Garnaut, the Greens, and the browning of Australia and the World

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SUMMARY The *Interim Report* of Ross Garnaut's *Climate Change Review* is as one would expect a very sophisticated exercise in advocacy of rigorous methods to reduce carbon dioxide emission both globally and in Australia. In addition to suggesting that Australia should take the lead in adopting even more ambitious targets for emission reduction, of as much as 90 per cent below the 2000 level by 2050 (the Rudd Government has so far committed only to 60 per cent), the Report proposes establishing an "Authority" to manage the programme of emission caps and trading aimed at securing the recommended emission reductions.

The *Interim Report* insists that an "emissions trading scheme (ETS) is the center-piece of a domestic mitigation strategy [but] establishing it will be difficult and will make heavy demands on scarce economic … resources". Those resources may not be all that scarce - Rod Sims, Nicholas Gruen, and Jack Pezzey have already put their hands up (in recent articles in the *Australian Financial Review* and *The Canberra Times*) as being available for employment by the Authority.

Be that as it may, the *Interim Report* is also notable for deliberate omissions. None of its graphs showing emission trajectories depicts the associated oceanic and terrestrial uptakes through photosynthesis. For example, its Fig.2 shows three of the IPCC's "SRES" emission scenarios with cumulative totals to 2100, implying that there have been zero uptakes from 1990 and will be none to 2100. Its whole emphasis is on reduction of carbon dioxide emissions from fossil fuel burning and land clearing. Nowhere does it evaluate either the option of focusing exclusively on enhancing the rate of uptakes, or the impact of reductions of emissions below the rate of uptakes on the level of atmospheric carbon dioxide. Uptakes have accounted for about 60 per cent of all emissions since 1945, despite the rapid growth of emissions since 2000, and there is no hard evidence of any decline in the rate of such uptakes since 2000.

Carbon dioxide in the atmosphere is what makes life possible on this planet, both by keeping the average global temperature at an equable 14^{o}C, plus or minus 1^{o}C or so, and by providing the essential resource for the photosynthesis without which there would be no life at all. All living creatures eat either or both the plants that result from photosynthesis and the animals that eat those plants (notably fish, poultry, cattle, sheep, and pigs). The UN's FAO's food production data show a 60 per cent increase between 1980 and 2006. Garnaut's *Interim Report* fails to consider what the 60%+ emission cuts that he proposes will have on the future production of such plant and animal matter. If adopted, his and the Rudd Government's target for such reductions could reduce carbon uptakes from the atmosphere by as much as 4 billion tonnes of carbon a year, with devastating consequence for world food production.

Ross Garnaut's Interim Report won acclaim from the Greens' Senator Milne and the Green movement in general for its suggestion that the Rudd Government needs to move beyond its declared intention, of aiming for 60 per cent reductions of carbon dioxide emissions by 2050, to reductions of 90 per cent below the 2000 level. Regrettably none of these promoters of such stringent reductions in emissions offers any consideration of the effect of depletion of atmospheric carbon dioxide on world food production. One might have thought that at least the Greens would consider how brown – and very cold - the earth would be in the absence of atmospheric carbon dioxide. Without that CO_2 we will all be dead by or soon after 2050.

The level of carbon dioxide in the atmosphere at the end of 2006 was equivalent to 811 billion tonnes of carbon (GtC, a figure derived from the volume of carbon dioxide as measured then at Mauna Loa in Hawaii (and a few other locations), which was 382 parts per million. The aggregate figure amounts to 126.7 tonnes of carbon per person, or 465 tonnes of carbon dioxide per capita. The atmospheric carbon is a rather small proportion of the amounts stored in the earth's sub-soil and in the depth of the oceans, estimated at 40,000 GtC. About 550 GtC are held by existing vegetation, and in equilibrium (strictly, steady state), additions to this quantity of about 101.5 GtC a year through new growth via photosynthesis of atmospheric carbon dioxide are offset by an equal amount returning to the atmosphere via respiration and decomposition. Note that human beings and all other animal life are invariably omitted by the IPCC from its data above on what it calls the "carbon cycle". If the population of the animal kingdom was not growing it would produce no net take-up of atmospheric carbon, but both the animal and vegetable populations of the globe have been growing strongly since about 1750, so there has indeed been a net take-up. This is currently estimated at an average of 5 GtC a year since 2000, and has accounted on average since 1959 for 57 per cent of the estimated emissions of carbon dioxide of 9.1 GtC a year from burning of fossil fuels and land use change (Canadell et al., 2007a).

If such emissions cease and take-ups continue only at the present rate, the present level of atmospheric carbon will fall to zero within 162 years, well within the time horizon of the UK's *Stern Review*, which based its calculations on the costs of not mitigating climate change through to 2200. However the IPCC and the lead author of its Third Assessment Report (2001, and Houghton 2004) state that most atmospheric carbon will remain in the atmosphere indefinitely if emissions cease totally, no doubt mainly because most of it is far distant from the earth's surface (see Dyson, 2007). Moreover Houghton implies that if emissions cease, uptakes will also cease (2004, p.39). That must have serious implications for a world whose population is still growing and enjoying the higher standard of living afforded by the current rapid growth of food production. The above data on the annual flows of emissions and atmospheric and earthly uptakes are summarized in Table 1 below. [2]

It is important to remember at all times that global uptakes of carbon dioxide through photosynthesis are not measured or indeed measurable, but are derived as a residual from the difference between recorded emissions from fossil fuels including estimated emissions from land use change, on the one hand, and the measured increase in the atmospheric concentration of CO2 on the other. That means the take-up of carbon dioxide by the globe's oceanic and land biosphere using the data in IPCC 2007 and Canadell et al. (2007a) noted above was *necessarily* 5 GtC (unless it went missing somewhere else!) If that had been only say 3 GtC, the atmospheric level would have to have increased by 6 GtC instead of the actual 4.1 GtC, with a presumed consequent higher rate of global warming[3]. Equally, if the estimated emissions from land-use change, of 1.6 GtC in the 1990s, were understated by Canadell et al. (2007a), then it also follows that their figure for uptakes is also understated. This proves to be the case, as their primary data source (CDIAC) cites one of their co-authors, R.A. Houghton (in *Tellus*, 2003) showing an average net flux of carbon to the atmosphere from 1990 to 1999 of 2.176 GtC, and another of their own co-authors (Ciais, in Gitz and Ciais 2004) cites even higher emissions from land use change, at 2.4 GtC in 1990. Using these latter figures raises the residual for total uptakes by the oceans and land

by equal amounts, and reverses the claims by Canadell et al (2007a, 2007b) of "declining efficiency" and "saturation" of the oceanic and terrestrial sinks (see Table 2).[4]

It is not the least of the failures of due diligence in the Garnaut Interim Report that it accepts (pp.11, 21) the Canadell *et al.* claims of saturation (despite the alert to those deficiencies in my own first Submission to the Garnaut Review). The Interim Report has no basis for its incorrect assertion that "observations (sic) suggest that absorptive capacity has been falling more rapidly than estimated by the main models". If there are such observations - and they are not to be found in the source (Canadell *et al* 2007a) cited by the Garnaut Report – they are contradicted by the uptakes implied by the raw data in the sources in Table 2 using the raw data in CDIAC cited but not actually used as-is by Canadell et al. (2007a).[5]

That is why the plot in my Fig.1 from CDIAC's raw data shows a declining trend in the *observed* proportion of emissions retained in the atmosphere. The truth is that as yet there is no evidence of any reduction in the rate of uptakes of carbon dioxide from the atmosphere. On the contrary, all the evidence is that the uptakes have always since 1959 exceeded the emissions retained in the atmosphere, which is why the annual increase in the amount of the atmospheric concentration of carbon dioxide is on average not more than 45 per cent of the amount of annual anthropogenic emissions. This evaluation is consistent with that of James Hansen, of NASA and the Goddard Institute of Space Studies (GISS), who is justifiably credited with the invention of the global warming hypothesis (at a presentation he gave to then Senator Gore's committee in 1987). In his paper (2004) for the same journal that published Canadell *et al., Proceedings of the National Academy of Sciences,* he and his co-author (M. Sato) affirmed that the proportionate uptake of carbon dioxide emissions by the atmosphere has been "remarkably constant" since 1945. Hansen and Sato concluded that there is no basis for reducing emissions below the rate of uptake, unlike the EU, Garnaut, the Rudd Government, and Australia's Greens[6].

A further failure of due diligence in the Garnaut Interim report is its unquestioning acceptance of "global" temperature data in the standard source managed by James Hansen at NASA-GISS. Evidence is accumulating that this data is seriously contaminated. First, it relies on temperature data for 1880-1900 to establish the benchmark base year for global warming since 1900. However as late as 1900 there were virtually no weather stations across the tropics, so naturally "global" temperature then was weighted towards the much cooler northern hemisphere where there were weather stations. Secondly, Anthony Watts has established that NASA-GISS relies heavily on all too many weather stations in the USA that are sited in car parks and below air conditioners, resulting in serially over-stating temperature trends in the continental USA (see my example of such siting below). Thirdly, Stephen McIntyre has shown how NASA-GISS has a tendency to expunge monthly data from stations world wide that show a declining temperature trend since 1990, see my Fig. 6 below for an example from Bolivia. GISS claims that data is not available, but although it is on their site, it is not brought to account for the "global" monthly data series, no doubt because it shows a cooling trend since 1990 (see www.climateaudit.org, *passim*).

Table 1
The Global Carbon Budget
Averages

	1959-2006	1970-1999	1990-1999	2000-2006
Sources of Emissions GtC p.a.				
Fossil fuels	5.3	5.6	6.4	7.6
Land Use Change	1.5	1.5	1.6	1.5
Total Emissions*	6.7	7.1	8.1	9.1
Sinks, GtC p.a.				
Atmosphere	2.9	3.1	3.2	4.1
Ocean	1.9	2.0	2.2	2.2
Land	1.9	2.0	2.7	2.8
Total Sinks	6.7	7.1	8.1	9.1
Distribution of sinks in %				
Atmosphere	43	44	39	45
Land and Ocean	57	56	61	55

* Totals may reflect rounding
Source: IPCC WG1, Table 7.1; Canadell et al., PNAS, October 2007, Table 1.

Note: The figure for "land use change" emissions here at only 1.6 or 1.5 GtC after 1990 is quite different from that in Gitz and Ciais (2004, even though the latter is a co-author of Canadell *et al.*) who show net land use emissions of 2.4 GtC in 1990 rising eventually to 4 GtC by 2100.

Table 2
How to get the Airborne Fraction of Emissions to rise

GtC	Opening Atmos. Carbon	Fossil fuel Emissions	Land-use Flux	Total Emissions	Carbon Uptakes	Closing Atmos.Carbon	Mauna Loa CO2 ppm	Airborne Fraction %
Gitz & Ciais 1990	749.11	6.50	2.40	8.90	5.52	752.49	354.22	37.98
Canadell 1990	749.11	6.50	1.60	8.10	4.72	752.49	354.22	41.73

Sources: Gitz and Ciais, 2004; Canadell with Ciais et al., PNAS, 2007a

Going back to the primary school arithmetic of the basic equation outlined above, if current annual emissions of 9.1 GtC are reduced by 60 per cent to 3.64 GtC (EU, Rudd and Wong), or by 90 per cent to 0.91 GtC (Ross Garnaut), or by 100 per cent to 0.0 GtC (Sen. Milne and Greenpeace), then they will fall well below the current rate of uptake of carbon dioxide by the oceanic and terrestrial biosphere, which is 5 GtC per annum. The standard view of bio-geochemists is that the level of uptake of emissions is critically dependent on the level of emissions, because of what they call the "partial pressure" of carbon dioxide in the atmosphere. Simply put, what gets taken up depends on what is put up. If the latter is reduced, the former also declines. Thus if emissions fall below the current annual uptake level of 5 GtC, the resulting fall in partial pressure will reduce photosynthetic uptakes, approximately *pro rata* –

(see Fig.5 below). Nowhere do Stern, IPCC, and Garnaut consider this impact of emission reductions.

Climate change advocates always base themselves on what they believe to be the disastrous increase in the level of atmospheric carbon dioxide, from the pre-industrial level of 280 parts per million by volume (ppmv) in about 1750, to the current level of 383 ppmv. But economic historians have since Malthus noted that the world and its biosphere were in equilibrium until about 1750, in the sense that any increase in population was always checked by stagnant food production. All available data show that both world population and food production were indeed always in balance, by decade or millennium, from about 5,000 years before the present era until about 1750. But around that year carbon dioxide emissions from burning of coal became significant in England, and by 1800, in Europe and the USA (Captain Cook's earliest maritime experience was on ships bringing coal from Newcastle to London, and the *Endeavour* itself was a converted collier).

It is undeniable that since 1750 population growth, carbon dioxide emission, and food production have grown broadly in step with each other. For example, from 1980 to 2006 the world's population grew by 44 per cent, food production by 60 per cent, and carbon dioxide emissions by nearly 40 per cent (see Fig.2) . Obviously agricultural output also depends on plant breeding, fertilizers, and other inputs apart from carbon dioxide but has evidently outstripped population growth – if not for much longer with the switch from food to biofuel crops, but the latter are also dependent on atmospheric carbon dioxide.

The question avoided by Garnaut and the Australian Government is what will be the impact on Australian agricultural production of reducing emissions to below the current level of uptakes of atmospheric carbon dioxide? No less an authority than Sir John Houghton, who masterminded all IPCC Reports before that of 2007, has stated that in the absence of emissions there will be no uptakes at all, because of the inertia of a constant level of atmospheric carbon dioxide (2004:39).[7]

The resulting very inconvenient reality is that all those involved in the process of setting targets for reduction of greenhouse gas emissions to below the current level of uptakes by the global biosphere (more than 5 GtC per annum) are blithely condemning all of our children and grandchildren to starvation as early as 2050. For without the current level of emissions, the present level of world food production is unsustainable. My Fig.2 shows how since 1980 world food production has been closely correlated with emissions of carbon dioxide – and has not visibly been affected by rising temperatures.

The fertilization effects of atmospheric dioxide have been extensively documented, and it is well known that in greenhouses it is necessary to add carbon dioxide, to as much as 1000 ppm, to obtain optimal yields.[8] Field experiments (known as Free CO_2 Air Enrichment, or FACE, data for various sites is available from CDIAC's website) have shown similar gains in productivity for wheat and other crops when additional carbon dioxide is provided, confirming the observation by Freeman Dyson (2007) that

> *The fundamental reason why carbon dioxide in the atmosphere is critically important to biology is that there is so little of it. A field of corn growing in full*

sunlight in the middle of the day uses up all the carbon dioxide within a meter of the ground in about five minutes.[9]

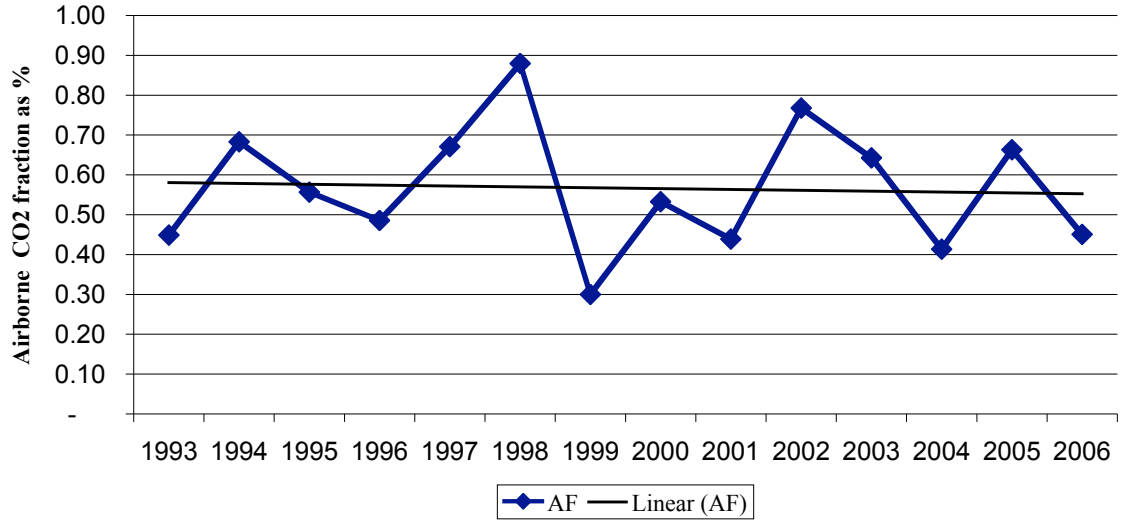
Starvation will also result from the alternative scenario where global uptakes of carbon dioxide do continue growing at their historic rate from 5 GtC a year despite emissions reductions of 60 or 90 per cent of the 2000 level by 2050. For then the absolute volume of atmospheric carbon dioxide will decline every year until by 2050 it reduces by more than 4 GtC a year. That means that as early as 2057 the volume of atmospheric carbon dioxide will have returned to 280 ppmv, which is where it was in 1750, when life was nasty, brutish, and short for most people across the planet because of persistent food shortages.

My Figs. 3 and 4 sketch these alternative scenarios, where either uptakes fall nearly to zero, and agriculture and fisheries virtually cease production, or uptakes continue at the present rate until the aggregate level of atmospheric carbon dioxide has fallen to the 1750 level, when intense cold reduces the growing season and a veritable shortage of carbon dioxide cuts food production to a fraction of its present level (see also Fig.5). **However, by then most school history books in Australia will be referring to Mr Rudd, Ms Penny Wong, Dr Ross Garnaut, and Senators Milne and Brown as co-founders of the Global Brown Earth Coalition.**

Conclusion

Perhaps one of the most disappointing features of the Garnaut Interim Report, as also of the UK's Stern Review, is its subservience to all too often self-serving "science" hardly any of which would find its way into a journal like *Econometrica.* There is no reason why any competent economist cannot make a cool appraisal of "science" which often deploys unacceptable statistical methods, and like the IPCC develops Scenarios – stated to be all equally plausible – for the state of the world in 2100 using economic projections into which economists have made no contribution and which are manifestly improbable. The Interim Report's refusal to analyze the stocks and flows of additions to and subtractions from the atmosphere, and to assess the impacts of reducing the atmospheric concentration of carbon dioxide to levels that last obtained in 1750, is delinquent, and worthy of class actions against its authors when the costs of its proposals for securing emission reductions become manifest, and the benefits fail to materialize.

Fig1A. The Declining Trend in the Airborne Fraction of CO2 emissions since the Pinatubo Eruption



Sources: Fig1A. Carbon Dioxide Information Analysis Center (CDIAC); Canadell et al. 2007a.

Fig.1B. C.D. Keeling, from ftp://ftp.cmdl.noaa.gov/ccg/co2/trends/co2_gr_mlo.txt

Fig.1B The actual declining airborne fraction is confirmed by the declining trend in the growth of atmospheric CO2 at Mauna Loa

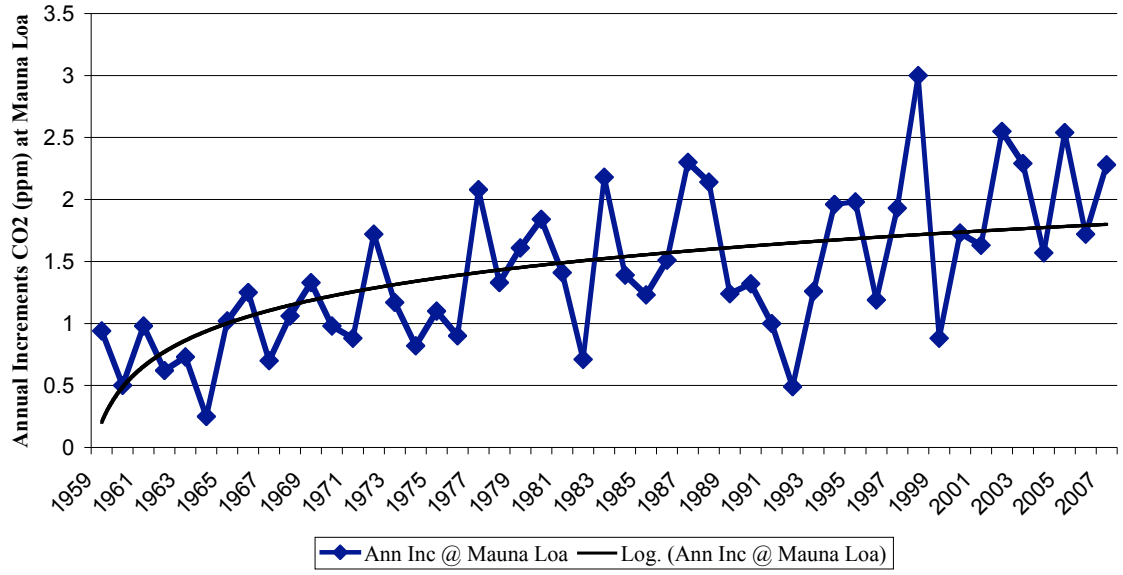
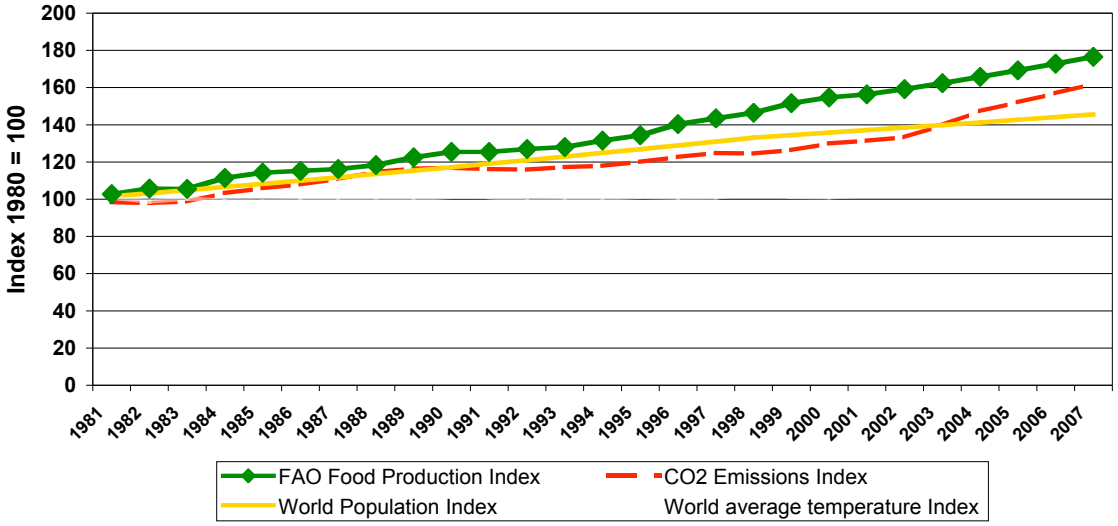


Fig. 2 How the world is being better fed despite - or because of? - rising temperature and CO2 emissions



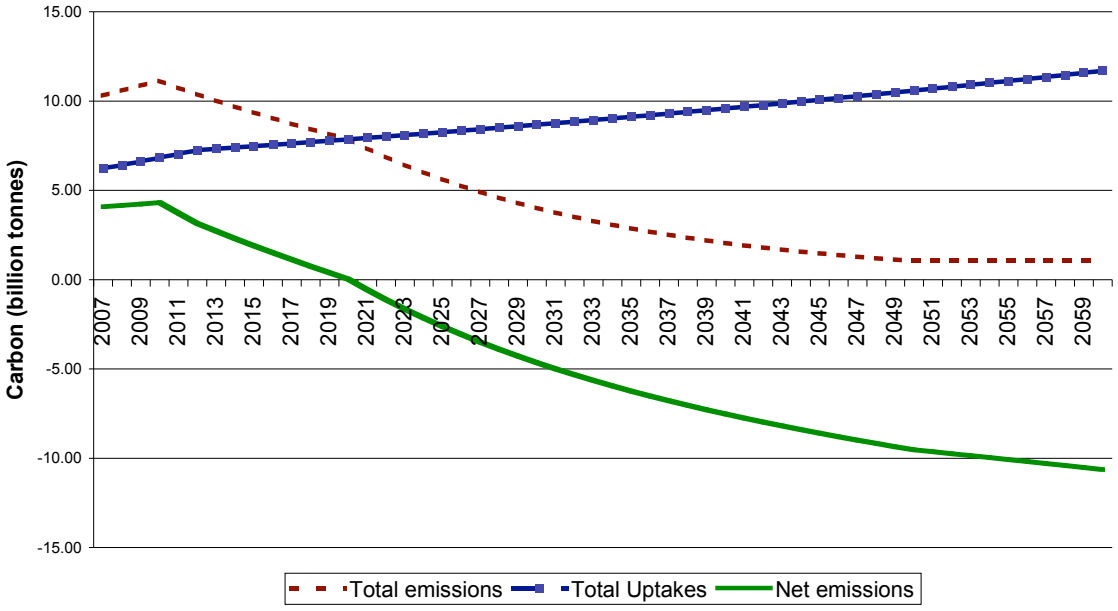
Note to Fig.2

All four data series are indices of the raw data using 1980 as the base year, when the world population was 4.43 billion, the global mean temperature was 14.4°C, and fossil fuel emissions were 5 GtC. By 2006 the world population was 6.38 billion, the global mean temperature was 14.66°C, and fossil fuel emissions were 7.85 GtC.

Sources for Fig.2

Food production, *Prodstat*, FAO; World Population, World Bank, *World Development Indicators*; Temperatures, NASA-GISS; CO2 emissions, from www.cdiac.ornl.gov.

Fig.3 The Garnaut Emission Reductions



Notes and Sources (Fig.3)

The emission reduction schedule shown here is taken from the Garnaut Review's Interim Report, pp.19 and 39, with global emissions peaking around 2010, falling to 2000 levels by soon after 2020, and then for Australia falling to about 90 per cent of the 2000 level by 2050 (for attainment of a global atmospheric concentration – ignoring Uptakes - of no more than 450 ppm $CO_{2\text{-}e}$ by then). The Uptakes schedule here assumes that these continue after 2012 at the historic rate of one per cent p.a. as observed from 1959 to 2000. These continuing Uptakes produce the declining atmospheric concentration shown in Fig.4 below of 280 ppm by 2057/58.

Fig. 4 Atmospheric concentration of GHGs with Garnaut emission reduction programme

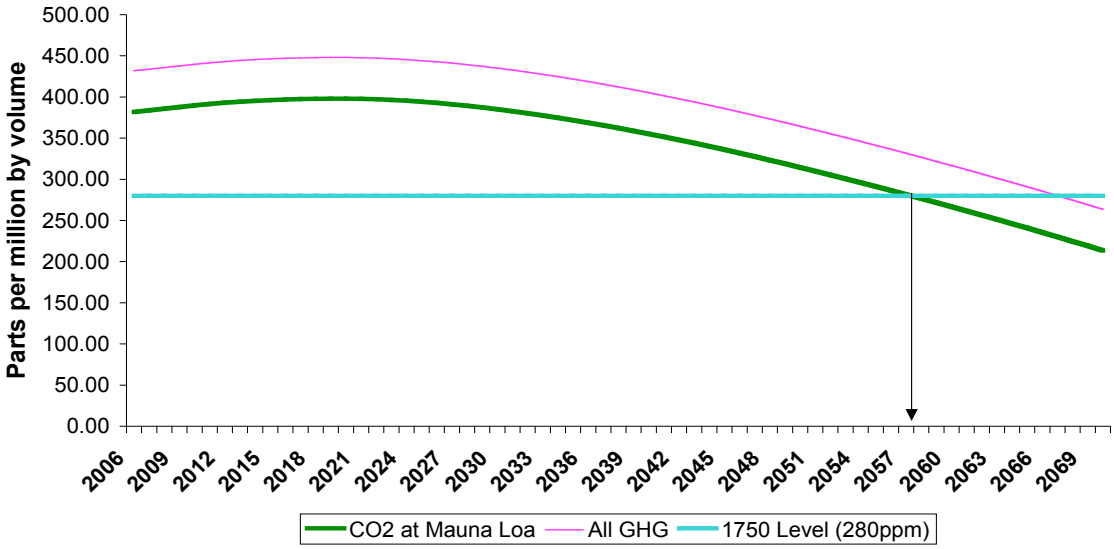
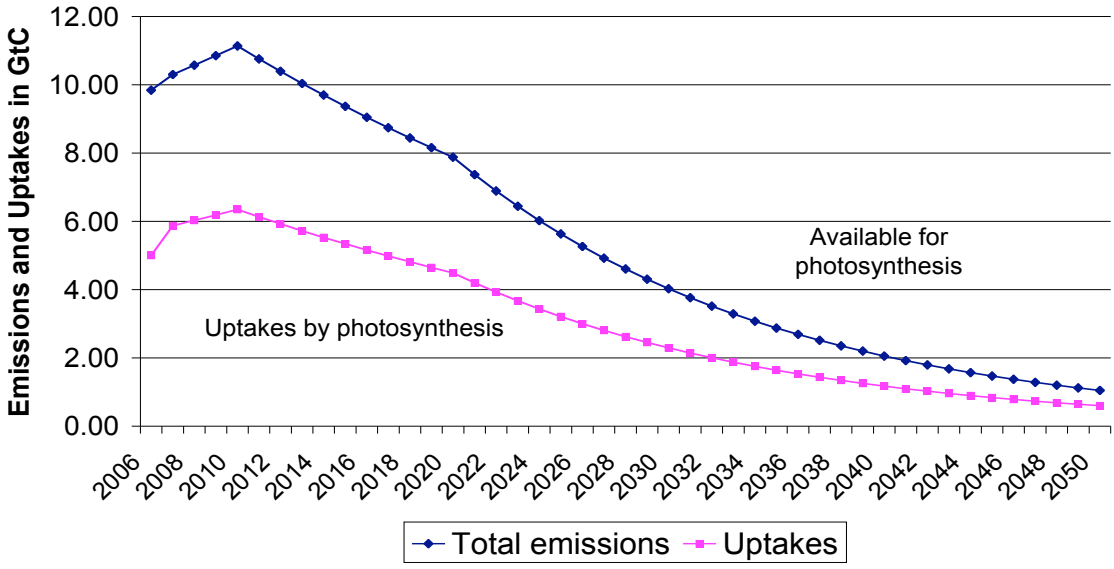
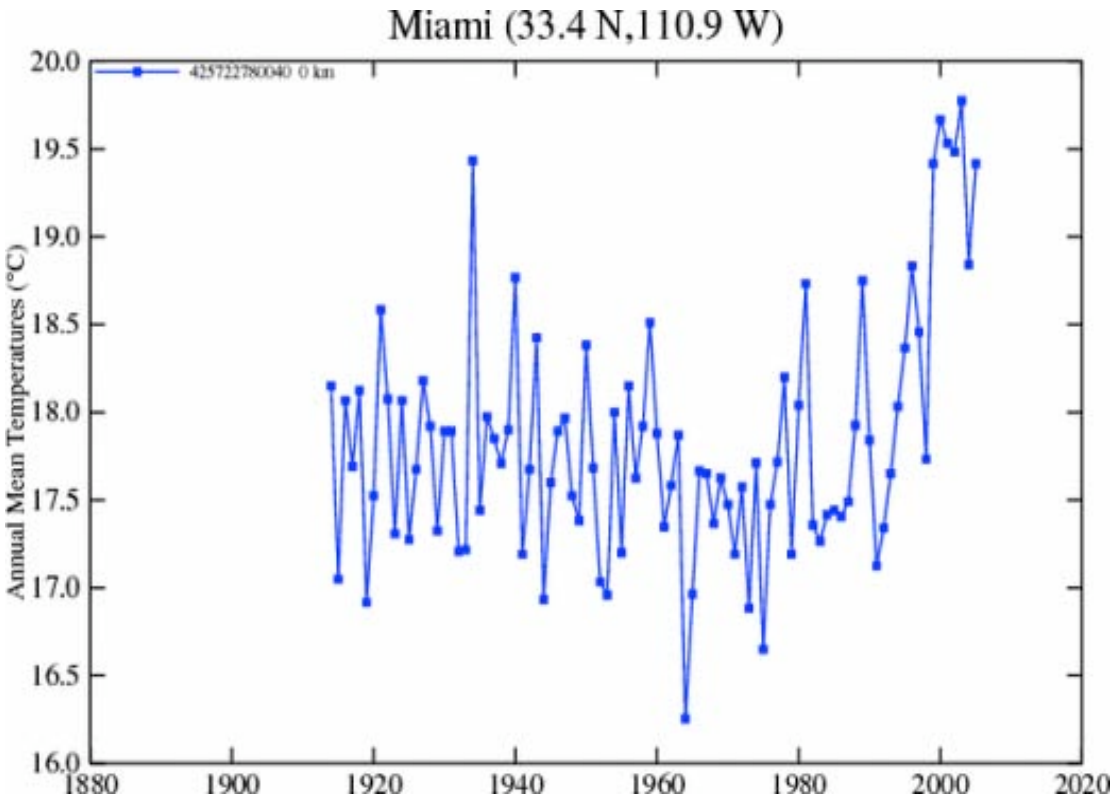


Fig. 5 The Garnaut Plan for World Fisheries and Agriculture

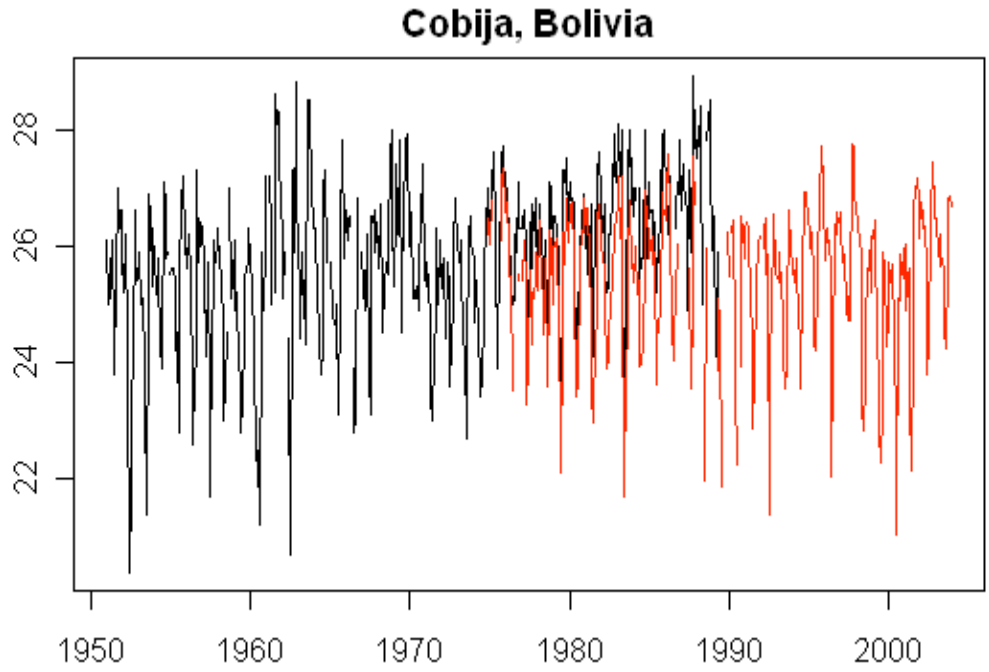


Note: Fig. 5 depicts the availability of atmospheric carbon dioxide for photosynthesis under the Garnaut Plan, using the average rate of Uptakes relative to emissions from 1959 to 2006 of 57 per cent (Canadell *et al.* 2007a, Table 1).



Notes for photograph of, and the GISS data (above) from, the weather station in Miami, Arizona. This "rural" weather station was relocated to this clearly urban site in about 2000, with resultant spike in the temperature record.
Source: Anthony Watts, www.climateaudit.org, who displays similar photographs and GISS data for many other "rural" stations in the USA.

Fig.6 The Missing data from Cobija in Bolivia, not recorded in the NASA-GISS monthly series since 1988, because it is not CC (climatically correct)?



Source for Cobija, Bolivia, and the uncollated GISS data – its global monthly record has omitted Cobija since 1988 (GISS classifies the site as "rural" but the data is collected from the airport at a large town):
Stephen McIntyre, www.climateaudit.org, 27th February 2008

Endnotes

[1] Tim Curtin was an economic adviser for the Ford Foundation, European Union, Crown Agents, and the World Bank in East Africa, Egypt, Nigeria, and Papua New Guinea between 1970 and 1999.

[2] IPCC: Working Group I Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change 2007, especially Table 7.1, in *Climate Change 2007. The Physical Science Basis*. CUP, Cambridge. For Table 1 here see Canadell, J. and C Le Quéré, M.R. Raupach, C.B. Field, E.T. Buitenhuis, P. Ciais, T.J. Conway, N.P. Gillett, R.A. Houghton, G. Marland, Contributions to accelerating atmospheric CO2 growth from economic activity, carbon intensity, and efficiency of natural sinks. *Proceedings of the National Academy of Science of the USA,* October 25, 2007. For the claim of already "saturated sinks" see Canadell, J., and P. Ciais, T. Conway, C. Field, C. Le Quéré, S. Houghton, G. Marland, M. Raupach, E. Buitenhuis, N. Gillett, 2007. *Recent Carbon Trends and the Global Carbon Budget*. Global Carbon Project, Canberra.

[3] The basic equation is an accounting identity, namely that the change in any given year in the atmospheric level of carbon dioxide, C, is necessarily equal to the difference between the volume of emissions (M) in that year *less* the uptakes by global synthesis (U). So we have

$$C = M - U \ldots (1)$$

and then, given data for C and M (in GtC), we have

$$U = C - M. \ldots (1').$$

[4] Canadell *et al.* (including Houghton R.A. and Ciais P.) (2007a:4) justify their lower figures for the land-use flux of only 1.6 GtC solely on reductions in deforestation estimated in an FAO paper (*FAO Forestry Paper 147*, 2005), even though elsewhere (IPCC 2007) it suits these authors to support claims of ever *increasing* deforestation (e.g.,Gitz and Ciais, *Climate Change*, 67: 167-184,2004), like those in Stern (2007) and also in Garnaut's Interim Report (e.g. pp.40, 42). The FAO paper provides no basis for the reduction in the Houghton (2003) and Gitz (2004) estimates of the land use flux, as it is simply non-comparable in scope and coverage, and thus provides *no* data on the flux from land use change.

[5] R.A. Houghton, *Tellus*, 55B: 378-390

[6] Hansen, J. and M. Sato (2004). Greenhouse gas growth rates, *Proceedings of the National Academy of Science*, November 16, 2004, vol.101, 46, 16109-16114.

[7] Houghton, J. (2004). *Global Warming. The Complete Briefing*. CUP, Cambridge.

[8] Blom, T.J.; W.A. Straver; F.J. Ingratta; Shalin Khosla; Wayne Brown (2002-12). Carbon Dioxide In Greenhouses

[9] Dyson, Freeman (2007). *A Many-colored Glass. Reflections on the Place of Life in the Universe*. University of Virginia Press. Charlottesville and London.