Canberra's Ecological Footprint: what does it mean?

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Date of submission of this version

21 October 2011

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"Prosperity consists in our ability to flourish as human beings – within ecological limits of a finite planet. The challenge for our society is to create the conditions under which this is possible. It is the most urgent task of our times." (Jackson, 2009, p. 5).

1   Introduction - What is the Ecological Footprint?

The Ecological Footprint is a measure of human demand on the bioproductive land area that is required to support our resource demands. It represents the land area equivalence (in hectares) of all the resources required to support the lives of people and to absorb their pollution. It distinguishes six types of bioproductive areas that provide renewable resources for human consumption:

- **Cropland** is the land type with the greatest average bioproductivity per hectare and is used for growing crops for food, animal feed, fibre, oils and biofuels, it is an actual land area needed to provide biological resources;
- **Pasture** (or grazing land) is used for raising animals for meat, hides, wool, and dairy products;
- **Forest** area is natural or plantation forests used for harvesting timber products and fuelwood;
- **Built land** is land used for housing, transportation and industrial production, it is not a bioproductive area but has probably replaced cropland because human settlements are predominantly located in fertile areas;
- **Water** area needed for human consumption includes lakes and rivers used for freshwater provision, hydropower, fishing, freshwater aquaculture and recreational purposes; and
- **Energy land** is a notional land area required to absorb the carbon dioxide emissions due to consumption patterns, energy land answers the question "how much woodland and forest area would we need to have in order to absorb all CO_2 emissions from the burning of fossil fuels?" (Dey, 2010).

The ACT's Ecological Footprint is a measure of land used to provide goods and services for activities such as building cities, growing fruit and vegetables, grazing cows to provide dairy and beef products, growing trees for paper and wood products, and absorbing carbon dioxide produced from using electric appliances, driving cars, operating machinery, etc. The total Ecological Footprint of all ACT residents is approximately 3,200,000 global hectares, or equivalent to nearly 14 times the geographical area of the ACT. Fifty seven percent of the ACT's Ecological Footprint is 'energy land' – which mainly reflects the biocapacity required to absorb carbon emissions. Nineteen percent of the Ecological Footprint is in Forests – primarily used within the residential construction industry. In comparison, only 3% of the ACT Ecological Footprint is in Built Land (Dey, 2010).

The Ecological Footprint is an indicator for the impacts of the consumption of ACT residents *wherever* the products and services are produced.

Note that 'energy land' is sometimes referred to as the Carbon Footprint component of the Ecological Footprint. It is in this sense that the term *Carbon Footprint* is used throughout this document. The high contribution of 'energy land' to the Footprint indicates that activities to reduce greenhouse gas emissions will also reduce the ACT's overall footprint.

2   How does the ACT Ecological Footprint compare with that of other cities, states and territories?

2.1 States and Territories

The average Ecological Footprint of the population of the ACT is one of the highest in Australia. However, caution needs to be exercised in making precise comparisons with other footprints for Australia's states, territories or major cities, since there can be differences in footprint methodologies. It is not always that exactly the same methodology has been used or the same year/s covered. Footprints for the same entity can change from year to year because of production and consumption activity changes (economic cycles) but also due to land productivity changes relating to natural fluctuations and land use policies.

The overall Australian Ecological Footprint in 2009 averaged 8.1 gha (global hectares) per-capita, up from 6.8 gha in 2007 [1]. This is as calculated by the Global Footprint Network (GFN). By comparison, the ACT's 2009 per-capita footprint was considerably higher at 9.2 gha, calculated using as far as possible a similar methodology to the GFN. In 2008, Victoria reported a need for 6.8 global hectares per-capita [2] also calculated similarly (see Figure 1).
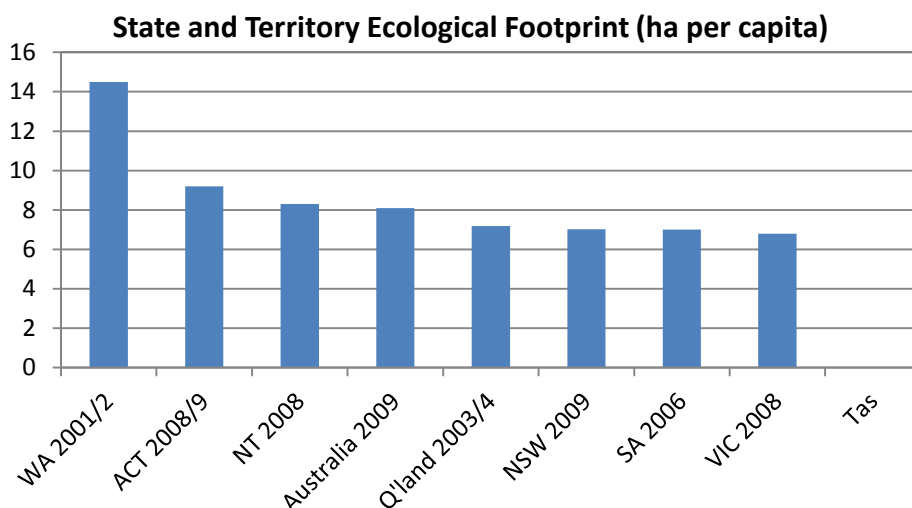

Figure 1: State and territory EFs. Note that different methodologies may have been used and the results shown may represent different years, also the year in which the study was conducted may be different from that of the underlying data. The VIC, ACT, Australian, NSW & Queensland studies used the same or similar methodology but were conducted in different years. The studies are dated: WA, 2001/2[3]; ACT, 2008/9[4]; NT, 2008[5]; Australia, 2009[6]; Queensland, 2003/4[7]; NSW, 2009[8]; SA, 2006[9]; VIC, 2008[10]; Tasmania does not seem to have conducted a state-wide EF study.

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[1] http://www.footprintnetwork.org/en/index.php/GFN/page/2010_living_planet_report/ (accessed 13/07/11)
[2] https://epanote2.epa.vic.gov.au/EPA/Publications.nsf/2f1c2625731746aa4a256ce90001cbb5/4a69e348b2b6f513ca25745e0010f50f/$FILE/1267.pdf (accessed 13/07/11)
[3] http://www.soe.wa.gov.au/site/files/pdf/SoE%20Tech%20Paper%204%20Ecological%20Footprint.pdf (accessed 10/08/11)
[4] Dey, 2011
[5] http://ext.cdu.edu.au/newsroom/a/2008/Pages/090219-Assessing-Northern-Australia%E2%80%99s-ecological-footprint.aspx (accessed 10/08/11)
[6] See above footnote 1
[7] Wiedmann et al, 2008
[8] See below footnote 13
[9] http://www.sustainableliving.sa.gov.au/resources/Eco_Footprint_Brochure.pdf
[10] See above footnote 2

According to the NSW State of the Environment Report 2009, the ecological footprint of New South Wales increased from 6.35 hectares[11] per-capita in 1998–99 to 7.02 ha in 2003–04. Over the same period, Sydney's ecological footprint grew from 6.67 to 7.21 ha per-capita indicating some stabilisation in footprint growth over the period. This study was based on the Household Expenditure Survey from the Australian Bureau of Statistics for 2003–04.

For the financial year 2003-04 the average Queensland resident had an ecological footprint of 7.19 gha, nearly three and a half times higher than the world average. At the same time that of Brisbane residents was about 7.3 gha per-capita (Wiedmann et al, 2008). Given that the methodology was generally consistent, this is an increase of 0.43 ha on 2004 (see Table 1).

A 2009 paper by Charles Darwin University's School for Environmental Research, using ISA methodology, showed that the average Northern Territorian needed 8.3 hectares of land to support themselves [12].

2.2 Cities

In 2010 the Australian Conservation Foundation issued its Sustainable Cities Index. This was compiled from data prepared by the University of Sydney for the 2007 Consumption Atlas[13]. Below is a table comparing the Ecological Footprints of 20 Australian cities for the year 2004, including Canberra (Table 1). Most of the footprint results mentioned above were originally calculated by the ISA research group at the University of Sydney.

Australian Conservation Foundation, Sustainable Cities Index 2010	
City	2004 EF ha per-capita
Perth	7.66
Canberra	7.09
Darwin	7.06
Brisbane	6.87
Sydney	6.82
Adelaide	6.72
Townsville	6.55
Gold Coast-Tweed	6.52
Cairns	6.4
Toowoomba	6.36
Melbourne	6.33
Sunshine Coast	6.31
Wollongong	6.14
Newcastle	6.1
Geelong	5.99
Albury-Wodonga	5.8
Ballarat	5.75

Table 1: Per-capita ecological footprint of major Australian cities, from the Australian Conservation Foundation Sustainable Cities Index 2010[14].

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[11] Note that these are given in hectares rather than global hectares indicating that a different methodology was used.
[12] http://ext.cdu.edu.au/newsroom/a/2008/Pages/090219-Assessing-Northern-Australia%E2%80%99s-ecological-footprint.aspx (the report compared this with an Australian Footprint of 6.5 hectares) (accessed 14/07/11)
[13] www.acfonline.org.au/consumptionatlas/
[14] ACF Sustainable Cities Index 2010: Information sourced from the ACF Consumption Atlas (www.acfonline.org.au/consumptionatlas) which is based on research by the University of Sydney's Integrated Sustainability Analysis (ISA) team, p. 16. http://www.acfonline.org.au/default.asp?section_id=360 (accessed 13/07/11)
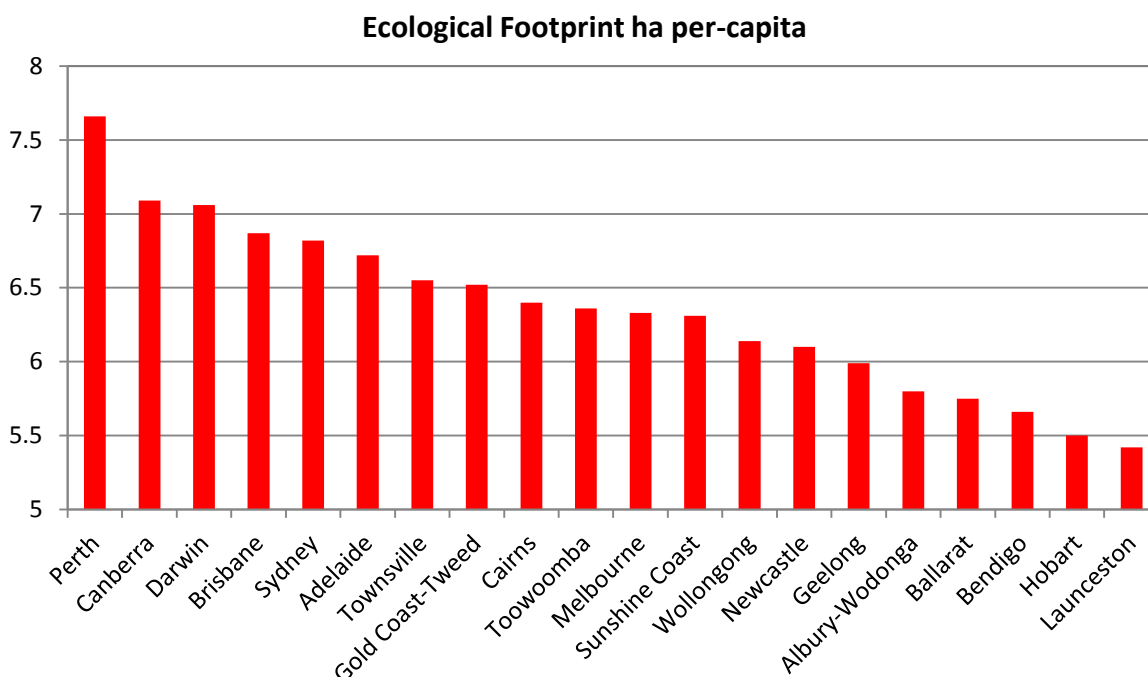
Ecological Footprint ha per-capita

Figure 2: Ecological Footprint in hectares per person per year: A comparison of 20 cities from the Australian Conservation Foundation Sustainable Cities Index 2010 http://www.acfonline.org.au/default.asp?section_id=360

On all measures, it seems that the Ecological Footprints of Canberra and the ACT are high compared with other similar cities and regions. However, the 2011 Footprint Report for the ACT (Dey, 2010) indicates that direct impacts from electricity, gas and vehicle fuel use by households have stabilised or diminished over the last few years[15], which has contributed to a smaller footprint increase. Nonetheless the overall footprint is still rising because of increasing income, and therefore increasing expenditure. The increase of the average ACT household income compared to the Australian average is particularly strong since about the year 2005. It should also be remembered that we are dealing here mainly with per-capita impacts: population growth in the ACT recently was estimated to be about 1.2 per cent per annum[16], one of the highest levels in Australia when compared with the other states and territories. Hence the total impact from ACT residents is continuing to grow.

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[15] Reduction 2003/4 – 2007/8: reduced electricity use of 6%; 7% reduction in natural gas use; reduction of approximately 600 vehicle km per-capita.
[16] Estimated to fall to 0.6% per annum by 2055/56 http://www.cmd.act.gov.au/__data/assets/pdf_file/0010/119719/act-population-projections-2007-2056.pdf

3   Why is the ACT's EF so high?

The ACT's household consumption has grown with the growth of household disposable income. This in turn has driven the increase in the Ecological Footprint (2003-2008) from 7.2 gha to 9.2 gha per-capita (Dey, 2010, p. 21).

> *"With direct energy use steady or falling in the ACT in the last 5 years, the main contributions to the increasing overall footprint are steadily rising consumption of goods and services. In turn, this increasing consumption is related to strong growth in ACT household income. It is a commonly observed trend in affluent societies, whether at the level of whole nations or at an individual household, that total environmental pressures tend to continue to grow with income, even if the immediate or direct impacts are steady or falling. This trend presents a clear challenge for us to examine closely our consumption patterns and what it means to live in societies with high incomes."* (Dey, 2010, p. 4)

3.1 Affluence and the EF
The above statement taken from the 2010 report on the ACT's 2008-2009 Ecological Footprint sums up the core issue for the ACT and for any affluent household, community or country. In modern market economies, the Ecological Footprint is generated predominantly by spending money. The more money available to spend the higher the Ecological Footprint is likely to be. Figure 3 from the 2010 Living Planet Report (p. 77) illustrates this point at a world level.
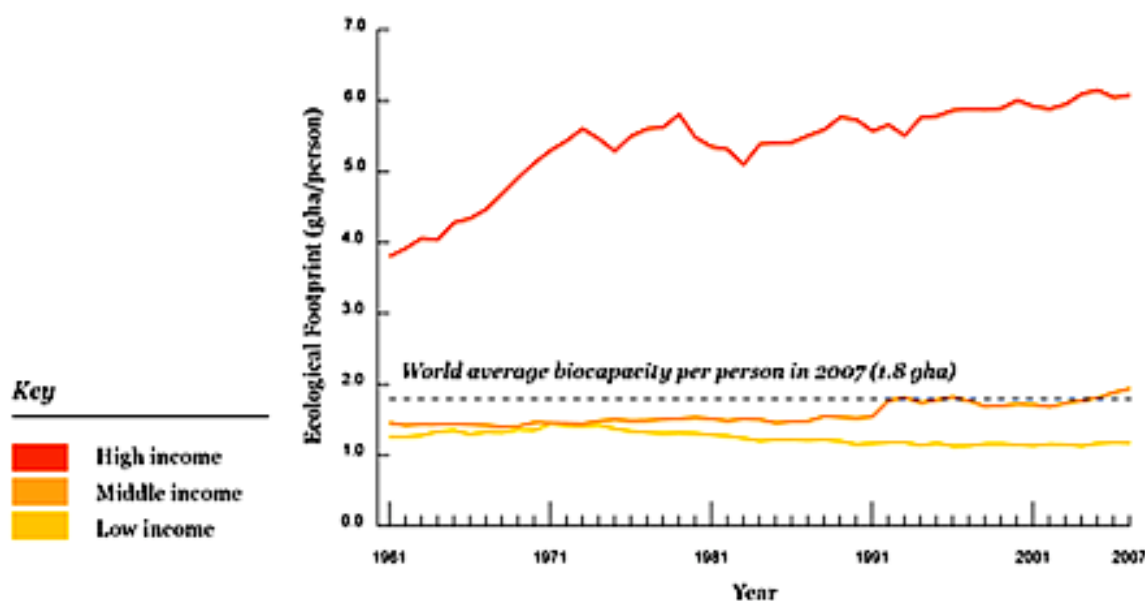

Figure 3: Changes in the Ecological Footprint per person in high-, middle- and low-income countries between 1961 and 2007
The dashed line represents world average biocapacity in 2007 (Living Planet Report 2010[17]).

Affluence is related to the EF because the greater the household income the more *disposable* income there is available for such activities as air or car travel and the construction and furnishing of new dwellings as seen in the ACT – all of which contribute significantly to the Footprint because of their high energy needs (see Table 2 and Figure 3 for example). In the case of wooden furniture and new dwellings land used for forestry is also a factor. A high *disposable*

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[17]

http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/demands_on_our_planet/footprint_income/ (accessed 04/08/11)

income also means that there is more money available for discretionary purchase of manufactured goods, which can contribute considerably to the Ecological Footprint often because of high embodied energy.

This phenomenon is not peculiar to the ACT, neither is it a simple linear relationship. In a comparison of per-capita emissions in Australian states and territories, Lenzen and Cummins (2010) observe that "a AU$10,000 increase at a base salary of AU$50,000 causes a 6% increase in emissions, but only a 3% increase [in emissions] at a base salary of AU$90,000. This is a general pattern observed for emissions (Wier *et al.* 2001), as well as for other environmental quantities [such as water use and land disturbance] (Lenzen and Foran 2001; Lenzen and Murray 2001; Lenzen *et al.* 2006), which can be explained by preferences shifting from emissions-intensive goods to less emissions-intensive services towards higher incomes."
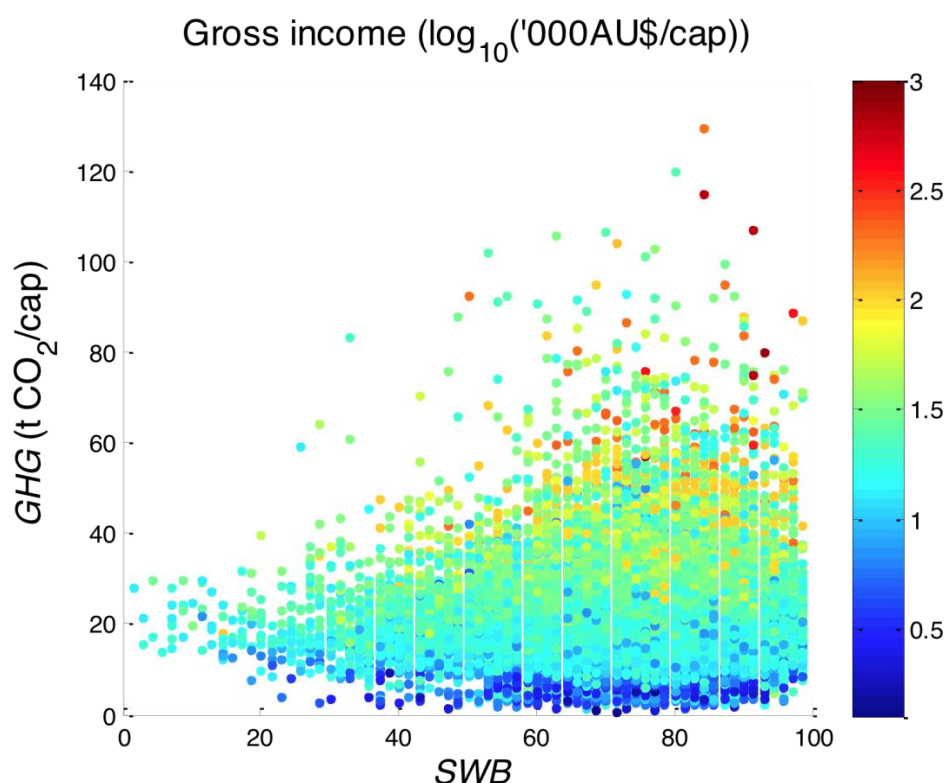

Figure 4: The 'income cloud' maps GHG emissions against Subjective Well Being (SWB) over the range of incomes in Australia. The red dots signify high income, blue dots signify low income. Red/orange dots in the lower right region of the graph show high income, high wellbeing and low emissions. Blue/green dots in the top right region show low income, high wellbeing and high emissions (Lenzen & Cummins, 2010).

Lenzen and Cummins (2010) also discuss income (and its related emissions) and *wellbeing*, which is an attempt to provide some indication of quality of life. They found that up to a point wellbeing increases with increased income but for higher incomes, "a 10% increase in income leads to a 0.4% increase in wellbeing, and in a 2.9% increase in emissions … Diminishing additional well-being at increasing incomes has also been observed (see Frey and Stutzer 2002, Tabs. 2 and 5 in Stutzer 2004, references listed on page 15 in Gowdy 2004, and Mayraz *et al.* 2006; Abdallah *et al.* 2008; Brereton *et al.* 2008; Cummins *et al.* 2009)." They conclude that although emissions tend to increase with income this is not the case for wellbeing, with additional income generating diminishing returns in subjective wellbeing (Figure 4).

3.2 The ACT's Footprint

The key items that make up the ACT's Ecological Footprint are: Electricity supply, residential building construction, retail trade, spending at hotels, clubs, restaurants and cafes, air travel, petrol, food products, wooden furniture, spending associated with home ownership and clothing (Table 2).

Rank	Commodity	Impact (gha/capita)	% of Total
1	Electricity supply	1.07	12%
2	Residential building construction	0.56	6%
3	Retail trade	0.51	6%
4	Hotels, clubs, restaurants and cafes	0.44	5%
5	Air and space transport	0.35	4%
6	Petrol	0.32	4%
7	Other food products	0.29	3%
8	Wooden furniture	0.25	3%
9	Ownership of dwellings	0.24	3%
10	Clothing	0.21	2%
11	Electronic equipment	0.20	2%
12	Beef cattle	0.17	2%
13	Finished cars	0.16	2%
14	Education	0.15	2%
15	Non-building construction	0.14	2%
16	Gas supply	0.14	2%
17	Non-residential building construction	0.14	1%
18	Wheat	0.12	1%
19	Recorded media and publishing	0.10	1%
20	Pharmaceutical goods for human use	0.09	1%

Table 2: Top 25 commodities in terms of per-capita Ecological Footprint in the ACT in 2008-09 (Dey 2010).

Use of electricity constitutes 12% of the ACT per-capita Ecological Footprint. This is high because the ACT's electricity supply comes mostly from coal-fired power stations which have one of the highest carbon dioxide emissions of all forms of electricity generation. Of course, were it not for household energy efficiency measures being in place, the ACT's Ecological Footprint would be even higher. The contribution of residential building to the EF comes mainly from the forest area needed for timber and the carbon footprint from energy used by the construction industry. The retail trade contribution to the EF is from the retail sector's use of fuel in distribution of goods and electricity use in shops. Food consumption and private transport are also major contributors to the ACT's overall footprint. Of the total food footprint 57% is plant based whilst the remainder is animal based food products.

This list of key contributors is not unique to the ACT. A study conducted in 2008 for Victoria using the same methodology found almost the same categories in much the same order of significance (Figure 5).
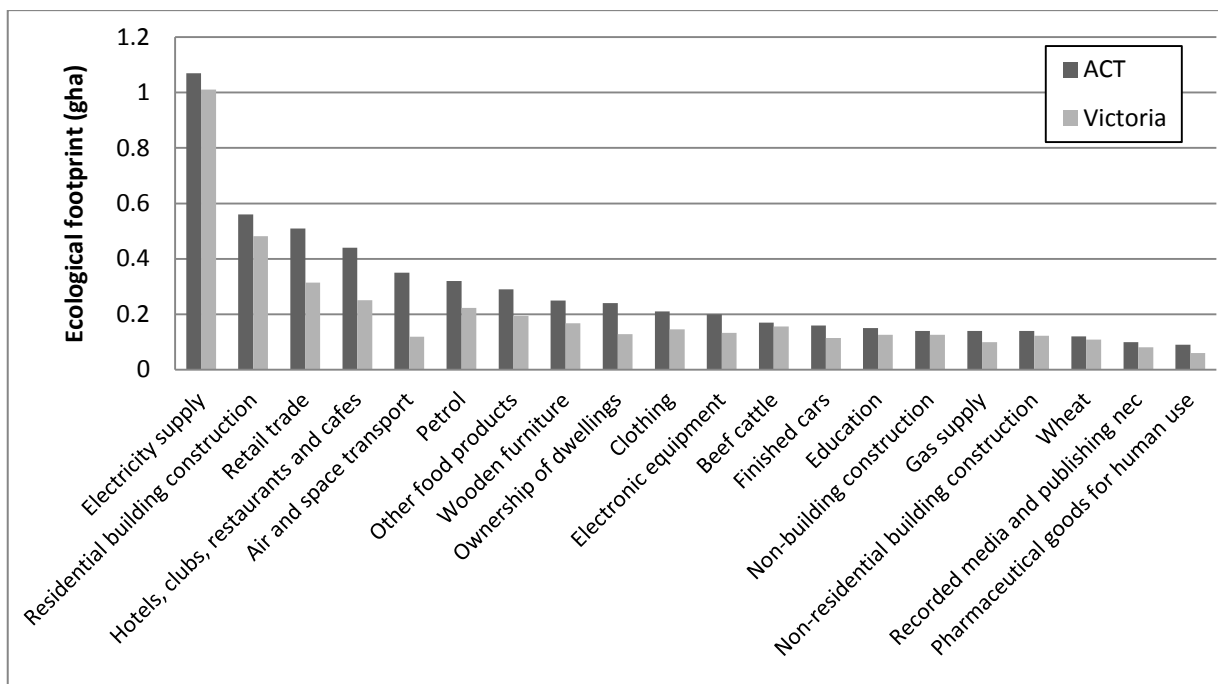
Figure 5:   Top ten commodities in terms of per-capita Ecological Footprint in ACT and Victoria. (data for Victoria from Wiedmann, T., Wood, R., Barrett, J. Lenzen, M. & Clay, R. (2008). *The Ecological Footprint of Consumption in Victoria*. EPA Victoria https://epanote2.epa.vic.gov.au/EPA/Publications.nsf/2f1c2625731746aa4a256ce90001cbb5/6a4f318c29647984ca2574710004e3ad/$FILE/ATTAD7EZ/1269.pdf page 9 (Note: item 10 of VIC EF was *Wholesale trade* at 0.08)

It should be noted that Australian consumer ecological footprints are generally high in world terms. We have some of the highest per-capita footprints in the developed world. This is due mainly to the combination of being a wealthy nation, our high-emitting electricity system which currently is mainly coal-fired power stations, and our extensive agricultural systems which use a great deal of land in a relatively dry country.

To put the ACT's footprint in a global context, generally higher income, more developed countries, make higher demands on the planet than poorer, less developed countries. According to the Living Planet Report, 2010 in 2007 " the 31 OECD countries — which include the world's richest economies — accounted for 37 per cent of humanity's Ecological Footprint. In contrast, the 10 ASEAN countries and 53 African Union countries — which include some of the world's poorest and least developed countries — together accounted for only 12 per cent of the global Footprint." (Living Planet Report, 2010, p. 37).

4   What does the ACT EF mean for the ACT and Australia's long term sustainability?

If we were all to have a fair share of the total global hectares available world-wide then the population of the ACT would have to live on 1.8 gha per person This would mean a drastic reduction from the ACT's current 9.2 gha per-capita (Global Footprint Network 2006; Global Footprint Network 2009).

To reduce the ACT's Footprint to a sustainable[18] level in global terms (i.e. to 1.8 gha per person) looks like an impossible task. Yet the Footprints of all developed nations will need to reduce, if only to provide room for the poorest nations' Footprints to grow to an equitable level. This is an ethical question that faces individuals and governments regardless of their contribution to the global Footprint. Setting manageable targets and defining indicators that will assist in monitoring progress will be essential steps to reducing the local impact and to bringing about a more equitable future.

Much of the ACT's footprint is embodied in goods and services from outside the ACT. For example the *Agriculture, forestry and fishing* industry contributed 0% to the Gross State Product (GSP) in 2009/10[19]. It is therefore likely that the vast majority of wood used in construction or furniture making is from outside the ACT. It is also likely that much of the food consumed in restaurants and the *Other food products* bought by ACT households are also from outside the Territory. *Manufacturing* also contributed 0% to the 2009/10 GSP suggesting that manufactured goods bought by ACT households will have originated outside the Territory.

While residents can take steps to reduce their overall purchase of discretionary goods, or purchase of goods from outside the Territory's boundary, it is unrealistic and undesirable in many cases to substitute local for 'imported'. The report *Buying Choices for a more Sustainable Canberra*[20] discusses for example, the case that foods grown elsewhere in ideal conditions require less material inputs (including transport) than foods grown locally but in less than ideal conditions, which means that 'importing' can sometimes be the better Footprint option. However the ACT's growing per-capita food consumption should be addressed in the interest of long term sustainability and also for general health and fitness promotion. Cutting down on food waste can also make a contribution to overall sustainability.

No modern economy is an island and most trade transactions result in inter-dependencies that support a vast web of local economies elsewhere. Therefore all changes to purchasing habits will have knock-on effects, affecting social and economic sustainability elsewhere. Nevertheless environmental issues need to be addressed and markets will adjust over time with more sustainable industries growing as less sustainable ones diminish. What the ACT government and households can do is use their spending power to encourage changes in supply chains. This can be a change from one product to another such as increasing the number of vegetarian options and

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[18] The term *sustainable* here is taken to mean: able to continue at this level without insurmountable social, economic and environmental problems arising. The term *unsustainable* therefore means that social, economic and/or environmental problems that demand attention will arise from the continuation of 'normal' business. The EF is a measure of *unsustainability*. In the short term it may be possible to distinguish between local and global sustainability. However in the long term we are all in this together and we must take responsibility for our actions that contribute towards global unsustainability. The ACT's actions towards a sustainable future will probably take both local and global perspectives – although these two sets of interests will converge over time.

[19] http://www.treasury.act.gov.au/snapshot/GSP.pdf (accessed 04/08/11)

[20] Ryan, S. (2011). *Buying Choices for a more Sustainable Canberra.* Report for the ACT Commissioner for Sustainability and the Environment.

reducing the non-vegetarian when catering for meetings or feeding a family; or it could be a change in supplier, for example purchasing wood or paper only from environmentally certified suppliers. Asking questions of businesses about their supply chains, for example where the wood for furniture originated or if they use recycled paper, can prompt them to explore their own Ecological Footprints and make changes in suppliers if necessary. This will speed up industry changes and support job growth in new and more sustainable enterprises.

Much of the ACT's Ecological Footprint is tied to developments in the rest of Australia and across the world. Pressure on organisations from citizens, NGOs and governments worldwide to become more sustainable, including a price on greenhouse gas emissions, could be the incentive that some companies need in order to reduce the Footprint embodied in their goods and services. Any changes will reduce embodied emissions in the supply chain which will flow throughout national economies, including Australia's, and ultimately to the ACT.

It is worth briefly discussing here the notion of what a long term sustainability target might be, and what it would mean for the ACT. For example, should the ACT aspire to a level of consumption equivalent to 'one-planet' living? Similarly, in terms of greenhouse gas emissions (carbon footprint), a global sustainable level is approximately 5 tonnes of CO_2-equivalent per person per year. The level in the ACT is approximately 5 times higher than this. This would mean an 80% cut on 2009 levels rather than the current target of 80% cut on 1990 levels by 2050. Thus very significant changes would be required for an ethically defendable, sustainable level of lifestyles to be achieved. This may seem like a daunting task but with a good supporting story and trust in people, the majority of whom want to be associated with creating a better world and a sustainable future, the ACT may be well placed to become an example of innovative action.

5   The distinction between local, national and global impacts from ACT consumption

Contributors to the Ecological Footprint, such as energy use and land disturbance are embedded in goods that move around the world through trade. With a global focus on carbon emissions, people world-wide are becoming more aware of embodied emissions and what this means for our responsibility in reducing them. This awareness of *embodiment* could equally be applied to the Ecological Footprint – the principles are the same.

5.1 Local impacts of ACT consumption
The local impacts of ACT consumption may be noticed, for example, in the loss of agricultural land or natural bush to housing development which is the second highest contributor to the ACT Footprint. People may experience increased traffic congestion or spend more time shopping for goods from a growing number of retail outlets (retail trade is the third highest contributor and petrol is the sixth). Weight gain among some members of the population from overconsumption or the increased consumption of some processed foods may be noticeable and may put pressure on health facilities (fourth and seventh highest contributors). Over the longer term there may also be increased severe weather events to which ACT consumption, like consumption everywhere, has indirectly contributed. However, even local (direct) energy use which is strongly related to local climate, behaviour, housing stock and so on, has a global context, since the resulting greenhouse gas emissions quickly become well-mixed in the atmosphere, with CO_2 in particular having a typical lifetime in the atmosphere of at least 100 years.

On the positive side, the local economy benefits by the contribution that the construction industry makes to the economy (0.6 percentage point contribution to GSP 2010) as well as retail trade (0.1 percentage point contribution to GSP 2010) and accommodation and food services (0.1). Local employment is also a benefit accruing to the ACT economy from the construction industry. Thus any reduction in Footprint is a balancing act. It needs to be sensitive to the local economy while reducing impact on the Footprint. It requires research into what exactly constitutes the Footprint at a micro level – the Footprints of individual projects and businesses in these high impact areas, followed by support programs focused on changes that can be made to project design or in supply chains in order to reduce impacts while retaining local employment.

5.2 National impacts of ACT consumption

All Footprints everywhere, be they carbon, water or ecological, cannot be disentangled from the effects of national or global trade. Consumption of electricity by households constitutes 12% of the ACT's total Footprint. Although this is still the highest contributor to the ACT's EF, average per-capita consumption of electricity decreased by 6% between 2003-04 and 2007-08 (Dey, 2010). The ACT meets its electricity needs mostly through coal fired power stations which have one of the highest carbon dioxide emissions of all forms of electricity generation. Electricity for shops is also a large part of the Retail sector's contribution to the footprint. The national impact of ACT consumption of electricity is in its contribution to our national per-capita emissions which are one of the highest in the world. Although total electricity use in the ACT has increased since 2007-08, national action on emissions will 'trickle through' so that less 'energy land' will be required to sequester electricity emissions over time.

Another national impact of ACT consumption is in its call on cropland, pasture land and forest to support food consumption and the use of timber for building construction and in Australia- made furniture.

5.3 Global impacts of ACT consumption

In a global economy there is no way to isolate oneself from the flow-on effects of global trade. Impacts of ACT consumption of imported manufactured goods are felt elsewhere in the world, for example in unhealthy working conditions in third world countries where air and water pollution from factories is high; or in contributing to severe weather events that devastate communities around the world. However in some instances global trade can have less impact on the environment than would local production of some goods. In such a case the importing of some goods, particularly food, could help to minimise the ACT's consumption footprint. For example a study by researchers at Lincoln University in New Zealand demonstrated that rearing and distributing British Lamb produced more emissions than importing New Zealand Lamb. This is because New Zealand farmers use more renewable energy and less fertilizer than British farmers[21]. Climate can also effect growing decisions. In 2005 Defra (Department of Food and Rural Affairs, UK) reported that it was more energy-efficient to grow tomatoes in Spain and transport them to the UK than it was to grow them in hot-houses in the UK. Economies of scale can also affect embodied emissions and can in some instances make it more energy efficient to manufacture at a distance and transport food than to buy local.

Contributions to the Ecological Footprint are also embodied in services, for example flights, which are a high contributor to the ACT's Footprint. In recognition of this global impact of local

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[21] http://www.lincoln.ac.nz/story_images/2328_RR285_s13389.pdf accessed 28/11/08

consumption the European Union has determined to penalize countries that do not have a price on carbon, under changes to the EU's emissions trading scheme Qantas will be forced to pay a tax on 15 per cent of its carbon emissions from its nearest port of call[22] in 2012.

6   What can be done by households, communities, and the ACT government to reduce the Ecological Footprint?

> *"…the possibility that humans can flourish and at the same time consume less is an intriguing one. It would be foolish to think that it is easy to achieve. But it should not be given up lightly. It offers the best prospect we have for a lasting prosperity." (Jackson, 2009, p. 7)*

There are three broad strategies for reducing the ecological footprint of the population of the ACT. The first concerns reducing consumption-related impacts in general. This does not have to mean reducing wellbeing, but involves ACT residents making shifts in their consumption patterns to lower footprint goods. The second strategy is for the efficiency of the land used to produce the goods and services consumed by ACT residents to be increased (ie. an increase in the *productivity* of the land). However, the ACT population does not have much potential to increase land productivity given how much they are dependent on footprints generated outside the ACT. The same can be said for most Australian residents who live in cities, with perhaps a realistic conclusion being that the best influence a concerned resident may have on land productivity is from their voting preferences at national level. There is a third strategy though, which is a combination of the first two strategies: *informed and deliberate* changes in consumption by purchasing goods and services from lower footprint sources and categories. By consciously changing consumption patterns ACT residents not only reduce their own footprints, but also start to reduce the Ecological Footprint of across Australia. In the following few sections we will discuss the meaning of this third strategy for the ACT.

What can be done by households?

It would seem that households can contribute towards reducing the Ecological Footprint by changes to their spending patterns, and can do so without affecting wellbeing. Tim Jackson (2009) in his discussion of wellbeing in *Prosperity without Growth?*[23], explores the question of what contributes towards improving wellbeing and discusses why people may be happier and live more sustainably when they "favour intrinsic goals that embed them in family and community rather than extrinsic ones which tie them to display social status." (p. 11). Since shifting away from increased spending on goods, while reducing the Footprint, will not necessarily interfere with feelings of wellbeing it seems that there is much to gain from any changes.

Two changes that will reduce the Ecological Footprint could be encapsulated as – spend less, spend better. The first – spend less – is to reduce overall household consumption (which will include waste), especially of energy and goods – switching to activities for spending time rather than money where possible. The second – spend better – is to always seek out the goods and services that can be delivered in the most Footprint-efficient way. This includes for example buying food that has been produced with the lowest embodied energy, water, land use etc.

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[22] Read more: http://www.news.com.au/travel/news/european-union-tax-on-carbon-to-push-up-airfares/story-e6frfq80-1226055808322#ixzz1Rxs4mj5G (accessed 13/07/11)
[23] Now a book: Jackson, T. (2009). *Prosperity Without Growth: Economics for a Finite Planet.* Earthscan: London.

What can be done by communities?

If wellbeing is enhanced, and lifestyles are more sustainable when life goals are embedded in community as well as family, then there is a role for community in reducing the ACT's Footprint. Many communities already come together for sporting and cultural activities such as local and national celebrations and festivals. Most communities have considerable organisational infrastructure ("natural capital") such as religious bodies, schools and clubs that can be built-on and extended. Supporting a community focus on a range of activities for all age groups would seem to be a good option for reducing the overall Footprint – making it an attractive option to spend time in activities rather than money on goods. Going further, it is usually possible to find links between many of these community fundamental values and with an overall motivation to reduce one's impact on the planet. For example, this is seen in the direct interest of some religions in environmental issues.

What can the ACT government do?

The ACT government can assist households and communities to reduce their Footprint through new policies and practices. It can also consider sequestration options for offsetting emissions as a measure to reduce its overall impact on the environment.

If households are to spend less on *stuff* it will require an education campaign to explain why and government support for alternatives for spending time rather than money. If households are to 'spend better' they will need guidance. Food and product labelling is one way to assist in this. However, it will need to be backed by research that accounts for the full effect of the product rather than, for example, some superficial 'food miles' type of labelling.

If communities are to extend their role in organising and supporting local activities that bring people together then education around the benefits and support for implementation will be vital. Support can be in the form of small grants to community organisations, making venues available, making public liability insurance accessible, assisting with security and providing support within a positive framework that removes barriers and welcomes ideas.

However Tim Jackson acknowledges the difficulty in pursing such goals in the face of the dominant consumerist culture and suggests that structural change is the only way to address it. He makes the point that although the task will be difficult because of the way in which goods are "deeply implicated in the fabric of our lives" (2009:10) change is essential if we are to seriously tackle sustainability. He recognises our need for consumerism as a source of identity but suggests that there are 'alternative hedonisms' – less materialist pursuits that are nonetheless satisfying. These can include celebration of creative endeavour in all its forms including social, creative and performing arts, sciences and sport. Developing an infrastructure and environment that encourages and supports tempting 'alternative hedonisms' for the display of wealth (if necessary), is a role that government can play. One way would be to encourage and reward creative solutions to this dilemma – ones that do not at the same time increase the ACT's Ecological Footprint[24].

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[24] In a slightly different vein but to illustrate government creative thinking: Turku in Finland, the 2011 European capital of culture, introduced cultural prescriptions to combine residents' wellbeing and culture. Its board of healthcare distributed free tickets to cultural events as a supplement to medical treatment. http://www.turku2011.fi/en/news/doctors-prescribe-tickets-cultural-events_en
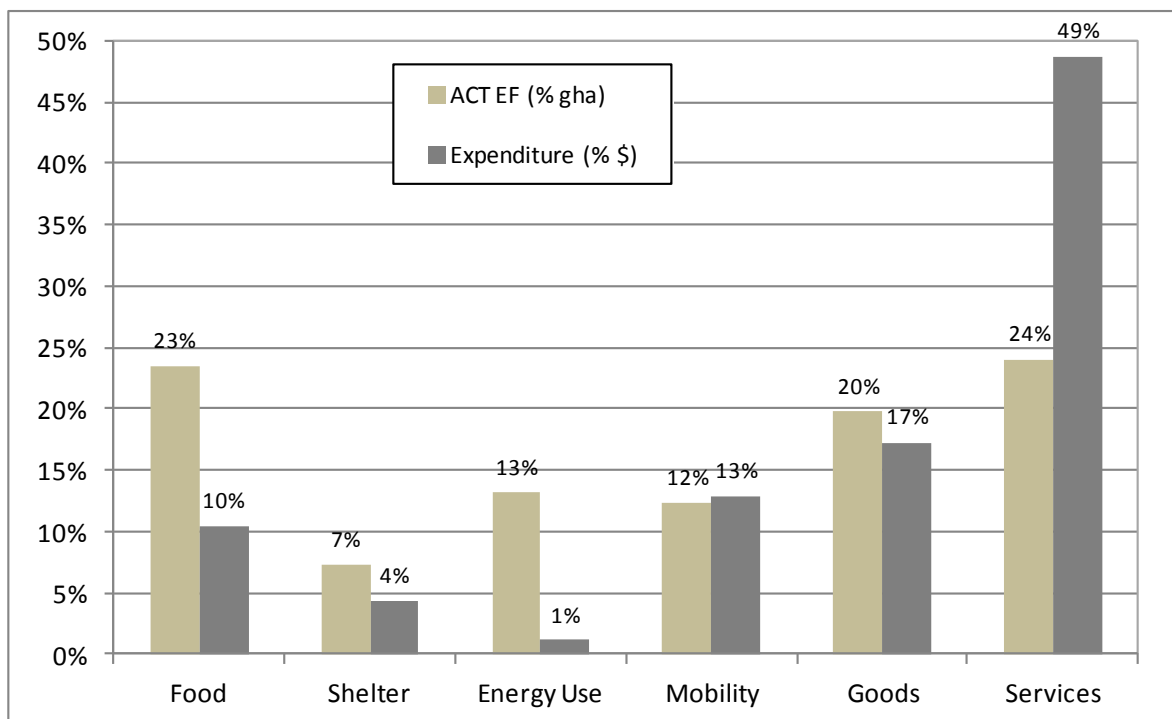
Figure 6: Contributions of consumption categories to total footprints and total expenditure (Dey, 2010). Note that although services represent 49% of expenditure their contribution to the ACT EF is 24%. Compare this with the 17% expenditure on goods which generates 20% of the footprint.

Recognising the value of a shift from buying goods to buying services is a step towards reducing the total Ecological Footprint. The challenge is to provide the type of services that are going to satisfy a range of needs for those on higher incomes and to provide services that are going to encourage a shift in spending habits for those who have not reached the income level where such effects usually kick in naturally. Figure 6 shows the different contributions of consumption categories to total footprints and total expenditure indicating the benefits that could ensue from such a shift.

Government can also assist in reducing the contribution of residential and non-residential building construction at the approval stage of developments. New projects should be assessed on the amount of land disturbed, passive heating and cooling design and water efficiency measures, encouragement for cycling and walking, support for just in time shopping to reduce waste and facilities that encourage community activity.

ACT has a high carbon sequestration potential. The Australian National University used National Carbon Accounting software to calculate how much carbon could be sequestered by revegetation of various of its ACT properties. It was suggested that if 175 ha of the 215 ha Spring Valley Farm property were to become open woodland forest then "a maximum average annual above ground carbon biomass of 89 tC/ha[25]" could be achieved. The report concluded that revegetation efforts can reduce the carbon footprint of the ANU[26] while increasing biodiversity by supporting local vulnerable bird species[27].

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[25] Tonnes of carbon per hectare.

[26] It was estimated that the Kioloa (NSW) and Spring Valley Farm sites have the potential to sequester approximately 21,000 tons of carbon over 25 years.

[27] http://www.anu.edu.au/anugreen/files/1352_Daines_carbon_sequestration.AP.pdf

This result accords with the ANU's 2008 report to the ACT government on the value of trees in Canberra's streets, parks and reserves (Killy et al, 2008). This report found great potential for sequestration in non-urban estates. While the urban estate, with only 1% of the ACT's carbon stock, accounts for 48% of the sequestration, non-urban land with 95% of current carbon stock accounts for only around 52% of sequestration. Young fast-growing trees have a high sequestration rate – 0.6 tonnes of carbon per hectare – compared with 0.07 tonnes per hectare for mature native vegetation surrounding Canberra. This suggests valuable potential for sequestration in non-urban revegetation projects.

There is also Ecological Footprint offset potential for the ACT in the management of its own land. Better management and rehabilitation of land which can lead to increases in biodiversity and other measureable improvements, is another local response to the dependence of the ACT on ecological disturbance outside of its boundaries. The notion of 'biodiversity offsets' or 'bio-banking[28]' is controversial and not without problems when applied to areas wholly within a jurisdiction[29]. However, the perspective here is to offset from within the ACT boundaries, impacts that occur outside the ACT resulting from purchase of goods and services on which the ACT population is reliant, but for which it has no direct management potential.

7   Production and consumption footprints and what they mean for action

Consumption footprints and production footprints are both in use worldwide. They serve different purposes and they give different results. For example the Ecological Footprint bases its calculation on what is *consumed* per-capita irrespective of where the good or service came from. The footprint calculated for the ACT by Dey (2010) is a consumption footprint. It accounts for everything consumed in the ACT irrespective of where that good or service was *produced*. On the other hand National GHG Inventories that are reported to the UNFCCC include emissions from *production* only. They do not include emissions embodied in imports. They take into account everything *produced* within a defined area irrespective of where that good or service is *consumed*. This approach is also used in reporting under the Kyoto Protocol[30].

It is important to understand the difference between them to avoid misunderstandings, or even the undermining of the science, should one or other unwittingly be presented in the media as '*the* footprint' – something that caused a problem in the UK in 2008 (see below). The two different calculation methods also support different possibilities for abatement action. The *consumption* footprint supports consumer action in a global framework because it addresses the full upstream supply chain; the *production* footprint is more useful for reducing emissions in business and industry at a national level.

In the developed world the footprint of everything that is consumed in a geographic area such as a city or state is generally higher than the footprint of everything that is produced by the population of that same geographic area. This is because we consume a lot of imported goods. Very often these are imported from less developed parts of the world. All of these goods embody emissions created during their production. Hence we import those emissions and in consuming the goods, these embodied emissions become part of our (consumption) footprint.

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[28] http://www.resource.nsw.gov.au/biocertification/offsets.htm (accessed 15/07/11).

[29] See for example Burgin, S. (2008). BioBanking: an environmental scientist's view of the role of biodiversity banking offsets in conservation. *Biodiversity Conservation,* 17:807–816.

[30] Note that the two examples of production footprints presented here (national GHG inventories and Kyoto reporting) apply to carbon footprints (GHG emissions) only.

The different consequences for responsibility and ultimately for action have been recognized for some time. Consider the examples below from the Wall Street Journal, 2007.

> "If a gadget is made in China by an American company and exported and used by consumers from Stockholm to Sao Paulo, Brazil, should the Chinese government be held responsible for the carbon released in manufacturing it?" (Wall Street Journal. N.Y. Nov 12, 2007. p. A.2)

In the case of a production footprint the producer is held responsible, and therefore counts, all of the effects of production in reporting for example to the UN (in the case above only GHG emissions have been considered but the principle holds true for the Ecological Footprint, water and all other effects). Country comparisons made by the UN Statistics Division are based on production footprints. However this is not without contention.

> "As China's emissions rise, everyone is pointing the finger of blame at China …
> The real responsibility for rising emissions should lie with the final consumers in Europe, North America and the rest of the world." (Wall Street Journal. N.Y. Nov 12, 2007. p. A.2)

In the case of a consumption footprint the consumers are held responsible, and therefore count, all of the effects of their consumption. This is what the Ecological Footprint does – it counts what is consumed per-capita irrespective of where the good or service came from.

The considerably different results can be seen in the reporting of trends in the UK. Reports show that between 1992 and 2004 their Kyoto GHG emissions reported a decrease of 13%. However in the same period consumer-based GHG emissions increased by 13% (Figure 7). This led to accusations in the press of misleading the public by reporting that emissions were decreasing when they were actually increasing. The UK government was accused of importing more and more embodied emissions in goods imported from China and in effect therefore 'exporting' the government's 'dirty work'.
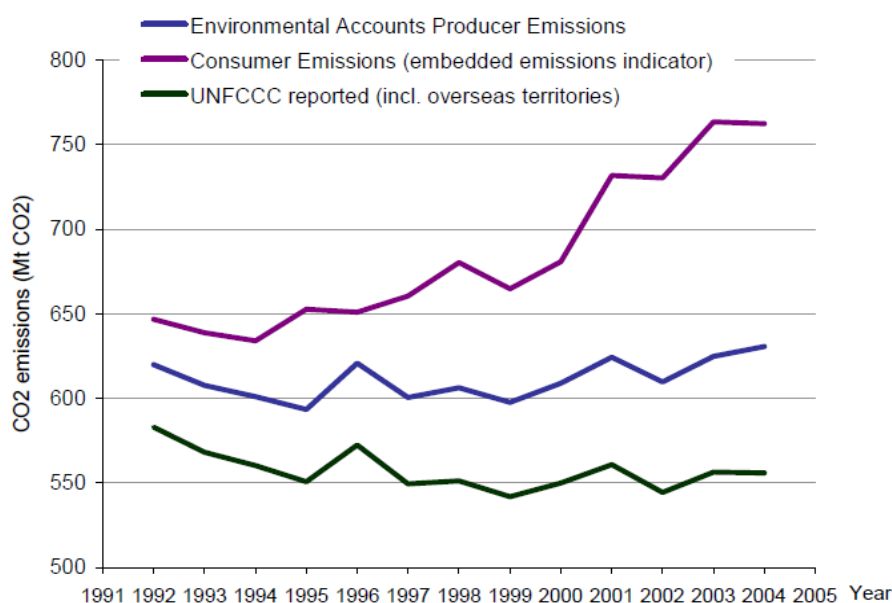

Figure 7: Development of UK CO_2 emissions from 1992 to 2004 according to different accounting principles (note that the vertical scale does not start at zero). From: Wiedmann et al (2008) available at:
http://www.isa.org.usyd.edu.au/publications/documents/Defra_EmbeddedCarbon_Main.pdf

The ACT's footprint captures the production and consumption of all goods and services because it accounts for the full supply chain of every item consumed, whether it is produced locally or imported. It is a measure of the effects of the consumption of the ACT population. As such it is a complete footprint including emissions embodied in all goods and services originating from outside the Territory boundary but consumed in the ACT.

From the UK example above it can be seen that such goods and services (largely goods) add considerably to the overall footprint. However, as discussed above, some imported goods carry a smaller Footprint than a locally produced equivalent. Consumers need to be discerning and well informed if they are to make Ecological Footprint-friendly purchases.

Some measures that households can adopt to reduce their Ecological Footprint (i.e. consumption footprint) are well covered in *Buying Choices for a More Sustainable Canberra* (Ryan, 2011). They will go some of the way to reducing the ACT's overall footprint. Other measures that households and communities can adopt need to be supported by Government policies and practices that help make it easier and attractive for households and communities to spend time on activities instead of money on *stuff*.

8   Implications of recent trends and some speculation about the near-term future

Residents of the ACT slowed their increase in electricity usage 2002/3 – 2007/8 and their passenger car travel levelled off over that same period. Despite this, the Bureau of Transport and Regional Economics predict the total passenger car equivalent kilometres to increase by 29% in Canberra between 2005 and 2020. One obvious response is to reduce the footprint per distance travelled by vehicles, through more fuel efficient vehicles, different types of vehicles or achieving higher average occupancy. But less obviously action to reduce this trend calls for consideration of the reasons for high car dependency and its relationships with urban form, and then some creative thinking around solutions that would at least slow the increase in vehicle kilometres.

With nineteen percent of the ACT's Ecological Footprint in forests – primarily used within the residential construction industry (Dey, 2010:24) – it would seem that building performance deserves closer examination. Consideration of the possibilities for Canberra's building stock over the next 40 years will be worth investing some time into. This should include consideration of the broader environmental implications that arise from new housing settlements and general population growth. Such considerations should include an integrated approach to planning so that community gardens, transport including bicycle infrastructure, work, just-in-time shopping, education and leisure are included from at the planning stage of any development.

Food is responsible for the largest single category of the ACT Ecological Footprint (Dey, 2010:24). Of the food Footprint, 57% is plant based whilst the remainder is animal based food products. As discussed above and in Ryan (2011) substitution of local produce, albeit from community gardens may not always be the answer, although it could well be that less food is wasted when the effort to produce it has been personal. This is important because food waste is generally considered a factor in increasing emissions from food purchases. A second factor is health related: over consumption is a factor in the growing problem of obesity. Thus issues around food purchase habits, food growing and consumption are well worth investigation.

9 Discussion of broader footprint indicators for more complete decision making

The Ecological Footprint is an important headline or *endpoint* indicator for unsustainability. It rolls up a great deal of complexity into a single world-view indicator, telling us how much of the planet we are taking up through our lifestyle. An endpoint indicator requires painstaking data collection and complex modeling and computation (for discussion of midpoint and endpoint indicators see Lenzen, 2005). Many think that such simple indicators are easier for people to understand (Heijungs et al., 2003). For example, as a metaphor the Footprint is easy to envisage and extremely useful in conveying a message. However as a basis for decision making it can be criticised as being limited by its very simplicity.

Retaining the complexity also requires a range of what are known as *midpoint* indicators. Decision-making at midpoints has advantages because it allows for more of the complexity from the drivers to be examined; instead of providing a few aggregated numbers, the more multi-facetted midpoint information reveals the multi-dimensionality of the problem and can suggest a range of areas where action might be taken. Decision-making based on indicators is always going to be contentious because endpoints are too uncertain to allow a decision to be made with reasonable confidence, and midpoint information is complex, revealing competing issues that need to be balanced. In the end, people and societies always have to make decisions based on incomplete and uncertain information. However, the existence of some uncertainty should not prevent action being taken. This is the idea behind the "precautionary principle" approach to environmental management.

In the case of the ACT it would be helpful if the Ecological Footprint in future were to include as sub-sets a water footprint, land use footprint and GHG footprint. The Ecological Footprint is an excellent headline indicator, but for practical management and planning, for anything from new suburbs to individual infrastructure choices, a suite of indicators covering both local and indirect effects would enable more sophisticated decision-making.

Perhaps more useful still is the Triple Bottom Line (TBL) approach that takes into consideration not just environmental but also the social and economic effects of how we spend our money. A TBL approach can include the Ecological Footprint as an indicator just as it can include water, energy and land use. All are sub-sets of the overall sustainability (TBL) measure. The ACT's Policy and Cabinet Division of the Chief Minister and Cabinet Directorate has recently published a discussion paper exploring the possibilities for putting TBL principles into practice through use of a TBL assessment framework[31]. The ACT's sustainability policy, *People, Place, Prosperity: A Policy for Sustainability in the ACT* commits the ACT Government to embedding TBL assessment into its day to day decision-making processes. A full TBL approach recognises that we live in a complex system of interrelated webs of existence: change one thing and everything changes. If we make a change that affects the environment then there will be social and economic repercussions. The same goes for social and economic changes; they will inevitably in some way affect our environment. Taking a systems perspective acknowledges the complexity and begs that it be dealt with holistically. It is essential if we are going to deal with the tensions that exist for example between reducing environmental impacts and continuing economic growth. The methodology applied by the University of Sydney to the Ecological Footprint calculation is also used for TBL calculations.

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[31] Triple Bottom Line Assessment for the ACT Government: A discussion paper, June 2011
http://www.cmd.act.gov.au/policystrategic/sustainability

10 Conclusion

At 9.2 global hectares per-capita the ACT's Ecological Footprint is high compared with similar entities in Australia and very high when compared with the 1.8 global hectares per-capita available worldwide. The large ACT Footprint is driven by high salaries and high spending.

The ACT successfully reduced electricity, gas and fuel use between 2003/04 and 2008/09, all of which contributed to a reduction in these components in the 2008/09 footprint. It is now time to tackle the significant increase in consumption of goods and services that has pushed the Ecological Footprint to this height. With food the largest single category of the Footprint, closely followed by the provision of services to ACT residents there is a need for some creative thinking around how to reduce these components while maintaining high wellbeing and satisfaction with life for all.

Residential building construction is also contributing noticeably to the Footprint and is likely to increase because the population is continuing to grow. It is therefore important that integrated social, economic and environmental planning be undertaken for any new housing developments.

Finally, and most importantly, if the ACT Ecological Footprint is to be reduced, all government policy and practice must be designed to shift people away from consumption of goods to the consumption of low impact services and importantly to the spending of time in creative and thoughtful ways rather than spending of money on goods and foods that are superfluous and sometimes harmful to a healthy and happy lifestyle.

Sustainable processes and practices must become ubiquitous – a way of life. Although some people will accept such a shift as necessary for a fair and equitable world and will make changes to their lifestyle, it will be made much easier for everyone when sustainability-thinking infiltrates every aspect of government decision making so that infrastructure and policies support rather than work against it.

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