, and societal health costs are falling.

No-one contemplates building a house or apartment block, or approving a new subdivision or suburb, without considering food production and consumption issues, including the potential for on-site food production, the re-use of storm water, energy and nutrients, and the minimisation of waste.

Infrastructure issues around transport, water, renewable energy and waste management are either sorted, or well-planned and in the process of implementation.

A comprehensive and coherent evidence base across the Victorian food system enables the performance of the system as a whole to be tracked, and easy identification of 'hotspots' where performance could be substantially improved.

Linking Threads

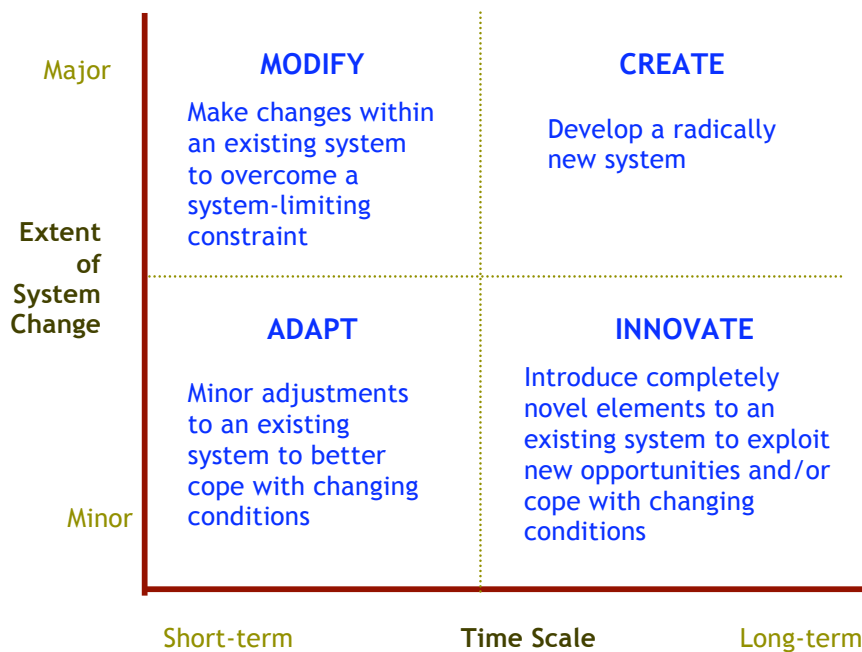
In developing the background paper and throughout the Melbourne workshop, some consistent themes emerged. These are worth mentioning briefly as they provide an important background context.

A systems approach

This project has looked at the intersection of what we currently see as three separate systems – the farming system, the food system and the health system – and how the food and farming systems in turn are embedded within the environment and are affected by both the global climate and the economy. Government decisions about food and agriculture need to be made within a whole systems model that includes human health, and vice versa. An understanding of the whole system of food production and consumption was considered by many workshop participants to be fundamental for the industry, and indeed for consumers and retailers as well.

In developing the propositions below, a conscious effort has been made to identify a complementary portfolio of initiatives, and to suggest measures in each of the quadrants in the graph below.

Figure 1. A conceptual framework for rethinking the Victorian Food & Farming System²



Some measures involve relatively minor tweaking of the status quo (in the ‘adapt’ and ‘modify’ quadrants) and can be implemented immediately. Other innovations will require a serious policy commitment and/or some development work but can be in place within five years. A few more creative options will require a more radical rethink of the way we currently do business in the food system, and will take most of the next decade to get well underway. However the latter sorts of measures are also those that are most likely to achieve lasting improvements in the performance and resilience of the Victorian food and farming system in the longer term, and where some of the biggest gains can be made.

² This is a modified version of a graph developed by the Future Farm Industries Cooperative Research Centre’s (FFICRC) [EverCrop](#) project

Seeking synergy

After the Melbourne workshop, the workshop facilitator Viv McWaters observed:

“Either/or thinking is dangerous. It sets up a competitive mindset that generates winners and losers. The challenges that face Victoria and the food and agriculture sectors require ‘and’ thinking that goes beyond lowest common denominator trade-offs and compromises. There is a difference between conversations for understanding and conversations for creativity. We need both. Conversations for understanding often include a lot of ‘yes, but...’ statements, while conversations for creativity embrace ‘yes, and...’ approaches.”

In the background analysis and in the propositions below, responses are sought for the challenges facing the Victorian food and farming sector, that do embrace ‘and’ thinking. We can lift productivity **and** look after biodiversity **and** use water more efficiently. We can shorten food chains **and** improve access to fresh healthy foods. We can grow carbon-neutral meat and dairy products **and** produce biomass energy. We can involve more people in growing food closer to where they live **and** reduce waste **and** increase recycling of water, nutrients and energy.

But only if we are smart, if we think and act systemically, and we invest in leadership and innovation.

Sustainability and Resilience

The terms sustainability and resilience are sprinkled throughout this document. Sustainability as used here refers to the ability for an activity or a system to be sustained into the long future, without further damaging the natural environment, or degrading or depleting natural resources faster than they can be replenished. In terms of food systems specifically, I like Ken Dahlberg’s definition:³

“Sustainability as it applies to food means that societies pass on to future generations all the elements required to provide healthy food on a regular basis: healthy and diverse environments (soil, water, air, and habitats); healthy, diverse, and freely reproducing seeds, crops, and livestock; and the values, creativity, knowledge, skills, and local institutions that enable societies to adapt effectively to environmental and social changes.”

Resilience is a key facet of sustainability, particularly in an era of intensifying climate change, as it refers to the extent to which a given system (an ecosystem, farming system, human community or whatever) can withstand, survive and recover from severe shocks or disturbance, without moving to a permanently altered state.

Resilience isn’t easily measured, yet it can be built, enabling individuals and communities to bounce back from adversity. Aspects of resilience identified in the workshop include flexibility, localised solutions and leadership, strong networks and links, and diversity. The ability for farmers to move from farming into other activities that are meaningful and rewarding for them is another aspect of resilience that the agricultural sector in particular needs to focus on.

Sustainability and resilience have strong ecological, economic and social dimensions.

Localised solutions

At the workshop, while it was clear that some solutions will need to be centralised, there was a consistent message that individuals and communities want to be able to contribute to their own well-being through localised solutions grounded in local contexts. This is strongly linked to the resilience theme.

³ This definition was developed by Ken Dahlberg, Kami Pothukuchi and Jim Bingen as part of the 2025 Vision Statement for Michigan Food and Farming. <http://www.mifooddemocracy.org>

Policy Goals and Milestones

2020 Goals

Setting some ambitious objectives for the Victorian food and farming system is an important first step.

In order to make a meaningful difference in improving the performance and resilience of the Victorian food system, the objectives of a food system strategy could include:

- To position the Victorian food system as a whole, and Melbourne as a city, as world-leading exemplars of how to produce and market healthy, sustainable foods in a highly variable, warming and drying climate;
- To ensure that all Victorians have access to safe, healthy, affordable fresh foods;
- To decrease average consumption of dietary fat in Victoria by 20% by 2020, and treble average consumption of fresh fruit and vegetables (increasing it radically in areas currently identified as ‘food deserts’, which should have all but disappeared by 2020);
- To halve the overall rate of obesity in the Victorian population and reduce it by a factor of four among children, by 2020 (working with other sectors including health, education and sport);
- To achieve energy use targets of 50/50 by 2020 – 50% reduction in net energy consumption and 50% of energy derived from renewable sources – across the Victorian food and farming system;
- To achieve water use targets of ‘factor 4’ by 2020 – halving water consumption and doubling total production – equating to a fourfold increase in productivity from the water used;
- To achieve water recycling targets of ‘factor 4’ by 2020 – doubling the proportion of water that is recycled, and doubling the use of recycled water – especially in urban food production and in the processing sector;
- To achieve waste reduction targets of ‘factor 4’ by 2020 – halving Victorian food waste (and waste along the food chain) and doubling the proportion of food waste that is recycled or used for bioenergy production;
- To halve greenhouse gas emissions from Victorian food transport by 2020;
- To ensure that the Victorian livestock sector is carbon-neutral (on-farm) by 2020 and has access to operating pilot schemes producing energy from biomass, biogas, solar and wind;
- To ensure that all new residential developments in Victorian cities incorporate Food Sensitive Urban Design principles, integrated with Water Sensitive Urban Design principles; and
- To develop several new cohorts of leaders across the food system and along the food chain, providing intensive leadership training for at least 1,000 people by 2020.

Milestones: 2010, 2012, 2015

The timeline for the above objectives is 2020. This is a meaningful planning timeframe. The urgency of the climate change situation demands responses on a significant scale now. The science and the economics of climate change indicate that the deeper and the faster we can cut carbon pollution, the lower will be the net cost in the long term. Delaying measures to reduce pollution will be more expensive and damaging – economically, environmentally and socially.

Significant measures need to be in place early in the coming decade, in order to achieve the changes outlined above by 2020, and to set the Victorian food system on a trajectory that would see even more ambitious objectives being reached by 2030, 2040 and 2050.

In order to meet such objectives by 2020, some interim milestones will need to be met. To illustrate the point, here are some suggested milestones for 2010, 2012 and 2015.

Milestones by 2010

In order to achieve the objectives above, the following measures would need to be in place by 1 January 2010:

- A Victorian Government commitment to an integrated healthy and sustainable foods strategy, based in part on assessment of the resilience and vulnerabilities in the contemporary food system;
- The establishment of a high level policy group across the agriculture, health and environment sectors, with strong links into energy, water, transport, infrastructure and education;
- The establishment of a complementary broad-based reference group encompassing all of the above fields, across all sectors of the food industry and all elements of the food value chain;
- The development of specific working groups (incorporating members of both the policy and reference groups, augmented with relevant specialist expertise) to work on detailed implementation plans in areas such as education (including community awareness and engagement), infrastructure, urban food production, biodiversity, energy, water, transport, waste and sustainable consumption;
- The design and implementation of a comprehensive and coherent evidence base for the Victorian food system, with work already commissioned and underway to fill the most important gaps in the information base such as those set out at Appendix B;
- The first iteration of a Victorian food industry leadership program well underway;
- A new cross-sectoral (agriculture, health and environment) food system research collaboration up and running (with or without funding from a new Commonwealth 'preCRC' program) having identified key research priorities for a sustainable and healthy food system and laying the groundwork for a centre of excellence in sustainable food systems;
- A government commitment to using the institutional foods sector (hospitals, aged care facilities, schools and defence establishments etc) as a pilot for the healthy and sustainable foods strategy, with a detailed implementation plan for that sector well underway;
- The food and farming system would be used to pilot a new approach to integrated planning across government (portfolios including transport, energy, health, water, agriculture, environment, education etc) to deal with cross-cutting issues like infrastructure, skills and innovation; and
- The first round of the 'foodies' awards would have revealed outstanding examples of Victorian innovation in improving performance, sustainability and health outcomes across the food system.

Milestones by 2012

The following measures would need to be in place by 1 January 2012:

- Every sector of the food system and component along the food chain would have a comprehensive understanding of its carbon, energy and water footprint and the most prospective means of reducing it;
- A comprehensive new food labelling scheme will have been agreed by FSANZ, encompassing the full environmental footprint of foods and food chains including carbon, water and energy;
- A review of the first phase of the healthy and sustainable foods strategy would be underway;
- The detailed investment strategy for new infrastructure in transport, energy, water and waste management (drawing on relevant working group reports) would be finalised and tenders let for the first projects;
- Performance, sustainability and health metrics for Victorian food system (such as those proposed in the next section) would be agreed, and the evidence base refined accordingly to enable such indicators to be tracked and reported upon;

The third cohort of 100 participants in the Victorian food industry leadership program would have graduated, and earlier graduates would be already influential across the industry, with a powerful network lubricated by web 2.0 knowledge sharing capabilities;

The food research alliance would have major projects well underway, attracting outstanding professorial staff, post-doctoral researchers and PhD candidates to work on world-class teams on the key issues;

The centre of excellence would be attracting significant co-investment from the corporate sector, and more adventurous philanthropic funding for its ambitious blue sky innovation agenda;

The lessons learned from the institutional foods sector pilot would be driving all government food system-related procurement and significant industry reform;

At least one major new urban development (e.g. new suburb) would be underway based on food and water sensitive urban design principles; at least one large scale rural landscape reconfiguration and reconstruction project (increasing productivity, improving wildlife habitat and biodiversity protection and reducing net carbon pollution and water use) would be well underway; and at least one large scale pilot project would be starting to shorten food chains and eliminate food deserts within an older urban area; and

Three rounds of the 'foodies' would have enhanced Melbourne's reputation as the food capital of the Southern Hemisphere, a mecca for sustainable and healthy food systems, and a magnet for gourmet consumers with a social and environmental conscience.

Milestones by 2015

The following measures would need to be in place by 1 January 2015:

Substantial improvements in food system performance and efficiency in terms of productivity, water use, energy use, water recycling, waste reduction and greenhouse gas emissions would already be evident – of the order of around 40% progress towards the 2020 target – and showing up in the performance data being collected;

The 'food literacy' of Victorians in all walks of life would have improved, with an increasing proportion of consumers understanding the implications of food labels and informing their purchasing accordingly;

The diets of Victorians would also have already changed markedly, with increasing consumption of fresh fruit and vegetables, foods grown closer to home and foods grown in low-input farming systems, and some emerging evidence of a slowing of the obesity trend, especially among children;

Innovators supported by the centre of excellence and private investors would be trialling new options such as tractor drivetrains driven by renewable energy and biodiesel from algae;

The highest priority projects of the infrastructure component of the food industry strategy would be starting to come on-line, offering new opportunities for savings in water, energy, nutrients and reducing carbon pollution;

Urban food production in Melbourne, Geelong, Ballarat, Bendigo and the Latrobe Valley would be getting back to World War II levels, with a large proportion of suburban backyards growing food again and many exemplars of office buildings, apartments and industrial sites where food gardens are being established and irrigated with stormwater and recycled water;

Knowledge exports from the Victorian food system would be growing rapidly and in terms of value would rank with the top five food commodities in terms of export income;

The 500 graduates of the food industry leadership program would be driving innovation faster and further across the sector, sharing information and ideas across their networks in unprecedented ways using web 3.0 tools; and

The entry scores for agriculture and other food system-related tertiary courses would be back up to historic high levels due to increasing demand from talented school leavers realising the enormous potential opportunities and strategic importance of the food and farming sector.

Policy propositions for sustaining food & farming systems

This section outlines policy propositions that are intended to spark and structure further discussions around strategic food system policy development in Victoria and nationally.

Some of the more innovative elements of a new food strategy for Victoria will be necessarily experimental. They should be designed as such, with systematic measurement and monitoring built-in, so that lessons can be learned quickly and shared easily. One way of doing this is to establish some high profile pilot projects to test and demonstrate key aspects of a new approach – several of which are suggested below. Such pilot projects lend themselves to attracting co-funding from external sources, including the Commonwealth and the corporate and philanthropic sectors.

Joined-up governance and leadership on sustainable food and farming

Proposition 1: Government needs to develop an integrated sustainable food and farming strategy, with clear targets based on measures of environmental, social and economic progress.

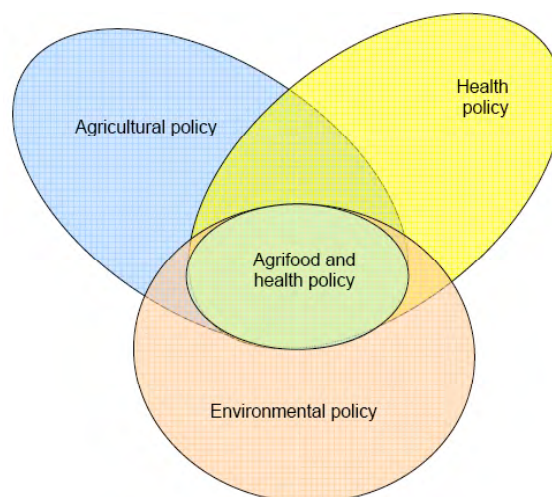
Food cuts across traditional policy boundaries (Fig.1⁴). Yet, governments generally – including the Victorian Government – lack a coherent, joined-up approach to food and farming. The institutional apparatus and information-gathering capacity essential to making progress or keeping up with international developments is similarly lacking. Given the centrality of food, this is a major flaw in governments' response to climate change, resource depletion, rising health costs and increasing demand as we move into a carbon-constrained future.⁵

Victorian policy makers need to commence work on an integrated strategy for sustainable food and agriculture across departmental boundaries. The agriculture, environment and health portfolios all have a stake in food policy, however a sustainable food system will intersect with additional policy domains, including planning, regional development, transport, energy and infrastructure.

At present, each of these domains has established strategies, leaders, forums, stakeholders, cultures, knowledge systems and ways of operating. Policy alignment and proactive development of synergies will be a major hurdle, but surmountable given leadership from the top sanctioning bold, innovative policy-making, and given dedicated resources and skills. In the absence of these key ingredients, any attempt at a collaborative approach is likely to stall.⁶ Box 1 below outlines a process checklist for strategic agrifood policy development within government.

This process of joining up government should extend to working with the Commonwealth and local governments. In so doing, Victoria could position itself as the national leader in this field by championing a national sustainable food and farming strategy at the Council of Australian Governments (COAG). Such an endeavour will also serve to bring Victoria and Australia up to speed with deeply

Figure 1. The centrality of food policy



⁴ From a Canadian proposal for an integrated Agrifood and Health Policy

⁵ The split up of the Victorian Department of Natural Resources and Environment into the Departments of Sustainability & Environment and Primary Industries has not helped.

⁶ The State Services Commission has a useful reference to joined-up government at the eGovernment Resource Centre <http://www.egov.vic.gov.au/>

systemic food policy development work underway in the UK, led by the Cabinet Office; providing an opportunity for cross-fertilisation of ideas and avoiding the need to reinvent the wheel.

It is equally important to develop productive collaborative approaches that extend beyond government to include industry (along the entire food value chain), NGOs (in the environment, agriculture, health and community sectors) and consumers.

In this endeavour, government is likely to receive support from across civil society and, at least in so far as it provides certainty, direction and new resources, from industry too. The Public Health Association of Australia (PHAA) recently called for a national integrated food policy “to ensure we are able to better manage the environmental and health problems that are already apparent, as well as adapt to new challenges.” (PHAA 2008, p3)

Box 1: A suggested process for establishing a genuinely integrated state food and farming strategy.

A similar approach could be undertaken federally. The effort will require a broad-based and well-resourced approach to develop the strategy and support its implementation, for example:

1. Form a sub-committee of Cabinet to oversee policy development and implementation, comprising *inter alia* the Premier and Ministers for Health, Primary Industries, Environment and Planning.
2. Form a high level officials group comprising people at Secretary and Deputy Secretary level from the key agencies pertinent to the performance and sustainability of the food system, including health, primary industries, environment, planning, education, infrastructure and energy, reporting to the Cabinet Sub-committee.
3. Form a broad-based food strategy task force comprising industry and stakeholder representatives from across commodity sectors and along the food chain, including consumer and environmental groups.
4. Map and analyse how existing policies and policy domains overlap with and/or affect the healthy and sustainable food strategy, identifying potential synergies and areas of tension.
5. Form a series of working groups to flesh out key themes within the strategy and develop implementation detail, comprising officials, stakeholders from the task force and specialist expertise in the relevant area.
6. Service the above apparatus with a dedicated, well-resourced secretariat staffed by committed and talented people, headed by a senior executive with a strong strategic outreach and consultative track record, and supported by a communications unit with experience in the use of web 2.0 knowledge sharing tools.
7. Undertake significant institutional experiments on a reasonable scale and build in very thorough learning, evaluation and audit mechanisms to ensure that lessons are captured and absorbed.
8. Look at opportunities to join up funding programs to create a large pool of funds rather than lots of little ones with narrowly-defined criteria.
9. The community has to own a new approach to food. Take public participation seriously (not just formal consultation mechanisms or one-way communication) and make more use of web-based social networking tools and social marketing approaches to engage the community, to capture and share good ideas and to seek community input.
10. Make sure that the key policy makers involved are fully conversant with the policy research in this area, especially at the intersection of health, agriculture and environment, and are fluent with the full repertoire policy instruments.
11. Give policy makers the time, space and licence to be bold and innovative

Proposition 2. Robust standards, measures and indicators of sustainable food and farming are needed to assess performance, identify areas for improvement and measure progress.

A comprehensive set of performance measures for the Victorian food and farming system is needed. Some of these indicators are much easier to quantify and assess than others. For many, it will be an essential and non-trivial task to establish a baseline and to get reliable data systems in place. This should be an early priority of the overall strategy and a key focus of work on the knowledge base. Establishing a ‘dashboard’ of key indicators will serve to drive the development of targets of action, highlight gaps in the evidence base and hence R&D priorities, catalyse public discussion and debate, and demonstrate that government and industry is serious about making change.

A collaborative approach to governance will entail engaging stakeholders from across the private, public and community sectors from the outset to develop a truly comprehensive set of indicators. These may include:

- **Economics and business indicators**, such as: the value of food exports and imports; average net farm business profit; the average proportion of the retail price for food products that is received by the producer; and the proportion of food producers requiring public financial assistance to remain viable.
- **Energy and environmental indicators**, such as: net greenhouse gas emissions from the sector (and for each key link in the food chain); the extent and condition of native vegetation in agricultural areas; the energy consumed by food systems (including processing and distribution, and the proportion of this derived from renewable sources); the amount of renewable energy *produced* by the system; water use (including consumption, re-used and recycling); and water quality and stream condition in agricultural areas,
- **Social and health indicators**, such as: the proportion of high-achieving school leavers choosing a career in sustainable agriculture & food; the proportion of supermarket shelf space occupied by foods assessed as being sustainably produced; consumption of fresh fruit and vegetables (as a proportion of the diet); consumption of dietary fat; obesity rates in adults and children (and perhaps other key indicators of a healthy diet); the proportion of food wasted (and recycled); and the proportion of households assessed as living in ‘food deserts’.

Some of these measures – such as obesity rates, the condition of native vegetation and water quality – are lagging indicators that may be affected by factors outside the remit of a sustainable food strategy, and thus subject to attribution difficulties. For example, obesity is influenced by lifestyle factors, especially exercise, as well as diet and nutrition. Nevertheless, in evaluation terms, arguments about attribution are good arguments to be having, because that implies that some impact has been measured. Apportioning that impact across different types of interventions can be difficult, but is not impossible. Box 2 outlines a set of key questions used in California.

Box 2. A checklist for food system metrics

California’s community-based sustainable food and farming initiative, the Vivid Picture Project, uses this checklist for the development of key indicators and metrics (Vivid Picture Project 2005).

- Is the indicator measurable?
- Is the data source available?
- Is the data cost-effective (i.e. affordable)?
- Is it reliable and credible?
- Is it easily understood by stakeholders?
- Is it usable (at different scales)?
- Is it responsive to changes in the food system?

The development of indicators should go hand in hand with the introduction of robust standards for sustainable food and farming systems. Such standards would set a baseline for industry performance that would need to be reviewed and upgraded periodically, and would otherwise provide the basis for preferred purchasing policies (see below) and international marketing. Importantly, credible standards will need to take account of actual performance – i.e. outcomes – not simply the implementation of procedures.

Proposition 3. A thorough assessment of food system resilience and vulnerabilities is essential, taking into account climate change and rising input costs.

Resilience is a key facet of sustainability, particularly in an era of intensifying climate change. It refers to the extent to which a given system (an ecosystem, farming system, human community or whatever) can withstand, survive and recover from severe shocks or disturbance, without moving to a permanently altered state. The core principles of resilience are flexibility and redundancy between elements in the system.

Resilience isn’t easily measured, yet it can be built, enabling individuals and communities to bounce back from adversity. Aspects of resilience identified in this project include flexibility, localised solutions and leadership, excellent training and research capabilities, extensive community engagement, strong networks and links, and diversity. The ability for farmers to move from farming into other activities that are meaningful and rewarding for them is another aspect of resilience that the agricultural sector in particular needs to focus on.

Sustainability and resilience have strong ecological, economic and social dimensions. It is important in adapting to a rapidly changing world not to lose sight of society's goals for fairness, environmental quality and sustainable prosperity.⁷ Prime Minister Kevin Rudd used a lecture in Westminster Abbey⁸ in the lead up to the G20 Leaders' Summit to suggest that the free market needs a moral compass:

To these values of security, liberty and prosperity must also be grafted the values of equity, of sustainability and community.

Proposition 4. Government should lead the way with a 'green, healthy and fair' food procurement policy, such that public sector food meets progressively higher standards and drives investment and innovation for sustainability.

Governments provide millions of meals every day in hospitals, schools, aged care facilities, prisons, defence establishments and so on. The public sector is therefore a significant direct player in the food system and a very large customer. There is a glittering opportunity to use public sector foods to drive innovation in the system by setting mandatory sustainability and health standards for these foods, shortening food chains and rewarding producers who meet high sustainability and health standards.

The institutional food sector should be a pilot for exploring and demonstrating new approaches to improving its environmental and health performance. This would set a great example (the best form of leadership) and would deliver significant public health and environmental benefits in its own right. Conversely, if government is incapable of lifting its own game with the parts of the food system it controls, then its credibility in leading reform of the wider food and farming system is compromised.

The UK's Public Sector Food Procurement Initiative (PSFPI)⁹ may prove a useful model for the Victorian and Australian Governments. That Initiative's priority objectives are to:

- promote food safety, including high standards of hygiene;
- increase the consumption of healthy and nutritious food;
- improve the sustainability and efficiency of production, processing and distribution;
- increase tenders from small and local producers and their ability to do business;
- increase cooperation among buyers, producers and along supply chains; and
- improve the sustainability and efficiency of public food procurement and catering services.

Consumer behaviour, organic food, animal welfare, fair treatment of suppliers, working conditions for catering staff and catering for ethnic minority, cultural and religious groups are ancillary objectives.

⁷ The UK Forum for the Future has developed a model framework for assessing the stocks, flows and adaptive capacity of resources, and for identifying risk thresholds in industries, sectors and societies. See www.forumforthefuture.org

⁸ <http://www.abc.net.au/lateline/content/2008/s2532594.htm>

⁹ See <http://www.defra.gov.uk/farm/policy/sustain/procurement/index.htm> for a comprehensive list of British case studies, tools and guidance.

Victorian farming transformed so that it is productive within ecological limits and adapts to global change.

Proposition 5. A sustainable food system is underpinned by healthy working rivers. Action to deal with the over-allocation of water should be strategic, prompt and sufficient to recover river systems, minimise social dislocation and realise alternative development pathways.

The current approach to water reform is largely haphazard, leaving regional communities and environmental assets such as wetlands and floodplains to risk deterioration and mounting social and financial costs. Moreover, the world is watching. Australian producers' reputation in key export markets, their social licence to operate and the health of their communities are placed in jeopardy so long as we allow river systems like the Murray-Darling to continue to fall into disrepair.

Past rainfall patterns are no longer a good guide to the future. A concerted and genuine effort is needed to bring water allocations back to within sustainable limits (assuming hotter, drier conditions in southern Australia) while giving communities and industries the tools to shape sustainable futures. This means being realistic about which districts are likely to be viable and which are not and developing targeted adaptation programs accordingly, rather than insulating communities from change and eventually incurring higher social, environmental and economic costs.

Some irrigation areas that have enjoyed high levels of water security in the past, will have to survive in the future with much less water, and much less reliable water. Radical re-configuration of irrigation infrastructure may be required, channels will need to be decommissioned, and it is likely that fewer farms will remain viable. With good planning, it is possible to reconfigure property boundaries and irrigation infrastructure to restore floodplain connectivity and floodplain-river connectivity, to return some land to environmental services, and to finish up with a fewer number of larger, more viable and more sustainable farms in the most favourable parts of the landscape for agriculture. Those people wishing to leave the irrigation industry can do so, receiving a good price for their properties. Those determined to stay have opportunities to secure a better-designed, better-located, better-serviced property. There are potential investors like superannuation funds for such landscape reconstruction projects.

It would be interesting to call for expressions of interest from irrigation districts, and from investors willing to investigate the potential for pilot large-scale landscape reconfiguration projects. Such projects would need to meet specified criteria in areas such as water savings, big improvements in water security, restoration of environmental assets and ecological function, and opportunities for people to leave the irrigation industry with dignity and reasonable financial equity.

Done well, irrigators and their communities could benefit from the retirement of debt and structural adjustment funds designed to stimulate private investment in new industries and the redesign of production systems. On the other hand, a failure to come to grips with the water reform challenge, and the subsequent erosion of the resource base and public confidence, will undermine other efforts to craft a sustainable and prosperous food system. The longer we wait, the more options slip through our fingers and the harder reform becomes.

Proposition 6. The food and farm sector needs to become much more active in the effort to avoid dangerous climate change. The full suite of policy tools will be needed to help the sector adjust to a low-carbon economy, harness opportunities, and adapt to changes already underway.

The food and farm sector's emissions represent nearly one-quarter of Australia's greenhouse gas emissions. According to ABARE, Australia is one of the countries most affected by climate change, and Australian agriculture is one of the most affected sectors. All stakeholders in the food value chain are likely to be affected by both climate change and the national and international policy response. The winding up of the *National Agriculture & Climate Change Action Plan* this year presents state and federal governments with the opportunity to craft a new, integrated approach to mitigation and adaptation in the agrifood sector.

A crucial measure of success is the extent to which the synergies between mitigation, adaptation and other social goals, such as public health, are identified and maximised, while trade-offs are minimised and managed. Within the broader food and farm strategy, would sit agreed industry or regional-scale targets and strategies backed up by a mix of policy and community-based approaches – i.e. carrots and sticks. This suite of tools would complement emissions trading, which is just one part of the response menu. A key to successful implementation is broad stakeholder engagement from the outset. The whole value chain, including consumers, should be brought on board.

There is enormous potential for agricultural and other land managers to play a powerful role in mitigation of greenhouse gas emissions. Moreover, the costs of cutting food and farm-related emissions are likely to escalate if they are delayed. Delay also denies producers and others the incentives that would position them for a low-carbon economy and the opportunities it affords. Leaving agriculture insulated, either from its liabilities or the opportunities will only make the inevitable catch-up much harder when the pressure intensifies.

Proposition 7. Reversing the decline of biodiversity in production landscapes needs to be seen as a high priority in food and farm policy. It will mean real whole-of-government support, stronger engagement along the food value chain, and a smarter policy mix of ‘carrots and sticks’.

The aggregate impact of farming on the health of the countryside is of crucial public interest. Despite a long history of Victorian innovation and national leadership in promoting and supporting nature conservation on private lands, our track record to date in preserving landscape health in farming districts (as measured by indicators such as water quality, stream condition, habitat fragmentation and species loss) has been patchy at best.

The basic problem remains that people doing the right thing at a farm scale (from a landscape health perspective) do not get sufficient reward from the market and/or government, and people doing the wrong thing do not get sufficient sanction. A consumer buying a steak in the supermarket has no idea if it came from a property that was over-cleared, over-stocked or over-grazed. The sanctity of private property rights remains paramount in Australia. Governments generally lack the resources and inclination to intervene in land management practices in all but the most egregious instances, and then usually only after the degradation has taken place. The natural resources statute books are full of fine-sounding and well-meaning legislation, without a commensurate compliance effort. More broadly, investment in conservation has failed to keep pace with the state’s economic growth and does not tally with the risk to ecosystem services.

There is now in Australia, and in Victoria in particular, a rich menu of policy instruments for encouraging and rewarding landholders for ‘doing the right thing’ especially in terms of conserving or re-establishing native vegetation for biodiversity values. Victoria has pioneered the eco-markets approaches such as Bush Tender developed by Gary Stoneham and his team, and has long supported the revolving fund approach of the Trust for Nature. Landholders wanting assistance with the cost of revegetation have also had access to grants via Catchment Management Authority (CMA) and landcare programs, and through the voluntary carbon offsets market through organisations like [Greenfleet](#) (Campbell 2007). At the October workshop, Prof Paul Martin described a proposal being developed at the University of New England ([Martin et al 2007](#)) through which farms within a region can get together to offer investment opportunities for environmental services, supported by tax-effective instruments a bit like Managed Investment Schemes (MIS).

The various forms of assistance available to assist in conservation efforts on private lands could be likened to an alphabet. For terrestrial biodiversity, we are just starting to put some of that alphabet together to start to tell a story at a landscape scale through larger initiatives like [Project Hindmarsh](#) and [Habitat 141](#). For soil health, and for aquatic biodiversity and the health and connectivity of rivers, wetlands and floodplains, incentives measures are arguably less well developed. There is a lot of money allocated to water buy-backs, but less emphasis at this stage on the targeting and aggregation of those buy-backs around the water needs of specific natural assets and the on-going management of such environmental water. The innovative [Future Farming Landscapes](#) project of VicSuper is a 25-year investment in land and water and farm reconfiguration in northern Victoria, managed for VicSuper by Kilter Pty Ltd.

To maintain biodiversity and improve its chances of coping with a hotter, drier and more variable climate, it will be crucial to improve wildlife habitat quality, to improve connectivity at a landscape scale, and to improve the management of threats such as pests, weeds and fire. This demands a strategic approach at a landscape scale and a concerted effort on the part of all sectors and all portfolios. The need for such a strategic approach will be compounded by the carbon market, as the spatial location of carbon plantings in rural landscapes will be critical from a water yield and biodiversity perspective. For serious integration of biodiversity into production landscapes, we should see the carbon agenda as an opportunity, not a threat.

For all of these reasons, plus the likelihood of significant changes in land ownership as more land is purchased by corporations marketing Managed Investment Schemes and by superannuation funds, having a solid rural planning framework underpinned by sustainability principles is crucial. The Regional Catchment Strategies prepared by CMAs are a good start, but they need to be revised in the light of the climate change and carbon agendas, and somehow they need to be better integrated with both water supply planning and the formal statutory planning and development approvals process.

We need to start going beyond an alphabet of incentives approaches to develop more widespread ecological literacy at a landscape scale, and to start to develop a literature and, in the long term, a canon of exemplary initiatives that have put the best of our knowledge and wisdom together on a large scale to rebuild whole landscapes across private and public lands.

With input from CMAs, non-government organisations such as the partners in the Victoria Naturally Alliance, and the knowledge base of the Department of Sustainability and Environment (DSE), it should be possible to identify 6-12 such initiatives across the state, and to seek expressions of interest from consortia willing to develop them further. When viable proposals have emerged, the government could prioritise the incentives at its disposal into such projects, and facilitate private and philanthropic investment into them. Where possible, ecological restoration should be linked to regional economic and community development opportunities.

While one should be cautious in suggesting that environmental branding will deliver higher prices for producers (O'Keefe 2008), there may well be opportunities for farmers operating within the scope of these large scale projects and whose practices are consistent with their objectives, to incorporate that link into their marketing strategies.

Proposition 8. Drought policy, and related business subsidies and concessions, should be overhauled to better reflect the reality of rapid climate change and to build resilient communities and landscapes.

"You can't drought proof Australia. We need to learn to live with the landscape, not try to fight against it all the time."¹⁰

More than one third of Australian farm businesses are relying on direct government financial assistance. The poor performance of current farming systems costs us in many ways. It has profound social costs in terms of the stress it places on farm families and rural communities. It has significant financial costs in terms of lost income and drought relief payments and subsidies. And it has major environmental costs in terms of the pressure placed on the resource base. In broad terms we need to move away from drought relief payments that reward bad practices and don't recognise those who have managed the same conditions better. Exceptional circumstances funding could be redirected into structural adjustment funding (help those with unviable businesses to leave the land) and adaptation funding.

The single biggest component of this challenge is adapting to climate change, especially on-farm, though systemic landscape-scale changes will be needed too. The most critical step in this process happens between the ears. We need to make a fundamental mind-shift, analogous to the step-shift in climate that appears to be taking place in southern Australia. That mind-shift is to accept that the climate has changed, to get over the notion that this is just another drought from which we will re-

¹⁰ The late Peter Cullen, quoted in an obituary by Asa Wahlquist, rural writer for *The Australian* <http://asawahlquist.com/content/view/26/2/>

emerge into a run of good seasons like we used to have 20-30 years ago. Southern Australia is already much drier, and may become more so. Seasons are likely to remain ‘out of whack’, with a much less distinctively Mediterranean pattern. We can no longer rely on an autumn break, a wet winter and spring, or a very dry January/February.

People who can make that mental leap will be able to look at their farming systems in a new light. Farming systems that are losing money now because their input costs are too high and/or their returns are too low, are likely to keep on losing money in the future. These farming systems need to be redesigned from the ground up. Farming systems that are still making good money now, in historically difficult climatic conditions – provided they are not doing so at the expense of the resource base – are a good platform on which to build businesses that can withstand and recover from climatic shocks with their natural, human and financial capital intact.

Proposition 9. Victoria, and Australia as a whole, needs a new soil policy framework to redress soil loss, improve soil management and maximise the services provided by soils, especially carbon sequestration.

Soil management is fundamental to longer-term food system performance and resilience. It is also crucial in terms of water, carbon and biodiversity. The last twenty years or so has seen a broader focus on managing natural resources at landscape and regional scales. An unintended consequence has been that some of the fundamentals about soil management, and the technical capacity and information systems that underpin them, have been allowed to depreciate. Campbell (2008) discusses the need for a new soils policy framework for Australia, setting out measures that would rebuild commitment, knowledge and capacity for better soil management. Victoria could take the lead in this area, building on the very good work already done within DPI and freshening it up from a food system resilience perspective.

The soil is a huge carbon store. Of the estimated 3,060 gigatonnes of carbon in the terrestrial biosphere, 82 per cent is in soils (Lal 2004). Poor soil management generates large greenhouse gas emissions. There is a strong imperative for Australia to introduce a suite of policy instruments that encourage sequestration of soil carbon and that discourage practices that lead to large emissions of soil carbon. Such instruments could include (Campbell 2008):

- developing robust, efficient, user-friendly methods for measuring the soil carbon store and tracking changes in it;
- using these tools to develop an accounting framework for soil carbon;
- the preceding two steps are prerequisites for any moves to include soil carbon in a national emissions trading scheme;
- measures to encourage abatement of greenhouse gas emissions from soils, which will inevitably lead to a greater focus on soil carbon, from a management as well as a measurement perspective;
- greater attention within planning and development approval processes on the risks associated with developments on particular types of land (not just from a soils perspective, but also flooding, storm risks, bushfires and so on) leading to demands for improvements to natural resources information systems for a wide range of users;
- a key priority is to develop consistent measures and measurement tools that can be used to evaluate the relative performance of different farming systems in improving key indicators such as soil organic carbon levels, water holding capacity, fertility and soil health; and

Another obvious area for attention is to identify and map where the best soils are for food production within urban areas. Some of these may have been irretrievably lost under buildings and bitumen, but others may be able to be brought back into food production, at least partially. Conversely, it is critical within the urban footprint to be able to identify contaminated sites that should not be used for food production unless they have been rehabilitated to appropriate standards.

Proposition 10. Ecological, low-input and ‘regenerative’ farming systems have the potential to improve resilience, and to deliver multiple social and environmental benefits. They should be given commensurate research, extension and policy support.

While the market may continue to drive innovation in on-farm resource-use and environmental efficiencies, in the absence of policy drivers the uptake of ecological farming methods, even where proven, is likely to be small and piecemeal. While agriculture has a history of innovation, the daily and yearly concerns that occupy farmers’ minds are many. Wholesale transformations of management practice are rare and often dependent on generational change. So far, the allocation of resources by governments to the development of low-input ‘regenerative’ farming systems is disproportionately low, falling far short of the scale of the challenge and the opportunity.

It is time to jettison the baggage of tired old polarised arguments and to start a completely new dialogue between organic farming and the so-called conventional farming sector.

Climate change, the policy responses to climate change, rising energy and nutrient costs and increasing water scarcity and hence prices, will all put pressure on the Victorian farming system to use inputs more frugally and efficiently, to make greater use of organic as opposed to synthetic nitrogen, to apply the principles of integrated pest and weed management, and to manage water very carefully. Health and broader environmental concerns will also put pressure on the food system to deliver fresher, healthier foods that meet consumer needs, that are not so replete with sugars, salts, saturated fats and food additives, and that minimise net greenhouse gas emissions along the value chain.

From both of these perspectives, contemporary ecological farming practices and the science of agroecology have many lessons to offer. In general, pollution and food contamination risks are much lower. There is solid evidence from well-controlled comparisons that the global warming potential of organic farming systems is, on the whole, lower than comparable conventional farming systems (Niggli *et al* 2008), and that food produced organically may have appreciably higher levels of anti-oxidants, flavonoids, vitamins, Omega 3 fatty acids and other nutrients than food produced conventionally.¹¹ Just as in conventional agriculture however, management expertise makes a huge difference. The gaps between best practice and the average, and between the average and the tail, can be more significant than those between organic and conventional. Nevertheless, an open-minded examination of the organic value chain is likely to reveal valuable insights for a sustainable future.

However, individually and collectively, these systems sit largely outside ‘conventional’ research funding streams and agricultural education, extension and advisory services. That needs to change. We need to substantially ramp up research into these low-input systems. That research should be systems-oriented and highly participatory, learning from the farmers and leaders who have pioneered these approaches and the farms that have been implementing them over many years. There is room here for some reductionist science to delve into particular processes, but only if embedded within an overall approach that is evaluating the farming system as a whole, not in disaggregated parts.

Key high-level research questions include the extent of any yield penalties (over a long run of seasons and a drying trend) from adopting these lower input systems, the bottom-line costs and benefits for reduced chemical dependence, and their ability to scale up to widespread adoption – i.e. would it work just as well (including the economics) if everyone did it? It would be essential to develop a consistent set of metrics to evaluate in a consistent and objective way, the performance of alternative farming systems in terms of carbon, water, energy, soil health, landscape biodiversity and financial performance.

In addition to a concerted R&D effort, both farmer-led and policy-driven approaches are needed.

In the 1990s, several European countries and Canadian provinces set bold national targets for farm input reduction, with most making impressive progress without sacrificing productivity (Pretty &

¹¹ Cordis 2007, Benbrook *et al* 2008 and Ellis *et al* 2006, cited in Larsen *et al* 2008; Asami *et al* 2003, Brandt and Mølgaard 2001, Carbone and Motta 2001, Davis *et al* 2004, Fox *et al* 2007, Mitchell *et al* 2007 and Ryan *et al* 2004, cited in Pollan 2008)

Waibel 2005). For example, by 1997 Denmark had cut its total pesticide use in half. Not satisfied, the Danes committed themselves to reducing farm chemical applications further still. The targets were backed up by new regulations, training programs, provision of alternatives and the strategic removal of perverse subsidies. The particular policy instruments are probably less important than the fact that societies committed themselves to ambitious yet achievable goals. Moreover, the commitment was not just rhetorical but came with a package of resources and measures intended to realise the goal.

Even where governments fail to set goals, agribusiness and communities can step up with targets and packages of their own.

We are also going to need innovative policy tools that address the underlying economic drivers of chemical dependence; policies that change the business model of input suppliers from simple purveyors of chemicals, to providers of farmland health insurance and information. For instance, the American Farmland Trust offers farmers ‘conservation insurance’ products as commercial service guarantees that remove the financial risk of unfamiliar practices, such as integrated pest management and reduced fertiliser use (AFT 2008).

Victoria is lucky in that it still has some higher rainfall zones, and some districts like the south-west where the drying trend has opened up new agricultural opportunities such as cropping in areas that used to be too wet. There are arguably opportunities to substantially increase the intensity of agriculture on the most favourable soil types that still enjoy reasonable rainfall, and that such intensification will be needed as production elsewhere is progressively affected by lack of rain. It is just as important to work on the development of these systems and to evaluate their performance as it is with the lower input systems discussed above. This sort of work should remain a high priority in order to develop new options that can plug into existing farming systems relatively easily, or can be incorporated into new approaches in a world where carbon is priced and rainfall is less frequent, less seasonal and less predictable.

The same farming system evaluation toolkit would apply for both low-input and high-input systems. Developing such a toolkit should be a very high priority. With such a toolkit applied using a standard suite of measures across a range of farming systems and a range of regions in a range of seasonal conditions, it should be possible over time to model and predict which sorts of systems are going to be most profitable under a range of climatic and economic scenarios – especially different scenarios for the relative prices of carbon, energy, water and farm gate receipts.

Box 3. Project Idea: Greening the tractor drivetrain

Victoria has a significant auto manufacturing and components sector that is already receiving significant government funding to help improve fuel efficiency. Why not challenge the sector to mobilise some of its engineering and design expertise to retrofit tractors to use renewable fuels, or further, to develop a tractor drivetrain that is ‘beyond oil’ – e.g. a solar-electric tractor? Tractors may be easier to retrofit than cars, as they don’t need to be aerodynamic, they can handle much heavier batteries and so on. Any breakthroughs would have worldwide application.

Embedding sustainability through the food value chain

Proposition 11. Businesses along the entire food value chain can and must play a stronger role in shaping supply and demand to meet sustainability goals. Government should use the full mix of policy tools to mobilise the private sector to transform food and farming.

In tackling the climate change imperative, governments could do much more with the food industry to improve the efficiencies of food supply chains in terms of carbon pollution and water and energy use, and to minimise waste and optimise recycling. Similarly, in response to the obesity epidemic, there is a strong imperative for governments to work with the food industry to improve access to and the relative affordability of fresh, whole foods, and to help consumers make informed choices about the health implications of their diet and shopping habits.

It is axiomatic that one of the characteristics of a free market functioning efficiently is that sufficient information is available to all players in the market to ensure that transactions are grounded in a good understanding of the nature of the product or service being bought or sold. Importantly, that information should be symmetrical, meaning that both buyer and seller have access to a similar level of detail about the product or service, sufficient to make a well-informed decision.

We are as yet a long way away from having a broader food certification and labelling system that encompasses the full environmental, animal welfare, food safety and nutrition information that consumers seek. Some aspects of food production systems are covered by established labels, such as 'organic', 'biodynamic' and 'free range', that have long-established standards and certification measures. However each of these just covers part of the on-farm picture. None cover carbon pollution, nor do they encompass the through chain to the point of purchase.

To succeed in the higher-margin end of the food market, serious attention needs to be given to the measurement systems, standards and systems of accreditation and labelling that are necessary to provide consumers with the information and confidence they need to be comfortable with the higher prices paid for these products. The international marketplace will start to require such information. For example, Tesco, the largest food retailer in the UK, has recently invested £25 million in a Sustainable Consumption Institute to work on an internationally-recognised carbon footprint methodology that will assist in food labelling.

In order to develop such systems, considerable work needs to be done at a baseline level with Life Cycle Analyses (LCA) of different products, production systems and value chains to generate robust data and to identify areas for improvement. There would be advantages for Victoria in commencing such work as soon as possible.

Victoria would need to work with Food Standards Australia and New Zealand (FSANZ) on initiatives to improve food labelling here. The timing is right – the October 2008 meeting of the relevant Ministerial Council agreed to commission an independent, comprehensive review of food labelling law and policy in Australia and New Zealand. This is much more complex than a five star rating system for the energy efficiency of a fridge or the water efficiency of a washing machine. It is naïve to expect that we will ever get to a single sustainability metric for food. Nevertheless, we need to do much better than the status quo, where a mish-mash of claims and labels based on partial measurement of some components of the system compete for consumers' attention on supermarket shelves.

It would seem realistic and sensible to aim for a system of food accreditation and labelling that could encompass, in addition to the existing panel of nutritional and additives information, another panel with a five star rating system for each of emissions of CO₂ equivalents, water use, energy use, waste (some index of packaging efficiency, biodegradability or degree of recycling), biodiversity and animal welfare. Such a matrix, if standardised across Australia and New Zealand, and well-designed, could enable consumers to compare alternative products relatively quickly, thus meeting the [FSANZ](#) objective of 'well-informed consumers'. This would not preclude industries and firms developing brands that claim to meet even higher sustainability standards, or regional distinctiveness, or social aspects such as fair trade, as a further point of differentiation.

The first step from an environmental perspective is to gain a good understanding of carbon, water and energy use and waste along the whole food chain for a wide range of commodities, and to identify hot spots and major opportunities to achieve efficiencies. Such an analysis would underpin a comprehensive strategy based on a partnership between government, industry and the non-government sector (producers, consumers and environmental groups) to substantially improve the environmental performance of the whole food supply chain from paddock to plate.

Similarly from a health perspective it will be important to identify those food products of most concern (and those whose consumption needs to increase) and to work in parallel on two fronts: ensuring that consumers are fully aware of the types of foods that they should be eating more of and those they should be eating less of – and ensuring that it is easy to tell the difference between these two categories in the way the food is labelled, presented and promoted.

There was considerable workshop interest in the widespread roll-out of a stewardship accreditation scheme for Environmental Best Management Practices (EBMP) scheme, with suggestions that the

landcare ‘caring hands’ logo could be used on fresh and processed food produced on farms actively engaged in EBMP, which would quickly become a minimum standard for food production and routinely demanded by consumers. The latter point about minimum standards is crucial. A recent report for the Australian Farm Institute (O’Keefe 2008) analysing how farmers can extract more value from food value chains, concluded that accreditation schemes like Environmental Management Systems or the EBMP scheme proposed at the workshop are useful for quality assurance purposes. But they tend to become a default minimum standard fairly quickly, are no guarantee of premium prices or higher profit margins for producers, and should not be promoted as such.

That said, the O’Keefe (2008) analysis suggests that producers and groups of producers who can consistently deliver high quality, sustainably grown products with distinctive attributes that are difficult for others to copy, and who have the partnerships along the supply chain to promote these attributes to consumers, are able to attain and maintain price premiums.

Proposition 12. Government and industry need to invest substantially more in education and training for sustainable food and farming to tackle skills gaps, recruit new people, and prepare for a more demanding, interconnected world.

The number of school leavers will decline over coming decades, with an estimated [shortage](#) in the agriculture sector exceeding 100,000 people over the next six years. Declining entry scores for agriculture at tertiary levels indicates that it is not attracting bright young people in the necessary numbers. We need to turn this around. This in part is about re-positioning and re-branding agriculture and food as being a life-sustaining, environmentally sound, high-tech, value-added sector with huge growth potential and lots of rewarding career and lifestyle opportunities in Australia and internationally.

It is also about offering great education and training choices, and marketing them well.

New skills are going to be required across the whole sector in order to meet the challenges of producing more and healthier food in a carbon, water, energy and nutrient constrained world. That will mean both attracting and retaining people with the requisite capabilities, aptitude and commitment, and ensuring that appropriate training resources are available to meet their needs and the needs of the sector as a whole.

A crucial early step is to get a handle on the size and diversity of the sector and to research and map its requirements in terms of people and capabilities. This is not a trivial task given the fragmented nature of the sector and the number of SMEs (small and medium enterprises) involved, but it is crucial if investments in education and training are to be targeted to real industry needs.

Proposition 13. A transformation to sustainable food and farming will require major investment in innovation and knowledge, as well as new interdisciplinary research and development networks.

Victoria has a very strong science base underpinning its food and farming system and a great platform for innovation and adding value. However, there are major knowledge gaps impeding the evolution of a more sustainable and healthy food system. These are discussed comprehensively in Larsen *et al* (2008) and summarised in Table B1 in Appendix B.

An urgent priority is to build new research collaborations across the health, agriculture and environment sector around the challenge of designing and implementing better performing, more sustainable and healthier food systems in a rapidly changing world.

In reviewing the Cooperative Research Centres (CRC) Program as part of the [National Innovation Review](#), Professor Mary O’Kane made an intriguing recommendation:

“That a new program be established to assist industry and other end-user groups to undertake strategic analysis or innovation mapping projects and to establish collaborative ventures between end-users and researchers, including publicly funded research institutions. The priority is to support new collaborations

in areas with little history of collaborative activity or a low research and development base, particularly service industries and those sectors populated by SMEs.”

Such a new program would seem perfectly suited to the current situation of the Victorian food and farming system: many SMEs, both on-farm and along the through chain, little history of collaborative activity across the whole system, and yet a pressing need for innovation and knowledge at the level of the system as a whole. Such a new program could be used to build cross-sector networks and fund scoping activities that would take the higher level analyses in this report and the VEIL Report (Larsen et al 2008), and develop much more detailed and grounded proposals to fill critical evidence gaps and to support much needed innovation across the system.

A food system innovation initiative could be anticipated by getting key players together and starting to share information and research scoping work. A good early project might be to work on a funding submission for this yet-to-be-announced new program. Having an archetypal project may influence the design of the program, and could well be an attractive pilot. Such work need not be wasted if the program does not eventuate. Other sources of funding, here and overseas, public and private, could also be approached.

Without anticipating such scoping work, and noting the gaps already identified by Larsen et al (2008), research priorities are likely to include detailed life cycle analyses (LCAs) to explore and map the stocks and flows of carbon, water and energy across the food system, in particular the through chain. This is needed in order to understand the full environmental footprint and then to identify those areas where gains in efficiency can be made most easily and quickly. It also highlights the areas where the biggest consumption and pollution is taking place, and hence where the need for new technologies is most urgent.

Another obvious area for work is to get a handle on just how big a contribution low-input, ‘regenerative’ farming systems could make. How big (if at all) is the net reduction in energy and water consumption or carbon pollution per unit of product (or value) compared with conventional approaches, how big is the drop in production (if any), and how high would carbon, water, energy and premium food prices need to go for such systems to be demonstrably more productive in a value sense? Looked at in another way, are these systems ever going to move beyond a niche for a small proportion of consumers demanding particular types of products, into the dominant mainstream approach?

Importantly, this work should not assume that existing price relativities will remain the same. There is a high probability that energy and nutrient prices will rise sharply in real terms, making low input systems more competitive. These systems have been under-researched for years, and they need to be brought into the mainstream in terms of research funding and extension support. There is an obvious link here with the soils agenda, especially around soil biological processes and microbial nitrogen fixation.

In areas close to main population centres at least, we need to be looking much more creatively at waste. Firstly how to minimise it, and secondly how to turn waste streams into nutrient, energy and income streams (including food production) through smart recycling and re-use systems. One suggestion at the October workshop was the establishment of a CRC for Urban Food Production with an explicit emphasis on linking health and food systems within the urban footprint. This is a tighter proposal than the one canvassed above, and it could be progressed immediately through the existing CRC program.

Proposition 14. A world centre of excellence in sustainable food systems in Melbourne would provide a focus for innovation and leadership, attracting talent and sustaining the energy for reform.

Developing and implementing the sort of strategy here will require talented people with specialist expertise in areas like agro-ecology, supply chain management, smart water management, renewable energy, urban design, biotechnology, transport, human ecology and so on. But having brilliant specialists will not be sufficient – it could even be counter-productive – in the absence of equally good thinking about how such elements interact and fit together at the level of the food system as a whole. Such thinking is more likely to develop and be promulgated where people are working together

and interacting on a daily basis. A Centre of Excellence in Sustainable Food Systems (preferably located with and partnering an existing institution), appropriately resourced and mandated, would attract talent from around the world, build a critical mass of expertise, and start to develop a new praxis around food system design and management in a carbon-constrained economy.

It would be a good strategic move to try to secure several [Federation Fellowships](#) to bring together leading professors from different disciplines in this area, who would in turn attract top post-doctoral and doctoral researchers to create a critical mass of talented researchers. Such a centre would of course be highly complementary to a CRC or pre-CRC bid.

However, while scientific and academic excellence is essential, it is far from sufficient in an area of applied research like this. The centre would need to be closely connected with the food industry at all levels, and with consumers and the sustainability sector, if it is to make a difference at the intersection between health, environment and food. Exchange measures such as internships with industry and provision of in-service training opportunities for industry people would assist in maintaining a very porous interface between the centre of excellence and the multifaceted sector it would seek to serve.

The background paper lays out in detail why the status quo is not good enough in terms of our ability to grow and market food profitably and sustainably in the current environment. It will struggle even more in future. While we could achieve big improvements simply through the better and more widespread application of existing knowledge and technologies, it is equally clear that we need new knowledge and new technologies to give us new ways of doing things and provide us with new options.

Kirsten Larsen and colleagues (2008) in their VEIL report on the knowledge base for sustainable and secure food systems for Victoria, comprehensively mapped knowledge needs, making a useful distinction between knowledge and innovation. This project has reinforced the need for innovation in the areas identified by the VEIL Report set out in Table B2 of Appendix B.

A sustainable food system innovation fund

Measures already proposed above, including the research and education agendas and the centre of excellence, are likely to generate considerable innovation within the Victorian food system. One of the perennial challenges for innovators, especially sole traders or small-medium enterprises (SMEs), is how to finance the development and early stage commercialisation of their ideas. Even relatively small grants can make a difference in getting a good idea to a pilot stage, or from a prototype to a full business plan. A fund targeted at sustainability innovation within the food system could be catalytic.

Food system leaders and engaged communities

Food is one of the most basic elements of human existence. It is one of the few issues that connects absolutely everybody. Improving the performance and resilience of food systems is about far more than just tweaking policy settings or investing in innovation and infrastructure – it will also require behavioural and lifestyle changes among individual people, families and communities. There is no way this can be delivered on the scale necessary unless people want it to happen and are on board.

This means that any food system reform package must have sophisticated, genuine and well-founded community engagement, communication, education and training components, working synergistically to improve the food literacy of Victorians and the skills of people working in every part of the food system.

Proposition 15. A long-term investment in leaders and champions of sustainable food and farming is a high priority.

“One doesn’t discover new lands without consenting to lose sight of the shore for a very long time.”¹²

¹² André Gide, 1925 *Les Faux-Monnayeurs* (The Counterfeiters), cited in Pretty (1995).

If you want to drive lasting change, start with leadership.

Leaders are crucial in changing perceptions about what is possible, in being prepared to ‘lose sight of the shore’ and in setting directions. Crucially, leaders inspire followers. It will be very difficult to attract the sorts of people and skills needed in the Victorian food and farming system in a tightening labour market if the sector is not, and is not seen to be, well led.

This means building the skills, networks, confidence and profile of existing and emerging leaders within the sector. A strategic partnership with an existing leadership program (for example the [Australian Rural Leadership Program](#), the [Williamson Community Leadership Program](#), or the [Vincent Fairfax Fellowship Ethics in Leadership Program](#)) could deliver several cohorts of industry leaders (say 100 people per year) sprinkled across the sector, with a powerful network grounded in shared experience and mutual understanding. This would be one of the fastest and most effective ways to build cohesion across the sector, in addition to the obvious benefit of developing people who are indeed able to discover new lands.

Such distributed industry and community-based leadership will be easier to attract and motivate however, if there is a clear direction and commitment right from the top of the state, from the Premier, the Cabinet and the heads of government agencies, about the fundamental importance to Victoria of improving the performance, sustainability and resilience of the food and farming system.

Clearly a mix of approaches will be required, including formal primary¹³, secondary¹⁴ and tertiary¹⁵ education, apprenticeships, TAFE and adult education. A comprehensive, integrated education and training package is required, that is not just about skilling up people working in the food system, but improving the understanding of the whole community about sustainable and healthy food production and consumption.

Proposition 16. Sustainable and healthy food systems would promote and enable a diet rich in fresh and minimally-processed foods – predominantly fruits and vegetables – as the mainstream choice.

It is now well understood that the contemporary Western diet comes with a heavy ecological footprint as well as substantial and increasing social costs. In particular, high levels of red meat and dairy consumption (Reijnders & Soret 2003), as well as over-consumption, appear to be contributing substantially to national and global emissions of methane and nitrous oxide – potent greenhouse gases.

In an interdisciplinary paper published in the medical journal *The Lancet*, ANU epidemiologist Tony McMichael and colleagues (2007) argue for a worldwide ‘contraction and convergence’ target to reduce average meat consumption to 90g per person per day, with no more than 50g from red (ruminant) meat. They suggest this might be sufficient to *stabilise* greenhouse emissions from livestock while improving the health of both the affluent and the world’s poor. Australians’ demand for meat is high, even by developed country standards, with the average person consuming more than their own body weight in meat¹⁶ each year (McMichael *et al.* 2007; ABS 1997/98). Such a target implies a substantial dietary shift within Australia, but allows for continued (even rising) exports of beef, lamb and dairy products to developing economies.

There are strong parallels between what might be called a sustainable diet and a healthy one, with powerful implications for public health and other social goals (Larsen *et al.* 2007).

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- ¹³ There are already some great examples of work in schools, for example the work on healthy school meals inspired by [Jamie Oliver](#) in the UK. Locally, the [Stephanie Alexander Kitchen Garden Foundation](#), with funding from the Australian Government, is offering grants of up to \$50,000 to assist schools to establish kitchen gardens and associated kitchens to integrate the growing, cooking and eating of fresh whole foods into school curricula.
- ¹⁴ A suggestion at the 3 October workshop in Melbourne was to ‘sexify’ home economics in schools and to accelerate roll out of food gardens in primary AND high schools.
- ¹⁵ The emphasis here should not just be on traditional agricultural science, but on the great diversity of ‘new economy’ careers in the food system, from advanced genomics and [functional foods](#), to [new biomaterials](#) and [urban food production](#).
- ¹⁶ Apparent average meat consumption, excluding seafood and processed meats, is approximately 300g per person per year (ABS 1997/98). This compares to around 200-250 grammes for the average person in the developed world, about 25-50g for someone in a developing country and the world average of about 100g (McMichael *et al.* 2007).

Consumers, like producers, often find themselves locked into unsustainable patterns of behaviour that mitigate against change. The reasons for people's food choices are complex. Garnett *et al.* (2008) and the United Kingdom's Sustainable Consumption Roundtable (SCR 2006) suggest a suite of alternative strategies. Some social marketing campaigns (such as the West Australian "2 for 5" campaign) have been shown to be effective in raising the consumption of fresh fruit and vegetables (Pollard *et al.* 2008). And there may well be 'lost lessons' from efforts to improve public nutrition in wartime (Wansink 2002). Such campaigns must be properly researched and resourced, in the knowledge that they have to compete with the overwhelming cacophony of advertising noise that promotes excessive and unsustainable consumption.¹⁷

Nevertheless, the sheer success of the advertising industry is testimony to the potential of marketing to serve the public good:

Too often we hear 'we cannot do this because consumers do not ask for it'. But the consumer did not ask for the iPod. Inspired marketers recognise the signs, or insights, translate these into anticipated future behaviour and then launch products, branded, to meet these anticipated needs. Or, technological advances are made and then sold in a way that creates a 'want'.

(SCR 2006, p23)

Proposition 17. Innovative community and commercial enterprises that promote resilient and sustainable food systems, and that re-connect consumers and producers, should be actively encouraged.

In 1900, almost 60 percent of people lived outside Melbourne. By 2006, just 27% (1.39 million people) lived in regional Victoria, and a fair proportion of these live in the larger regional centres. There is a disconnect between rural and urban lifestyles that feeds into mutual misunderstanding. For example, with widespread concern about water use, urban households tend to focus on water-efficient showerheads and appliances, when by far the biggest component of household water use is embodied in the food we consume. Urban people concerned about the Coorong or the lower lakes of the Murray rarely make the connection between irrigation water use and their own food consumption or export income. By the same token, there is a tendency for rural people to assume that urban people are ignorant of the real issues in the bush, without themselves having much understanding of the realities of the daily grind and the struggle to make ends meet for many people who live in the suburbs, without the compensations of a rural lifestyle.

Food can be a great platform on which to build a new alliance between rural and urban Australia, and between farmers and consumers. We all depend on it, and food is connected to nearly everything else, including carbon, water, energy, transport, planning, infrastructure, education and so on. As we progress efforts to grow more food in urban and peri-urban areas, and as we look to expand farmers' markets, community supported agriculture and other ways of shortening food chains, more people will be confronted with the sorts of dilemmas and choices that face farmers every day. Turning around the long-run decline in the proportion of the population engaged in growing food should be a good thing for improving community understanding about agriculture.

Box 4. Project Idea: The Foodies Awards

Melbourne is already recognised as a gourmet food and wine capital. Like the UK, we have a stellar stable of celebrity chefs and lifestyle TV programs. There is lots of scope to engage high profile people in promoting and showcasing the growing, cooking and consumption of fresh, whole, local foods. Together with the Centre of Excellence proposal, Melbourne's 'food capital' status could be underlined with an annual or biennial healthy foods festival culminating in "The Foodies" – a high profile awards night celebrating excellence across the whole food and farming system and along the value chain from paddock to plate.

¹⁷ Michael Pollan argues that much of what passes for food on American supermarket shelves is not real food, but 'edible food-like substances', of which there are 17,000 new products every year, promoted by a US\$32 billion per annum food marketing effort (Pollan 2008)

Engagement in food system sustainability cannot just be about government leadership and framework setting, complemented by grassroots community voluntarism. Leadership and proactive participation is needed by the full range of players along the food chain, including retailers, processors, wholesalers, distributors, insurers, financiers, advertisers, media, fertiliser and pesticide companies and so on.

Developing a new national conversation about how we can continue to feed ourselves and others in a changing world should be an overarching goal of the community engagement and education agendas outlined earlier, and it should be assisted by the leadership programs and centre of excellence proposals outlined above. But it won't just happen, it will need a strategic approach to foment a constructive dialogue based on 'and' thinking rather than the conflict and tension angles which the mass media seeks out and amplifies. In the meantime, local initiatives like community-supported agriculture, should be actively encouraged as a way of building social capital.

Proposition 18. The new approach to food and farming needs to be owned by the community, implying a more innovative and extensive community engagement effort on the part of government, industry and NGOs.

An education and training package, and a community awareness and engagement campaign, should be complementary and mutually reinforcing. Well-designed programs in schools are a great way of getting to parents for example, and community perceptions are crucial in attracting people into (or deterring them from) education and training programs.

Only a small proportion of people will get fired up about the sustainability of food systems in the abstract. But everyone can relate to their own patch, their own family and their own community. Many participants at the Melbourne workshop mentioned the importance of grassroots activities, of the potential for relatively small local grants to make a difference, of the potential of, for example, local newspapers, arts festivals and charities to drive change – and that this should be leavened by a sense of fun, not doom and gloom. Again, it is better to work through existing local groups and organisations where possible, rather than try to create new ones. Community hubs, extended exponentially on-line by web 2.0 tools, could assist people with information and resources on individual and commercial redesign of food systems.

Planning and design for sustainable, healthy food systems

Closing loops in terms of water, energy and nutrient cycling, making much better and more frugal use of depletable resources, anticipating climate change, and placing more emphasis on renewable sources of energy in particular, will require a revolution in planning and design, both in the built environment and in the wide open spaces of rural and coastal Australia. The food system is a great arena for such a revolution.

Proposition 19. The principles of Food Sensitive Urban Design need to be embedded into planning policy and regulation.

For the first time in human history, more than half the world's population now live in cities.

The Victorian government estimates that it will need 600,000 new houses to meet projected demand from current population trajectories. Presumably this means more suburban development. This should not mean further expansion of the ugly, resource consuming, energy guzzling, poorly serviced "McMansion" estates dominated by hard surfaces and lacking decent street trees, that have been allowed to blot and consume the landscapes around Melbourne over recent decades.

Water Sensitive Urban Design ([WSUD](#)) is well established conceptually, if not yet widely implemented. Kirsten Larsen's concept of Food Sensitive Urban Design is novel and innovative. As a Melbourne idea, it deserves to be fleshed out, articulated and demonstrated in a Melbourne context. As the Planning and Environment Act is being reviewed for the first time in twenty years, this seems timely.

A pilot urban development project could look at urban food production, water, energy, waste, residential design and public transport in an integrated way, with ambitious targets for urban food

production and to eliminate food deserts. Community gardens, roof gardens, market gardens and fresh food markets could be co-located with public transport, with areas of high population density and with for example aged care facilities – and designed to utilise and recycle organic wastes, storm water, rain water, waste water and renewable energy. Simple measures such as having open-pollinating fruit trees in public open spaces, or apartment buildings that facilitate recycling, can make a difference, along with changes to water restrictions to exempt food gardens. A workshop suggestion was to create incentives for developers to incorporate food gardens and recycling systems, and to create disincentives or require offsets whenever good agricultural lands/soils are converted to urban and covered with concrete or bitumen.

Such a project could start with an international design competition to attract the best and brightest urban planners, environmental consultants and sustainability architects from around the world, to work on a challenge that will be confronting all big cities over coming decades. A complementary project could look at retrofitting an existing older suburb to increase urban food production and to make access to fresh whole foods easier.

Proposition 20. The potential for significant and sustainable food production in urban areas should be thoroughly explored and tapped.

The principles outlined above extend to the production of food within city limits. There are already several successful examples of urban agriculture in Melbourne and other Victorian cities, but the potential is far from fully tapped. From London to Havana to New York to Mumbai, urban communities in both the developing and developed world are taking urban food production from a backyard industry to something much greater. In January 2009, the Mayor of London announced the *Capital Growth* initiative to create 2,012 new food-growing spaces across the metropolis by 2012.¹⁸ Closer to home, Brisbane City Council has recently embarked on a climate change action plan that includes urban agriculture, with an emphasis on technological innovation, improving liveability, food security, job creation and reducing oil dependence in a rapidly changing world.

Researchers at Columbia University in New York have devised a plan for the development of interior farms in skyscrapers using existing greenhouse technology as their starting point.¹⁹ The plans incorporate eco-design principles, including solar electricity, together with incinerators fuelled by the farm's waste and closed-loop water use. Year-round crop production in a climate-controlled environment without the need for pesticides and the elimination of waste are other benefits.

Community action and the market may drive the growth of urban food production to some degree, but there is clearly a role for government – for example in facilitating and coordinating the research and development, by communities and businesses, of urban food systems designed for a carbon, water and land-constrained world.

Proposition 21. Planning strategy should secure peri-urban zones for sustainable agriculture and resilient food systems.

Moving out to the urban fringe and peri-urban regions within commuting distance of Melbourne and regional centres, it is equally if not even more important to increase food production. This means thinking about agriculture and residential or rural residential, not agriculture or residential. Places like the Keilor Valley, Bacchus Marsh, Yarra Valley and Mornington Peninsula are strategic assets that are critical to the resilience of the Victorian food system, and their food production capability should be secured and improved as a high-priority planning objective. Again, waste streams of water and nutrients can be utilised to produce food in such areas.²⁰

¹⁸ <http://www.capitalgrowth.org/home/>

¹⁹ Cooke, Jeremy, Vertical farming in the Big Apple, June 19 2007, <http://news.bbc.co.uk/2/hi/americas/6752795.stm> During World War II, America produced 40% of its food needs within cities. Australian cities are similarly spread out, with low population densities and considerable room for food production.

²⁰ The background paper (Box 6.3) cites a classic example: the vegetable producers of the Keilor Valley currently have to purchase tap water at retail prices to irrigate their crops, while less than 2km away the sewer en route to Werribee has a flow three times larger than their total water requirement. With appropriate treatment, this resource could provide water and nutrients for food production, taking pressure off potable water resources and the Maribymong River.

The early history of Australian cities pivoted on access to food. With the rise of cheap energy resources, the distance between food production and consumption has become less and less important. At the same time, the price of land on the urban fringe has risen, with the result that much land has become too costly for farmers to buy and too valuable not to subdivide.

To begin with, state and local governments need to recognise the loss of finite areas of productive land around cities as a negative externality requiring strategic intervention. This is not simply because of a loss of amenity values (though this is significant) but because in a world where energy prices rise sharply, the irretrievable loss of some of the country's best land to housing constitutes a potential major risk to urban food security.

Urban growth strategies seldom account for food production as a strategic resource worthy of strategic protection. Even today, around a quarter of our food is still grown on the periphery of cities. To date, state planning policies have only had limited success in protecting farmland from urbanisation, with only weak regulatory enforcement in the face of development pressures. The *Melbourne 2030* urban growth strategy, and the recent *Melbourne @ 5 million* update, while making an effort to balance competing interests as the city expands, do not reflect a more resource-constrained world in a warming and drying climate. It is too early to tell how effective the strategy will be in guarding against the loss of a key strategic resource. An independent appraisal of the threat to farming on the edge of cities should be a feature of the resilience and vulnerability analysis put forward above.

We need to develop new models of peri-urban development that look less like suburbs on a larger scale (every house with its own driveway, power lines, water supply and a few hectares of under-utilised land), and more like much of Europe, with clusters of dwellings and small villages surrounded by lands that remain primarily agricultural.

Rapid environmental change, resource depletion and an end to cheap energy mean that systemic changes in land-use are inevitable. The focus should now be on working with regions and industries to build resilience, develop new opportunities and manage transitions.

Proposition 22. Major investment, research and policy attention in energy farming is needed to reduce dependence on fossil fuels, build resilience and reduce net greenhouse emissions.

If Victoria is to continue producing large quantities of high quality grass-fed, rain-fed beef and sheep meats in a carbon- and energy-constrained world, then the integration of woody perennials into grazing operations for carbon sequestration and biomass energy production will be increasingly important. There will continue to be a market for beef and sheep meat. Health and pollution concerns are likely to see premium prices paid for meat from grass-fed, rain-fed, open range, sustainably managed grazing systems as opposed to feedlot production systems. But the methane emissions associated with grass-fed ruminants are significant. In the absence of a technological breakthrough to reduce methane emissions from enteric fermentation, it will be desirable to offset those emissions, and from a marketing perspective, 'carbon neutral' or 'carbon plus' beef and sheep meat should have an advantage.

According to Dr Richard Eckard,²¹ for the average Victorian sheep property to offset its on-farm greenhouse gas emissions (i.e. carbon-neutral at the farm gate, not counting transport or processing emissions) with fast growing eucalypt plantations, would require about 3-7% of the farm to be planted to trees. For beef, assuming slightly higher rainfall, the figure is 5-9% of the farm area, and for high rainfall dairy the figure is 25% – i.e. one quarter of the average dairy farm would need to be planted to fast growing eucalypts to offset just the on-farm emissions.

Of course well-designed revegetation carefully integrated into grazing systems offers ancillary benefits such as shade and shelter, wildlife habitat, erosion control, water quality improvement and landscape amenity. For beef and sheep properties, it is clearly feasible to incorporate sufficient revegetation to be carbon neutral at the farm gate in ways that complement agricultural production. The Potter

²¹ Richard Eckard is a research leader employed jointly by the DPI and the University of Melbourne who heads the [Greenhouse in Agriculture](#) research team.

Farmland Plan experience (Campbell 1991) suggests that with well-planned revegetation there need be no reduction in stock numbers at all after removing 10% or even 15% of land from grazing.

However on high rainfall dairy farms, it may be more feasible to achieve carbon offsets at a district or regional scale than on every individual farm, not just through plantations but also methane digesters producing bioenergy and selling it back into the power grid.

The background paper discusses the infrastructure required to scale up biomass and biogas energy production (second-generation biofuels) in rural landscapes, and the equally important planning dimension. We need to work out ways of planning carbon sequestration and biomass energy plantings in rural landscapes that don't just maximise carbon sequestration, but consider other issues such as water yields, wildlife habitat quality and connectivity, landscape aesthetics and the social cohesion and viability of rural communities. With appropriate price settings, left to its own devices the market will deliver carbon. But it won't deliver these other values in an integrated way in the absence of a strong planning framework and compliance regime. This clearly has implications both for local government planning and development approval processes, and for the regional catchment strategies of Catchment Management Authorities.

A pilot project to develop and trial a new planning process in a region that is highly prospective for large scale carbon sequestration and biomass energy plantings would be one way to tackle this challenge. Western Australia already has a pilot integrated wood processing plant at Narrogin owned by [Verve Energy](#) producing biomass energy, activated charcoal and eucalyptus oil from alley crops of oil mallees planted by wheatbelt farmers. It would be instructive to investigate the establishment of a pilot biomass energy plant in Victoria capable of utilising forestry by-products, woody biomass crops and agricultural wastes. This is a key piece of the jigsaw if we are to reduce energy use, increase use of renewable energy and offset greenhouse gas emissions in the food and farming system.

An emerging technology that also has the potential to be integrated with food production on farmlands, in particular in conjunction with more intensive livestock industries such as dairy, pigs, feedlots and aquaculture, is the production of biodiesel from algae. Algae grown in wastewater ponds draws down atmospheric CO₂ (or that emitted from a power plant) and can be converted to biodiesel. Residues can be refined into ethanol. Biomass production can be one to two orders of magnitude greater than those for a paddock of crops. In the United States, biodiesel from algae has been produced at prices ranging from about A\$0.25 per litre up to about \$2 per litre. Reliable production of biodiesel for less than \$2 per litre from algae grown in waste water lagoons would be a handy hedge against rising oil prices. Victorian trials to test and refine the methodology, hopefully improving productivity and reducing the net cost of the resultant renewable transport fuel, would be a good first step.

For a variety of reasons, the market is not moving quickly enough to build economies of-scale in sustainable forms of bioenergy. There is a need for agreed sustainability standards for the nascent industry to bolster stakeholder confidence at a time when the global bioenergy and biofuels sector is under scrutiny.

Proposition 23. The transition to sustainable food and farming rests on a transformation in distribution and major investment in sustainable transport infrastructure.

Positioning the Victorian food system at the premium end of the market will entail significant attention to infrastructure such as renewable energy, water and transport to improve the systemic efficiency and reduce the environmental footprint of the system as a whole.

An important component of a sustainable food system strategy is the development of an integrated food transport strategy that looks at how road, rail, sea and air can best fit together to maximise efficiency while minimising greenhouse gas emissions and energy consumption. Innovative packaging also has a role to play here, both to reduce waste, and to keep food fresh for longer, allowing greater use of more energy efficient modes of transport.

A recent study (Gaballa & Cranley 2008) found that it would be possible to almost halve the transport emissions from the Victorian food system by adding a comprehensive network of rail freight depots to the existing rail network, and then using rail wherever possible. Noting that, especially in spread-out cities like Melbourne, the biggest component of ‘food miles’ in many instances is the travel done by consumers, it is important to think about how food purchasing could also be better aligned with the rail network. It would be instructive to design and set up a pilot project to locate one or more fresh food markets and food retailers with the rail network so that both producers and consumers could use trains or trams to get to the market, coupled with a research project to measure savings achieved and evaluate the overall benefit-cost for producers, consumers and the environment.

As discussed in Box 3.1 of the background paper describing the greening of the Murray Goulburn’s milk tanker fleet, there are major capacity constraints in extending the use of [Compressed Natural Gas](#) (CNG) in Victoria. Removing these constraints by increasing the natural gas supply and extending the distribution network would enable not just Murray Goulburn, but large components of the truck, bus, tractor and vehicle fleet to be converted either fully to CNG, or as dual fuel with diesel.

While biofuels are clearly not a magic bullet, it is clear that within our lifetimes, or certainly those of our kids, in a big sparsely populated country like Australia we are going to need alternative transport fuels on a significant scale. Whether CNG, lignocellulosic biofuels or fuel cells, there are major technological and infrastructure issues on which we need to get cracking.

Proposition 24. Looming resource constraints require government and industry to work together and more proactively to close the loop between food and waste.

Melbourne imports and concentrates nutrients, water and energy from the rest of the state – much of which turns up in waste streams. There is considerable potential scope to undertake a forensic analysis of waste streams and stocks, then comprehensively mapping their embedded nutrients, water and energy. These could then be targeted as sources for recycling nutrients and water, and for renewable energy. This is about distributed, mostly small scale infrastructure – for example methane capture at landfills, green waste recycling, rainwater capture and stormwater treatment and storage. As mentioned earlier, there is a significant planning dimension here to allow for food production possibilities close to where energy, nutrients and water are funnelled, and to where people are concentrated. But the planning won’t help in the absence of technically sound infrastructure options.

Conclusion

The Australian Conservation Foundation's *Paddock to Plate* project, comprising the [background paper](#) and this propositions paper, has analysed future prospects and imperatives for the Victorian food and farming system for the period from now to 2020. It has mapped the existing food and farming system and analysed the drivers for change, noting developments in other countries. It has then identified measures that would improve the performance and resilience of the Victorian food and farming system in a carbon, water, energy and nutrient-constrained world.

The take home messages from this work are clear:

- Healthy farms, healthy landscapes, healthy food and healthy people are interdependent.
- We are living through a period of unprecedented environmental change that is likely to intensify – **this is not a blip**.
- Business as usual is not a viable trajectory. The Victorian food system needs to improve its performance irrespective of climate change. But climate change raises the stakes & increases the risks associated with continuing the way we are.
- To decide not to succeed, is to decide to fail.²² The signs pointing to the need for change are clear. There is a very high degree of scientific consensus about the main drivers for change and plenty of empirical evidence that supports that consensus. There are very significant economic, environmental and social risks associated with doing nothing or delaying action to improve the performance and resilience of the food and farming system.
- New partnerships are needed across the health, food and farming systems, and along the food value chain. We need to do a much better job at the interface between health, agriculture and environment in developing policy, in gathering data and in looking at the whole system.
- Victoria can lead a new approach to producing and marketing sustainable and healthy food in a drying climate. The know-how and technologies developed along the way will be in high demand around the world with considerable export income potential.
- This is about innovation, regional development & leadership – all high priorities for the Victorian Government.

Leadership is needed at all levels across the food and farming system and along the food value chain. Not just leadership in a representative sense, but leadership that imagines new possibilities, that challenges perceptions about what is possible, and that attracts people and gives them the confidence to try new pathways. This needs to start at the highest political levels, and it needs to be reflected within industry and the community. We need broad-based, multi-sectoral leadership to drive the necessary improvements in our food system.

This propositions paper has identified some of those improvements. It is not prescriptive in the way it discusses the opportunities, deliberately avoiding specific suggestions about who should do what and how. That is rightly the responsibility of the relevant authorities and experts.

A clear conclusion from this project is that Victoria needs a comprehensive healthy sustainable food systems strategy. This project has identified many of the elements that such a strategy could contain, without purporting to write the strategy. It presents the issues and potential responses with constructive intent, in the hope that people and organisations within the Victorian food and farming system will find a spark here that could make a difference.

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Greg Bourne (CEO of the World Wide Fund for Nature (WWF) in Australia) *pers. comm.* September 2008.

References

- AFT (2008) *A new tool to protect farm income while keeping the land healthy*. American Farmland Trust - Agricultural Conservation Innovation Center. <http://www.farmland.org/resources/ACIC.asp>
- Asami, Danny K., et al (2003) "Comparisons of the Total Phenolic and Ascorbic Acid Content of Free-Dried and Air-Dried Marionberry, Strawberry and Corn using Conventional, Organic, and Sustainable Agricultural Practices." *Journal of Agricultural and Food Chemistry* 51:1237-41
- Barling, D., Lang, T. & Caraher, M. (2002) "Joined-up Food Policy? The Trials of Governance, Public Policy and the Food System." *Social Policy & Administration*, 36:6, 556-574.
- Benbrook, Charles, X.Zhao, J.Yañez, N.Davies, and P.Andrews (2008) *New Evidence Confirms the Nutritional Superiority of Plant-Based Organic Foods*, State of Science Review.
- Benbrook, Charles (2005) "Elevating Anti-oxidant levels in food through organic farming and food processing" *Organic Centre State of Science Review*, Organic Centre, Foster Rhode Island.
- Brandt, Kirsten and Jens Peter Mølgaard (2001) "Organic Agriculture: does it enhance or reduce the nutritional value of plant foods?" *Journal of the Science of Food and Agriculture* 81.9:924-31
- Campbell, Andrew (2008) *Managing Australia's Soils: A Policy Discussion Paper*. Prepared for the National Committee on Soil & Terrain (NCST) through the Natural Resource Management Ministerial Council (NRMMC). Commonwealth of Australia, Canberra.
- Campbell, Andrew (2007) *Options for Catchment Management Authorities in the Carbon Market*. Report for Victorian Catchment Management Authorities. Triple Helix Consulting, Queanbeyan. http://www.triplehelix.com.au/projects_archived.html
- Campbell, Andrew (1991) *Planning for Sustainable Farming*. Lothian, Port Melbourne.
- Carbonaro, Marina and Maria Mattera (2001) "Polyphenoloxidase Activity and Polyphenol Levels in Organically and Conventionally Grown Peaches." *Food Chemistry* 72:419-24
- Climate Institute (2008) *Australia's 2020 Carbon Pollution Reduction Potential*, A Climate Institute Policy Brief, The Climate Institute. <http://www.climateinstitute.org.au>
- Cline, W. (2007) *Global Warming and Agriculture: Impact Estimates by Country*. Center for Global Development and Peterson Institute for International Economics, Washington DC.
- Commissioner for Environmental Sustainability (2008) *Victoria 2008 State of the Environment*, Victorian Government, Melbourne.
- Cordis RTD-News (2007) "EU Research Finds Organic Food Healthier and Better", *Food Quality and Safety - Cordis EU* <http://cordis.europa.eu/>
- Cribb, Julian (2007), *The Coming Famine: Constraints to Global Food Production in an Overpopulated, Affluent and Resource-Scarce World – The Scientific Challenge of the Era*, Julian Cribb & Associates Discussion Paper. http://www.apo.org.au/linkboard/results.shtml?filename_num=1902522BE4A2567CB00058A36
- Davis, Donald et al (2004) "Changes in USDA Food Composition Data for 43 Garden Crops, 1950 to 1999." *Journal of the American College of Nutrition* 23.6:669-82
- Ellis, K., G.Innocent, D.Grove-White, P.Cripps, W.G.McLean, C.V.Howard and M.Mihm (2006) "Comparing the Fatty Acid Composition of Organic and Conventional Milk" *Journal of Dairy Science* 89:1938-50
- Gaballa, Sophie & Liam Cranley (2008) *Food Miles in Australia: A comparison of emissions from road and rail transport*. CERES Community Environment Park, Brunswick.
- Garnett, Tara (2008) *Cooking up a storm: Food, greenhouse gas emissions and our changing climate*. Food Climate Research Network. Centre for Environmental Strategy, University of Surrey. UK.

- Gomeiro, T., Paoletti, M.G. & Pimental, D. (2008) Energy and Environmental Issues in Organic and Conventional Agriculture. *Critical Reviews in Plant Sciences*. 27:4, 239-254.
- Gunasekera, D., Tulloh, C., Ford, M. & Heyhoe, E. (2008) *Climate change: Opportunities and challenges in Australian agriculture*. Proceedings of the Faculty of Agriculture, Food & Natural Resources Annual Symposium 2008, University of Sydney.
- Lal, Rattan (2004). "Soil carbon sequestration impacts on global climate change and food security." *Science* 304, 1623-1627.
- Larsen, Kirsten, Chris Ryan & Asha Bee Abraham (2008) *Sustainable and Secure Food Systems for Victoria: What do we know? What do we need to know?* VEIL Research Report No.1, Victorian Eco-Innovation Laboratory, Australian Centre for Science, Innovation & Society, University of Melbourne. www.ecoinnovationlab.com/pages/library.php
- Lenzen, Manfred & S. A. Murray (2001) 'A modified ecological footprint method and its application to Australia', *Ecological Economics* 37: 229-255.
- Martin, Paul, Susan Shearing and Kip Warren (2007) *Concepts for private sector funded conservation using tax-effective instruments* Land & Water Australia, Canberra <http://products.lwa.gov.au/products/pr071389>
- McMichael, A., Powles, J., Butler, C. & Uauy, R. (2007) "Food, livestock production, energy, climate change, and health." *The Lancet*, 370(9594), 1253-1263.
- McNeely, J. & Scherr, S. (2003) *Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity*, Island Press, Washington DC.
- McWaters, Viv. (2008) Sustainable Future for Victorian Food & Farming - Workshop Report, Beyond the Edge Pty Ltd. (Unpublished manuscript).
- Mitchell, Alyson E., Yun-Jeong Hong, Eunmi Koh, Diane M. Barrett, D. E. Bryant, R. Ford Denison and Stephen Kaffka (2007) "Ten-year Comparison of the Influences of Organic and Conventional Crop Management Practices on the Content of Flavonoids in Tomatoes." *Journal of Agricultural and Food Chemistry* <http://pubs.acs.org/cgi-bin/abstract.cgi/jafcau/2007/55/i15/abs/jf070344+.html>
- Niggli, Urs, Heinz Schmid and Andreas Fliessbach (2008) *Organic Farming and Climate Change*. Technical paper MDS-08-152.E, International Trade Centre UNCTAD/WTO and Research Institute of Organic Agriculture (FiBL), Geneva. http://www.intracen.org/Organics/documents/Organic_Farming_and_Climate_Change.pdf
- North American Food Policy Council (2008) *What is a food policy council?* www.foodsecurity.org/FPC/
- O'Kane, Mary (2008) *Collaborating to a Purpose: review of the Cooperative Research Centres Program*. Commonwealth of Australia, Canberra. <http://www.innovation.gov.au/innovationreview/Pages/home.aspx>
- O'Keefe, Michael (2008) *Value in Value Chains: Collaborative Business Models and Farm Accreditation Systems Examined*. Report for the Australian Farm Institute and the former National Food Industry Strategy Ltd. August 2008. Australian Farm Institute, Sydney.
- Pollard, C.M., Miller, M.R., Daly, A.M., Crouchley, K.E., O'Conoghue, K.J., Lang, A.J. & Binns, C.W. (2008) "Increasing fruit and vegetable consumption: success of the Western Australian Go for 2&5[®] campaign." *Public Health Nutrition*, 11, 314-320.
- Pollan, Michael (2008) *In Defense of Food: an eater's manifesto*. The Penguin Press, New York.
- Preston, B.L. & Jones, R.N. (2005) *Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions*. A consultancy report produced for the Australian Conservation Foundation Business Leaders' Roundtable. CSIRO, Canberra.
- Pretty, Jules & Waibel, H. (2005) "Paying the Price: The Full Cost of Pesticides" Ch.3 in *The Pesticide Detox*, Jules Pretty (ed.) Earthscan, London.

- Pretty, Jules, D.Noble, D.Bossio, J.Dixon, R.E.Hine, F.W.T.Penning de Vries, and J.I.L.Morison (2006) "Resource-Conserving Agriculture Increases Yields in Developing Countries" *Environmental Science & Technology* 40:4
- Pretty, Jules (1995) *Regenerating Agriculture: policies and practices for sustainability and self-reliance* Earthscan, London.
- Ryan, M.H., et al (2004) "Grain Mineral Concentrations and Yield of Wheat grown under Organic and Conventional Management." *Journal of the Science of Food and Agriculture* 84:207-16
- Saddler, Hugh & Helen King (2008) *Agriculture and Emissions Trading: The Impossible Dream? Discussion Paper*, No. 102. The Australia Institute, Canberra.
- State Services Authority (Victoria) (2007) *Joined up government – a review of national and international experiences*, Occasional Paper No.1, Victorian Government, Melbourne.
- Steinfeld, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M. & de Haan, C. (2006) *Livestock's Long Shadow: Environmental Issues and Options*. The Livestock, Environment and Development Initiative and the Food & Agriculture Organisation, Rome.
- Sustainable Consumption Roundtable (2006) *I will if you will: Towards sustainable consumption*. Report prepared by the SCR for the Sustainable Development Commission, UK.
- Sustainable Development Commission (2008) *Green, Healthy and Fair: a review of government's role in supporting sustainable supermarket food*. Sustainable Development Commission, London.
- Vivid Picture Project (2005), *Envisioning a Sustainable Food System in California*. Ecotrust.
<http://www.vividpicture.net/>
- Waltner-Toews, D. & Lang, T. (2000) "A new conceptual base for food and agricultural policy: the emerging model of links between agriculture, food, health, environment and society." *Global Change & Human Health*, 1:2, 116-130.

APPENDIX A: Reference Group

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APPENDIX B: A Knowledge and Innovation Agenda for the Victorian Food System

(as identified in the VEIL Report by Larsen et al 2008)

Table B1. Knowledge gaps and information needs identified by Larsen et al (2008)

Focus	Knowledge gap or information need
Climate change	The IPCC has identified a number of research gaps regarding climate change impacts in Australia. These include: <ul style="list-style-type: none"> ➤ Impacts on agricultural pests, disease and weeds in Australia ➤ Interrelations of increased temperatures, carbon dioxide AND changing rainfall patterns on disease, weed and pest ranges (have mainly been studied separately – little is known about combined impacts)
	The IPCC has also noted that global modelling of projected food security under climate change has tended to rely on assumptions about economics, trade and technology that are poorly tested against observed data. Further work is needed in this area
	Expanded analysis of climate change adaptation in the food system beyond agricultural production
Responses to Climate Change	Update analysis of the energy and emissions of the full food chain (most recent Australian analysis is from 1982)
	Conduct full lifecycle analysis (particularly on greenhouse emissions) on a range of essential foods in Victoria, to better understand how they will be affected by policy changes, and how emissions can most effectively be reduced. Victorian information on direct agricultural emissions (from conventional systems) is good. However, beyond the direct on-farm emissions very little information exists.
	Measure and investigate the potential greenhouse benefits of non-conventional production and distribution systems (including techniques that reduce reliance on inputs).
Resource Constraints	Analysis of social and economic vulnerabilities to food price changes (linked to resource constraints).
	Explore the relationship between water pricing and nutritional value per litre - how can nutritional value from water and other scarce resources be maximised? Potential for analysis of L/\$ to be extended to L/kj or other nutritional measure.
	Improve understanding of the affects of water scarcity on food production, prices and security. Investigate the changing volumes of Victorian production, how much of this is exported and how this is impacting on changes in local prices.
	Develop consumer information around embodied water in food choices through detailed lifecycle analysis of key food products (correct market failure and reduce reliance on cruder measures).
	Investigate the water efficiency potential of active soil management in Victorian soils, in conjunction with soil carbon sequestration and other productivity benefits.
	Use of alternative water sources for food production – recycled water, greywater (research also required to ensure human and environmental safety). Increase production where these resources are most accessible.
	Assessment of the Victorian food system's vulnerability to oil and input scarcity – how reliant is it? Where is substitution viable and where is it unlikely? Could significant production decreases or supply disruptions occur? Need to model possible price / adaptation scenarios
	Improved land and soil management can have benefits for water use (greater retention in soils) and greenhouse emissions (carbon sequestration). Research specific to the Victorian context would help to fully capture emerging opportunities.
	There is a lack of statewide data on the actual state of soil health – little is known about the extent and spatial distribution of soil problems.
	Long-term monitoring of soil health, including impacts of physical, chemical and biological management in specific types of Victorian condition, network of sites to enable controlled comparison of management practices.
Biodiversity	Improve information about soil biodiversity – what's there, what's disappearing, what impact does that have on productivity and environmental services?
Waste	Analysis of waste throughout the food system in Victoria: <ul style="list-style-type: none"> ➤ Where does it occur (pre-harvest due to pests, through gluts, retailer logistics, spoilage, household, etc) ➤ Where can it be avoided, reused (as inputs to another process or redistributed), or recycled (potential resource?)
	Analysis of the balance between the environmental impacts of food processing, storage & packaging, and the saved impacts of wasted food
	Analysis of the productive potential of Melbourne / Victoria's food waste – including consideration of travel distances and available processing technologies
Health and Nutrition	Analysis of recommended 'healthy eating' in Victoria / Australia and the environmental implications of recommended changes to dietary composition (such as reduced sugar, increased fruit and vegetables, level of processing); are there areas where these conflict?
	Analysis of the impacts of carbon pricing on access to healthy and nutritious foods (which foods will become more expensive and how will this affect food access?)
	Analysis of potential improvement to nutritional densities of Victorian fruit and vegetable products through changed production methods – do methods that improve health outcomes have positive or negative environmental impacts? Which methods make a difference and for which foods?

	Analysis of the potential for health and nutritional aspects of food to be improved through changes in processing, distribution and supply chains
	Analysis of the potential to meet food needs through local, seasonal production in Melbourne / Victoria – what would diet include? Would it be nutritionally adequate?
Emerging Technologies	Governance of emerging technologies – particularly how to manage entry into the food system
	Environmental impacts of genetically modified crops, including on soils and surrounding biodiversity
	Potential environmental impacts of nanotechnology
New Production Strategies	Evaluate benefits of specific methods [farming systems] in Victorian conditions – which ones work best where and why? Measurement and evaluation through controlled trials
	How important are diverse farms to Victorian food production / security? Key questions include: <ul style="list-style-type: none"> ➤ What types of products? How is it being distributed? How viable are these businesses? ➤ What production systems / methods are they using? ➤ What are their relative efficiencies and environmental impacts? ➤ What is the potential contribution to food security?
	Analysis of the contribution of smaller farms and more farmers in the landscape to health and social objectives, and adaptation to climate change
	Long-term field trials of organic, biological and conventional methods, including: <ul style="list-style-type: none"> ➤ yield comparisons for different products ➤ overall efficiencies of inputs and yields
	Further investigation of the environmental benefits of low/no-input farming methods in a Victorian / Australian context, with particular attention to: <ul style="list-style-type: none"> ➤ The most significant changes – which techniques / processes make the most difference to environmental impact (including soil, water and emissions) and what is the potential for their adaptation more broadly; and ➤ For which food types or production systems are the benefits greatest – focus attention on development of methods and systems with most potential impact
	Investigate whether low-input production in Victoria is resulting in higher nutrient levels in fruit and vegetables – pursue opportunities for health and environmental gains
New Distribution Strategies	Analysis of benefits of local food consumption in Victoria, with consideration given to: <ul style="list-style-type: none"> ➤ How much environmental impact is related to transport & storage vs production; ➤ Different production conditions for different foods; and ➤ Relative environmental impacts of production / processing in Victoria vs elsewhere
	Analysis of the potential to meet food needs through local, seasonal production in Melbourne / Victoria – what would it include? Would it be nutritionally adequate?
	An understanding of the full transport patterns of Victorian farmers' markets, and comparison with full transport cycles of conventional distribution systems
	Explore the economic and social implications of increased urban agriculture – how much could it affect access to and affordability of food (particularly fruit and vegetables)
	Investigate how much food is currently, and could potentially be, produced within Melbourne - how much land could be available, and what technologies / systems could contribute?
	Analyse the resource / environmental costs and benefits of urban food production (specific to Melbourne and regional urban centres) <ul style="list-style-type: none"> ➤ Relative contributions of transport, energy, water use (including potential use of wastewater) ➤ Comparison of water / emissions / inputs of home vegetable garden & fruit trees to food from other sources
Consumer Choices	Are Victorian producers receiving 'fair' prices for their produce?
	How much food is wasted, and where in the system could it be reduced, salvaged, redistributed or recycled?
	Explore seasonality in Victoria (and/or different regions in Victoria) – is it changing?
	Analysis of the potential to meet food needs through local, seasonal production in Melbourne / Victoria – what would diet include? Would it be nutritionally adequate?
	Analysis of recommended 'healthy eating' in Victoria / Australia and the environmental implications of recommended changes to dietary composition (such as reduced sugar, increased fruit and vegetables, level of processing); are there areas where these conflict?
	Analysis of the most effective ways to reduce the environmental impact of diets through food substitution in a Victorian context – which foods to reduce, avoid, replace etc
	Adaptation of knowledge about behaviour change in other fields (health, water, drinkdriving etc) – how can food programs be developed, or integrated into existing programs?

Table B2. Opportunities for Innovation identified by Larsen et al (2008)

Focus	Innovation Opportunity
Climate Change	Increase diversity of food production to increase the likelihood of harvest even in unpredictable conditions
	Changes to planting dates and varieties, more resilient crops and systems
	Opportunities for low-input agricultural techniques (including organic systems)
	Redundancy and flexibility in processing, logistics and distribution systems
	Reduce the vulnerability of food distribution systems
	Shift to food production, processing and distribution systems that minimise greenhouse emissions will have competitive advantage under carbon pricing
	Market advantages where Victorian agricultural production is less emissions-intensive than international competitors
	Track and label emissions profiles to strengthen this advantage eg. inclusion of emissions data in new commodity tracking systems
	Drive development and extension (many are already known) of locally appropriate techniques for soil carbon sequestration
Resource Constraints	Increase efficiency of input use
	Transition to less water intensive foods or production systems – focus on making use of water where it is available (including storage where it falls and water in and around cities)
	Accounting systems that can record water information for supply chain and consumer decision making – through global supply chains
	Production methods and systems that are less reliant on oil, oil-based products (eg. chemical fertilisers and pesticides), and contested agricultural inputs
	Alternative biofuel production that is not reliant on conventional inputs or large amounts of productive land (possibility of genetically modified crops or algae systems)
	Developing markets / making use of potential biofuel feedstocks that are currently going to waste (eg. lignocellulosic (wood))
	Renewable / sustainable substitutes for petroleum-based agricultural inputs, including organic wastes
	Supply chains and distribution systems within cities – increasing production closer to consumption and/or innovations in food distribution and access
	Active soil management techniques designed to reduce input costs and increase productivity while improving land and soil quality
	Create supportive conditions for diverse innovation and experimentation across many landscapes eg. different farming systems, crops, scales of production
	Design of residential developments that make use of productive capability of the land on which they are being built (urban agriculture built in from the start)
	Integration of aquaculture with horticulture (aquaponics) makes use of the nutrients fish excrete to grow food and can be a very efficient mixed production system
Biodiversity	Use of native species for food – may encourage preservation and improved knowledge while reducing impact on the environment
	Identifying and applying (in new contexts) techniques and systems that improve biodiversity and productivity (win-wins)
	Food products that incorporate and value native biodiversity eg. 'premium' for saltbush lamb
	Soil carbon sequestration potential of some native species or ecosystems may facilitate habitat preservation
	Diversification of species, products, mixed-farming systems etc
Waste	Food preservation technologies and systems eg. reduced reliance on refrigeration
	Nutrients in food 'waste' as alternative fertiliser sources – organic waste recycling providing inputs to food production <ul style="list-style-type: none"> ➤ urban ➤ rural – innovation potential in logistics / distribution?
	Effective, self-managing home composting systems or services
	Biodegradable and recyclable food packaging
	Adaptive food processing systems – able to adjust products and systems in response to scarcity and seasonal gluts
Health & Nutrition	Identification of input / production factors that affect nutrition in food holds marketing / export potential
	Involvement in food production can increase knowledge of and access to healthy food, physical activity and/or community interaction
	Supply and distribution systems that minimise nutritional loss
Emerging technologies	New applications and reconfiguration of existing technologies
New Production Strategies	Further development and application of existing methods above, underpinned by research
	Certifications / branding that can take new issues into account – improved soil health, water use, emissions generation, potentially carbon sequestration
	Extension services for entrepreneurial small farmers to develop new products and reach new markets

	Production and distribution systems more suited to smaller land areas and farming enterprises
	Adaptation of agricultural knowledge and services to smaller-scale, diverse production systems
	Improving low/no-input systems and techniques – significant domestic and export potential for knowledge and innovation in this area
	Improvements to sustainability and resilience across all agricultural systems using knowledge / techniques developed in low/no input production systems
	Product quality improvements through organic / biodynamic / biological methods eg. Viticulture
	Build consumer awareness of biological / low-input farming systems other than organic – possibly branding / labels – enabling purchase of products from low-impact farming methods
	Integration of other technology development eg. use of ICT for precision farming, soil testing, GIS/GPS for low-input methods
New Distribution Strategies	Reducing environmental impacts and vulnerability of supply chains – logistics, packaging innovations, storage systems
	Collaboration with transport / retailer / health sectors to encourage change in how people access food ie. increase walking / cycling and ensure that increased local food purchase does not require extra car trips
	Increased efficiencies and accessibility of food distribution – reducing reliance on separate car / small truck trips
	Cheap, simple and safe household greywater systems enabling use for food
	Small scale green / organic waste composting systems (and larger scale energy from waste facilities)
	Integrated urban water treatment / food production systems
	Improved production practices in urban systems – applying useful agricultural knowledge to small-scale (household and community) systems
Knowledge and systems for urban food production have very significant export potential	
Consumer Choices	Reducing, reusing and recycling food that is currently wasted at the consumer end of the system (ie. retailer and household)
	Potential for processing innovations to reduce waste from seasonal 'gluts'
	Alternative sources of meat protein and other foods – native species?
	Systems and information enabling informed consumer choices



The Australian Conservation Foundation (ACF) is committed to inspiring people to achieve a healthy environment for all Australians. For over 40 years we have been a strong voice for the environment, promoting solutions through research, consultation, education and partnerships. We work with the community, business and government to protect, restore and sustain our environment.

ACF is Australia's leading national not-for profit environment organisation and is funded almost entirely by individual membership and donations. Since 1966, we have focussed on the most important and urgent environmental problems, seeking change with lasting political, economic and social support. ACF has played a key role in increasing protection for some of Australia's most outstanding natural assets including the Franklin River, Kakadu, the Daintree Rainforest and Great Barrier Reef.

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