

Submission to the Inquiry into the Ecological Carrying Capacity of the ACT and Region

The ecological carrying capacity of the ACT and region (the Australian Capital Region, hereinafter the ACR¹) depends on three broad factors:

1. the lifestyle of the people living in the ACR
2. the relationship between the ACR and the rest of Australia, and
3. the relationship that Australia has with the rest of the world.

Before examining each of these three factors in the context of the Committee's terms of reference, three important background issues need to be borne in mind: first, the special role of Canberra as the National Capital, second our present ecological understanding of the concept of *carrying capacity*, and third the identification of a framework for assessing options. We take each in turn.

Canberra as the National Capital

At the end of the nineteenth century, the people then living in the Australian colonies wanted to federate, but were unwilling to place the seat of the national government in one of the existing major cities. Like many federations before and since it became necessary to find a "neutral location" for the national capital and as is well known, after a lengthy and somewhat acrimonious debate, the site of Canberra was chosen².

It is important to remember that Canberra was and remains essentially a compromise: the price Australia had to pay for federation. Like other compromise cities such as Washington (a compromise between the commercial North and agrarian South of the United States), Ottawa, (between Canada's French and English speaking provinces), New Delhi (between the important ports of Mumbai and Calcutta) sites were selected that were outside existing areas of economic activity, resource poor and lacking opportunity for expansion³.

Although not made explicit at the time, what was once described as '*a clapped out sheep paddock*' became the preferred site for Australia's National Capital. It fitted the above criteria very well. And subsequent generations of Australians (with some notable individual exceptions) have been eager to see Canberra (both the city and the National Government: people still confuse the two) remain as small and economically dependent as possible. This despite the early rhetoric of creating the ideal "City Beautiful", the "Pride of Time" and what Edmund Barton called "a Statement of World Culture" and "one of the greatest creations of mankind".

¹ The Australian Capital Region (ACR) is located in South East NSW and comprises the ACT and 17 surrounding local government areas: Bega Valley, Bombala, Boorowa, Cooma-Monaro, Cootamundra, Eurobodalla, Goulburn Mulwaree, Gundagai, Harden, Palerang, Queanbeyan, Snowy River, Tumbarumba, Tumut, Upper Lachlan, Yass Valley and Young. It has a total area of around 6.7 million hectares and population at last count of 571,561 people.

² Fisher, K.F. (1984) *Canberra: Myths and Models. Forces at Work in the Formation of the Australian Capital*. Institute of Asian Affairs, Hamburg.

³ Other compromise cities include The Hague, a compromise between the competing port cities of Amsterdam and Rotterdam and Brazilia (between Rio de Janeiro and São Paulo).

As those who have lived in Canberra for any period of time know well, except for a few architecturally significant buildings such as Parliament House and the National Library, Canberra looks and feels much like any other Australian city. It consists mainly of bungalowled suburbia, connected by a few freeways with a few islands of high rise and shopping centres. It is a very pleasant place to live but with a population of somewhat over 300,000, by world standards, it is essentially a medium sized provincial town.

Although academic planners argue that Canberra's design is far from ideal and visitors find it extraordinarily difficult to navigate, from an ecological perspective, the leafy green ambiance of the 'garden city' or 'bush capital', contributes to making it potentially one of the most ecologically sustainable cities in the world. Some of the reasons for this are outlined in this submission along with suggestions for realising such a vision by enhancing the carrying capacity of the region.

The Concept of Carrying Capacity

The *carrying capacity* of an area is a concept used by farmers to assess the number of animals that they can raise sustainably on their property. More generally, it is also used to refer to the number of biological species that can be maintained in an area indefinitely. These definitions assume that the area is bounded in some way so that essential requirements such as food and water are always available from *within* the area. Under ideal conditions there are no external inputs or wastes. What one organism has no use for is highly prized by another so that the whole area operates as a cluster of relatively stable processes which are highly resilient to short term perturbations and adapt steadily to changing circumstances over time.

Boundaries are more permeable when assessing the carrying capacity for human populations because only humans have evolved a capacity to trade. From time immemorial, the negotiation processes for moving things and ideas between human populations have been a major driver for innovation and cultural evolution. As a result of stable trade arrangements, the assessment of the carrying capacity for human populations is more complex. Economists have long realised the importance of imports/exports and measure trade balances in money terms. But this is a virtual measure that ignores the physical movements of people and materials (which are not virtual) and which are the true determinants of sustainability. Materials flows analysis (mfa) and systems mapping techniques enable scientists to track the movements of people, materials and energy into and out of an area and determine whether the balance between inputs and outputs is sustainable in the long term⁴.

What is less well understood is that carrying capacity is not of itself a limiting factor. It is possible to increase the carrying capacity of a region through strategic natural resource management, increasing biodiversity and boosting eco-system services. Rich biodiverse eco-systems such as rain forests and coral reefs have very high carrying capacities because of the *diverse mix* of living organisms. The way they interact with each other forms their environment. In other words, life makes use of physical processes for its own purposes. It manipulates the laws of physics, draws on chemical processes in order to create environments and changes climate to suit, not the other way around. And in the event climates change too rapidly to adapt to or control, ecosystems move.

⁴ See for example Birkeland, J. and Schooneveldt J.C. (2003) *Mapping Regional Metabolism: a Decision Support Tool for Natural Resource Management*. Land and Water Australia, Canberra

Conceptual frameworks.

Some people think of a city and its immediate surrounds as a complex *machine* where cause and effect can be readily identified and all that is needed to manage this machine is a raft of regulatory provisions that encourage good things to happen and stop bad ones. Such mindsets crave certainty, are intolerant of ambiguity and too simplistic. While some regulatory machinery is necessary, cities and their hinterlands are not machines and this metaphor is especially inappropriate in considering issues of carrying capacity and sustainability. Unfortunately, advocates of 'law and order' place their faith in this simplistic metaphor which has been shown repeatedly to be largely counter-productive as people readily find ways through, under, over such regulatory embargoes. Even worse, simplistic prohibitions and clumsy enforcement arrangements have the opposite effect. They drive undesirable activities underground and undermine civil society and the rule of law.

More people think of a city and its immediate surrounds not as a machine, but as a complex *system* of interacting processes. Economists who hold this view argue that the processes that drive the system need little in the way of regulation, but require a set of policy settings that enable them to function optimally. For example, adoption of the principle of the free market, the removal of perverse subsidies, and most importantly, the requirement to meet externality costs and avoid monopolies.

What is not generally realised is that these well established economic principles are essential features of a well-functioning eco-system as well. While it is common-place to see advocates for economic and ecological well-being as being in conflict, it need not be so. Well designed and functioning economies work with and value natural systems, they do not destroy them.

This perceived conflict, while non-existent in bio-physical terms, is a real problem in the psycho-social domain, and especially for politicians and corporate decision makers. It requires a new way of thinking.

This third way of thinking about the ACR is relatively rare. In this view the area can be thought of as a living growing network of interacting organisms, thriving sustainably with a high quality of life on its own resource base, trading its surpluses and limiting its inputs to what it can afford. Rather than working against nature, or trying to control it, this view mimics nature and adopts bio-sensitive technologies. As we will see, a strict adherence to this view will enable the region to enhance its carrying capacity and quality of life of the people as well as the plants and animals that live in the region.

But this vision challenges some well established vested interests (who live mainly outside the outside the region) and some narrow view-points at home.

Terms of reference

a) The resources available to the ACT in terms of water, energy, and food sourced from within the Territory and outside it;

WATER

The ACT and region includes some of the highest rainfall areas in the country and support some outstanding water infrastructure assets such as Burrinjuck Dam and the Snowy Scheme. It is a net exporter of water which is sold to downstream irrigators at a very low price. There is no shortage of water in the region, even during prolonged periods of low rainfall. Arrangements for sharing the available water are however problematic and while these arrangements remain in place they severely limit the carrying capacity of the region.

The establishment of a somewhat freed up market in water (where water prices at least reflect the actual cost of supply) will address this shortcoming, provided smaller communities are able to access these sources.

While there is plenty of water in the ACR, some local government areas around the ACT have water shortages during prolonged dry periods due to the unwillingness of the ACT and Federal authorities to allow access to the available water. It is somewhat ironic that Canberra was able to negotiate an arrangement for extracting water from the Snowy Scheme to supplement its own water supply but then was reluctant to allow nearby communities such as Yass, Goulburn and other nearby centres to do the same. Queanbeyan is privileged in so far as it has access to ACT controlled water and water treatment facilities while it is outside the ACT. There is no justification for the ACT to deny basic water rights to other nearby communities.

Note also that, except for a narrow coastal strip, much of the region drains into the inland river system. This enables water used for urban purposes to be treated and fed back into the system. Before the drought, for example, the ACT used about 67 Gl of potable water per year and released 33.7 Gl of this (after treatment) back into the Murrumbidgee River for reuse downstream. Of the total ACT potable water, an average of some 32.4Gl/y of this was used for ACT parks and gardens⁵. Thus if gardens are excluded, virtually all Canberra's household and commercial water uses is already recovered and reused.

Water restrictions during the drought forced park managers and home gardeners to find alternative sources of water by catching storm water, utilising grey water and simply watering more strategically. As a result there has been a dramatic decrease in the number of green lawns, but the overall vegetation cover of the city has continued to increase, creating micro climates that protect more water sensitive species and reduce the harsh desiccating effects of sun and wind. When people unfamiliar with Canberra see aerial pictures of the place, they ask: where are the buildings? All they see are trees.

The only unsustainable use of water in the ACR is along the coastal strip where used water with all its nutrients is disposed of in the oceans. This practice is unsustainable because the nutrients are needed back on farm and cannot be recovered from sea water⁶.

⁵ See the analysis of ACT water flows by Dr Rob Dyball in Birkeland, J. and Schooneveldt J.C. (2003) *Mapping Regional Metabolism: a Decision Support Tool for Natural Resource Management*. Land and Water Australia, Canberra

⁶ Brown, A.Duncan (2003) *Feed or Feedback: Agriculture, Population Dynamics and the State of the Planet*. International Books, Utrecht, The Netherlands

Unlike the south east corner of Queensland where water storage capacity is limited, the south east corner of New South Wales has no such limit. If arrangements for re-use follow the Canberra model the available water can sustain a vastly greater population than the half million people that now live in the region and downstream water users and the downstream environment will not suffer any significant reduction in water flows as a result.

ENERGY

After Darwin and Perth, the ACT and region has the highest levels of sunshine in Australia. It also has abundant high areas suitable for wind generation as well as the largest hydro-electricity generation facility on the mainland. Over 600 wind turbines are at various stages of planning and construction and many more suitable sites exist. The take up of solar hot water units and household PV systems is already high. In terms of electrical energy therefore, the ACT and region could easily be self sufficient in a few years. This is without going into the potential for tidal and wave energy on the coastal strip and geothermal for space heating in the interior.

The region's overall potential for generating electricity from renewable resources is so high that it is a potential net exporter of clean electrical energy in the short term. In terms of carrying capacity, electricity supply is not a limiting factor.

Dependency on fossil fuels for transport is another matter. There is virtually no manufacturing in the ACR and almost all materials and a substantial proportion of the food is trucked or air freighted in. In addition, as the National Capital is located in the ACR, air movements into and out of the Canberra is very high. And because of the distances involved, the region's reliance on private motor vehicles is also very high. (Data on energy use is already readily available and has been tracked through successive State of the Environment Reports and will not be repeated here.)

The ACR is in a strong position to switch from unsustainable fossil fuels to biofuels for road transport. These can be produced from organic waste streams using pyrolysis, algae or other technologies. The fact that Sydney's waste is transported free of charge to the region should be seen as a valuable resource. Rather than burying it as a potential contaminant of ground water, it should be processed for its energy and fertiliser potential.

FOOD

The ACR includes some of the richest agricultural lands in temperate Australia. Work in progress at the Australian National University is looking at the levels of food production in the ACR and its food imports/exports in comparison with two other regions outside Australia: Copenhagen and Tokyo. It is likely that, in economic terms, the ACR is a net exporter, at least of commodities and possibly wine, but it is almost certainly a net importer of processed foods.

As rural Australia is well aware, being in the commodity business with no local value adding reduces the carrying capacity of a region. Some European nations have countered this trend by encouraging regional variations in style and product range, especially in high value foods such as cheeses, wines, processed meats, pastas and vegetables. In addition to encouraging the export of these high value foods, these regions also support a wide range of tourist attractions. For them, a narrow focus on a small number of bulk commodities is economic suicide: a race to the bottom. From an ecological

perspective, reliance on a small number of monocultures is economically dangerous and threatens the environmental stability of the whole region.

Through policies that encourage diversity and value adding European countries not only create a higher carrying capacity for their regions, they are also able to support a stewardship culture that enhances environmental as well as human well-being.

Unfortunately Australian Government policies encourage the industrialisation of agriculture which decimates rural communities, destroys natural soil processes, requires high levels of costly chemical inputs, and is vulnerable to exotic pests and diseases: a new opportunity for chemical manufacturers who deny their activities are doing harm.

In terms of tourist potential, the ACR has the greatest diversity of attractions in the country including the snow fields and alpine areas, magnificent beaches, coastal scenery, national institutions and so on. A focus on regional food production will greatly enhance the attractiveness of the region, and with it, its carrying capacity.

b) Effective measures for assessing ecological footprint and carrying capacity;

The assessment of the *ecological footprint* of an individual, enterprise, city, region or nation is an important tool for gauging impact. It has been done many times for many regions including twice for the ACT⁷. Footprint assessments offer a guide as to what we should/could do more or less of. It is usually taken as a measure of consumption and is useful in equity arguments about sharing the resources of the planet but it does not help us design a sustainable economic system. Its greatest weakness is that it is a linear measurement. It assumes the economy is an extractive machine which it is not. A sustainable economy, like a sustainable eco-system, is dynamic. Crucial measurements for assessing sustainability are the rates of recycling of materials, nutrients, water etc. The more comprehensive and rapid the recycling processes the greater the carrying capacity.

As explained above, the concept of *carrying capacity* is a measure of *potential* based on a specific area or region given its existing resource base. It does not tell us how that resource base might be increased. For example, through managing the vegetation of the region we can biosequester around 3 tonne of carbon per hectare per annum in cropping lands, 5 tonne per hectare in grazing lands and up to 10 tonne per hectare in forestry situations. These are annual figures and it is not known what the optimum level of carbon might be in these situations over the long term.

In the 1840s, on his travels around south eastern Australia, Strzelecki found soil organic matter in more productive soils averaged 14.7% and 5.5% in the lowest productive areas. This compares with less than 1% carbon now in most of our agricultural soils⁸.

⁷ Wackernagel, M. And Rees, W. (1996) *Our Ecological Footprint: Reducing the Human Impact on the Earth*. New Society Publishers, Philadelphia:

Wackernagel M (1997) *Ecological Footprint of Nations*, Earth Council, New Mexico

Close, Anne and Foran Barney, (1998) *Canberra's Ecological Footprint*, Working Paper Series 98/12 CSIRO Resource Futures Program, CSIRO Wildlife and Ecology, Canberra.

Australian Conservation Foundation (2008) *ACF Consumption Atlas*.

<http://www.acfonline.org.au/consumptionatlas>

⁸ See for example Taylor K.J. (1983) "The Australian Environment" and other articles in *Soils and Australian Viewpoint* CSIRO/Academic Press, London.

It is not difficult, with careful management, to re-build the region's soils to these levels and potentially even higher (Strzelecki reported productive soils as much as 37% organic matter). This would enable the ACR to biosequester all its CO₂ and CH₄ emissions (making the region carbon neutral) and either sell the surplus credits or offset emissions (for a fee) to high emitters elsewhere.

The figures presented here are well documented and supported by a wide range of published data. They are also hotly disputed by some institutional (but not independent) scientists.

In this context it is important to note that current research funding arrangements are based on competitive bids. Established research organisations have a vested interest in challenging old data, creating doubt, and raising problems and issues: big issues attract big research dollars.

c) Current levels of resource use by ACT residents, including: The current size of the ACT urban, ecological and carbon footprints and how this compares to national averages and similar sized cities globally; and Trends in resource use in the ACT and the sustainability or otherwise of these trends continuing.

This material has all been published several times over and is the subject of yet more ongoing research. The ACR is undoubtedly the most data rich and studied region in the country. However to pull all this material together and compare the data to the rest of the world requires a huge effort and well beyond what can be included in a single submission.

Much of the data sought is available in the ACT State of the Environment Reports as well as the ACT bureaucracy. An integrated data bank of facts and figures on the region could readily be made available on the web. It would require the institutions that create and hold these data to share what they know.

d) A sustainable level of resource use, in terms of ACT urban, ecological and carbon footprints, for the ACT;

Resource use is sustainable only if the resources are recycled. Linear extractive approaches (extract/use/waste) are essentially unsustainable. If the ACR can achieve 100% recycling its ecological footprint would be zero and its carrying capacity would be much higher. How high depends on the design of the built environment: does it generate its own energy (as plants do from the sun)? Does it recycle its own wastes as soil organisms do on a vast scale? Is the biomass and biodiversity of the region stable or even increasing in proportion to the human population? Does the nutrient and materials content of imports match or be substitutable for its exports?

Recycling requires a high level of human activity and hence employment and wealth generation at far higher levels than the archaic use/waste models which privilege extractors and processors at the expense of everyone else. Economic growth in a *use/waste* economy is unsustainable, but in a recycling economy, growth depends on the *rate* of recycling. Faster recycling means higher growth, just as in a rainforest or a coral reef. A recycling economy not only results in more jobs, but also a greater diversity of jobs. For example, farmers will be able to care for their land and livestock again instead of the mind deadening spray/drive option offered by industrial farming. The construction industry (which accounts for over half the materials and energy wasted in the current paradigm) will not only be able to construct, but remodel, and re-construct using the same stock of materials. Consumer goods can be re-manufactured, and so on. While the embodied energy in a brick is high,

if we can use and re-use that brick for a thousand years (as in Rome where many of the bricks in existing buildings have been used and reused since Roman times), the energy investment in such a brick is essentially sustainable.

Incidentally, there are cementiferous materials available that absorb CO₂. It takes a long time, but if cement products are designed to last with configurations that can be re-used, even the ubiquitous concrete can be sustainable. So too for aluminium (what some call 'congealed electricity'), steel and other metals provided the same stocks are re-used often enough.

The extent to which these processes operate and eco-system services are maintained will determine the region's carrying capacity.

It is worth noting that, in the past, the region sustainably supported no more than 10,000 people living the lifestyle of hunter gatherers. With current technology, lifestyles and the dominant extractive mindset, many are questioning whether we can sustainably carry the current 0.5 million now living in the ACR. But just how large a population the region can support is addressed below.

It is ironic that the ACT Government's Zero Waste policy of some years ago was one of the most advanced ideas around. Just as other regional municipalities around the World are promoting zero waste what is the ACT Government doing to build on this innovation?

e) Appropriate ecological carrying capacities based on current, higher and lower consumption models;

Based on the available evidence and density patterns elsewhere, with a current density of 1 person for 11 hectares, the ACR could clearly support a larger population. To estimate how large we need to look at two variables. First, the stock of materials and energy consumed (ie is eventually wasted) compared with the stock of materials and energy recycled. The higher the level of recycling the more diverse the economy and the more people it can support. Second, the level of ecosystem services delivered, not just from the undisturbed natural environment, but from judicious management of our agricultural lands and the built environment⁹.

Given the media interest in simplifications, slogans, and selling themselves, to suggest a numerical carrying capacity under any, let alone ideal circumstances, would be to encourage sterile debates about numbers. The central issue is about systems change: not numbers.

f) Effective measures for reducing the ACT's ecological footprint;

The following are suggested.

1. Encourage recycling, not just of metals, paper, plastics and glass, but especially of organic wastes to produce bio-fuels and fertilisers.
2. Levy base rates, not on the unimproved value of land, but on the proportion of the land covered by impervious surfaces. Impervious surfaces prevent water absorption and reduce eco-system services. This is an externality cost that people who cover their land with concrete will need to meet.

⁹ See for example the 2002 report produced by Nature and Society Forum for the Department of Urban services as part of the ACT Sustainability Audit: *"A Material Flows Analysis of the Residential Sector of Canberra."*

3. Put a fair (unsubsidised) price on water and allow regional communities that have no capacity to catch, store and deliver water services access to ACR stocks.
4. Put a price on carbon either as a tax or through a market mechanism.
5. Establish an integrated (non-politicised) regional facts and figure website.
6. Negotiate arrangements between the NSW, ACT and Commonwealth Governments to foster closer planning and service delivery arrangements across the ACR.

g) The environmental, economic and social impacts of reduced resource consumption and a sustainable population;

A sustainably designed regional economy based on recycling its water, materials and using renewable energy sources enhances economic activity. It builds biodiversity and ecological resilience and supports a substantially higher population than a linear extractive one.

h) The role of the ACT in the region in relation to population and resource use;

While Canberra is officially the nation's Capital, it is also the de-facto capital and principal city of the region. It forms the region's economic hub. Canberra people invest in property throughout the region, particularly on the coast, but also in the mountains and in rural areas. Conversely people living within 100Km or so from Canberra find employment in the city and often shop there as well. Canberra also provides high level government services in health, education, and aged care to the region.

In addition to the Commonwealth Government with its specific powers over the ACT and the ACT Government whose powers are limited to the ACT (and subject to veto by the Commonwealth), the people in the ACR are also subject to the NSW Government and its seventeen local government authorities (LGAs) that make up the ACR. LGAs also have limited powers that are subject to veto by the NSW authorities. There are also a number of statutory authorities and government sanctioned bodies (such as rural protection boards, marketing authorities and the like) that have been given power to raise levies on their members.

The complexity of governance arrangement exceeds that of any other jurisdiction in the country and is a severe impediment to achieving sustainability. Worse, the veto powers of bodies with different interests and priorities prevent the people of the region acting responsibly in their own interests.

As with all government agencies, survival and power are the highest priorities resulting in frequent territorial disputes, and more often than not, policy gridlock. This is most notable in the planning area where the ACT depends on high land prices while all around the ACT are regional communities crying out for development opportunities that are being blocked by bureaucratic inaction.

The problem is not easy to resolve, (especially at the government level which has a vested interest in maintaining the status quo) but the region has to ask itself if the current 0.5 million people are well served by the present governance arrangements.

Regional development of such areas of South-East Queensland (population over 900,00) and the Hunter Valley region (population over 600,000) simply developed themselves with government authorities trailing far behind.

To some extent, citizens in the ACR are already doing this also, but it would be helpful to have some better co-ordinated regional planning to aid their efforts.

Perhaps the best strategy for the ACT government (with its very limited powers) is to stop blocking attempts by the region to sustainably develop itself and support efforts at cross jurisdictional dialogue, especially in relation to planning.

i) Relevant infrastructure issues;

The most critical infrastructural issues are in the areas of water sharing and transport. As water issues are currently under consideration as part of the National Water Plan and, as pointed out earlier, there is no actual shortage of water even during dry times (recall that it is the politically produced *arrangements* for sharing the available water that are the problem) this submission will focus on the transport issue.

The most obvious is the underdevelopment of a regional public transport system. With only half a million people scattered over 67,000 square kilometres, the economic viability of such a system is problematic. Small European countries of comparable size to the ACR (for example, The Netherlands, area 41,500 sq kilometres, population 16.7million; Switzerland, area 41.3 square kilometres and population 7.6 million and many more) can afford to establish and maintain superb public transport systems.

But the region should make a start as the absence of an adequate transport system is definitely a limiting factor for the region's economic development and carrying capacity.

j) Any other relevant matter.

The most crucial issues in discussing carrying capacity are the issues of *location choice* and *life style*.

Australian's have shown a marked preference for living near the sea in suburban bungalows, a trend that is the most expensive and least sustainable form of development. Australia is the only developed country in the world that has not developed on a hub and spokes model and so far has been unable to manage sprawl.

Canberra is the Nation's largest inland city and has an opportunity to become a major regional hub, the first in Australia, and one that goes well beyond being a mere rural servicing centre. It has the potential to become a fully integrated, sustainable economy offering a range of high quality life-style opportunities.

Those concerned that the lifestyle of the current half a million people living in the region already exceeds the region's carrying capacity are right to be concerned, especially if the region is seen in terms of simple linear trends and projections. For example, Australia now has the largest and most expensive houses per capita in the world while at the same time, the growth of poverty seeing growing poverty in large parts of the country is truly alarming, as is the growing rate of obesity and urban violence.

But the cyclical model proposed in this submission, if adopted progressively will lift the carrying capacity of the region and the quality of life for the people in it, especially in rural parts of the region who are currently experiencing much greater economic and health challenges than their urban counterparts.