Nature&Society

The Journal of the Nature and Society Forum **February - March 2007**

Editorial

In Britain there is no doubt that the herring gull (a bird with silver-grey wing backs) and the lesser black-backed gull are distinct species; even the birds agree. But travel around the Arctic Circle and you find a ring of gulls, each able to breed with the neighbouring birds, in which birds change subtly from one area to the next. It is only where the ring meets up with its tail that the two species are distinct.

Similarly in the mountains around the central valley of California there exists a ring of salamanders, with strongly blotched markings on the eastern side, getting plainer and plainer towards the western side of the arc. In that southern section, the two species are quite distinct.

> *Not only is life on this planet amazing, and deeply satisfying, to all whose senses have not become dulled by familiarity: the very fact that we have evolved the brain power to understand our evolutionary genesis redoubles the amazement and compounds the satisfaction.*
>
> *Richard Dawkins*
> *The Ancestor's Tale, 2004*

This year we celebrate the three hundredth birthday of Carl Linnaeus, the originator of the Linnaean system of classification of botanical and zoological specimens, with its distinctive names of genera and species. The classification was an enormous step forward for science, enabling the rapid development of botany, zoology and palaeontology. It is a basic tool of taxonomy, a study that is vital for pest control and quarantine (although, sadly, too few students elect to become taxonomists nowadays).

Humans have always liked to classify and divide, and give names to categories. Babies are applauded when they learn to distinguish between dogs and cats, horses and cattle. But it is salutary to realise that it is only because all the intermediate species are extinct that such classification is possible.

In the pilgrimage to the dawn of life that is told in Richard Dawkins' *The Ancestor's Tale* modern humans travel back through time to find their ancestors. Every other modern species is also seeking to find their ancestors. At our first rendezvous point humans join up with chimpanzees as we meet our most recent common ancestor, or concestor, in Dawkins' terminology. Together we travel back until we meet the gorillas, as they and we find our concestor. And so it goes, joining with more distant relatives at each rendezvous. Animals eventually meet the plants, and all together go back to find the earliest forms of life on earth. Along the way many pilgrims tell tales and the whole is a varied and interesting exposition on evolution, well worth reading. Dawkins shows that all evidence from fossils, genetics and other branches of science agrees that life is a continuum, that evolution accounts for the amazing variety of life, and that this is wonderful and inspiring in its own right.

From Linnaeus on, science has progressed by separating and categorising, and there is still need for this in many situations. At the same time it is now necessary to look at all the connections in the world, the blurring of borders between species, between sciences, between all parts of the environment.

We can only appreciate our place in the world when we realise that there has been a continuum of species between ourselves and the chimpanzees, that we are first cousins, as

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it were. A few centuries ago it was reasonable to see humans as distinctly different from animals. Now whatever criterion we consider, tool use, tool making, intelligence, communication, empathy, even morality, we find that some other species exhibit something of the same feature. Dolphins, apes, elephants, birds, the more we study them, the more of what were considered to be uniquely human characteristics are to be found to extend to other species. This does not come as a surprise to anyone who has lived closely with animals. The surprise is that anyone could have thought differently, could have thought that animals had no intelligence, were just automatons with simply instinctive actions and reactions; that they had nothing in common with us.

The blurring of borders between species is reflected in the blurring of boundaries between different areas of scientific study. In the eighteenth century men (and women) of science studied whatever took their fancy. Polymaths were common. As separate science disciplines developed, so specialisation became important. But learning more and more about less and less has limitations, and now we find that all sciences interlink and need cross-disciplinary teams.

In this book we are concerned with evolutionary history, with the dead as well as the living. When we are talking about all the animals that have ever lived, not just those that are living now, evolution tells us there are lines of gradual continuity linking literally every species to every other. When we are talking history, even apparently discontinuous species like sheep and dogs are linked, via the common ancestor, in unbroken lines of smooth continuity.

Richard Dawkins
The Ancestor's Tale, 2004

Darwin himself worked in biology and zoology, the broad domain of the naturalist. Even then it was obvious, if you care to think that way, that the interaction between biology and geology works both ways. The existence of limestone, coal and oil is sufficient to prove it. Now it is known that life has even had a role in the formation of some ore bodies.

In this way the huge impact of humans on every aspect of the environment is part of the continuum of interaction between life and the physical world. The trouble is that we have developed unusually powerful ways of interacting with the environment. Because of our intelligence, we could take intelligent action to limit, or even reverse, the damage we are doing.

Unfortunately there are people in influential positions who refuse to acknowledge the reality of what we are doing to the earth. Some of these same people refuse to believe that evolution has occurred.

Given the overwhelming evidence for the age of the earth, and for the fact that evolution has occurred, this is amazing, and sad. Not only has evolution occurred, but it is occurring now; there are well documented cases of it amongst the finches of the Galapagos and in other places. Doctors coping with antibiotic resistance in bacteria, farmers experiencing increasing resistance to herbicides and pesticides in crop pests, are experiencing real time evolution. To deny this science is to deny ourselves the ability to understand a great deal about the earth. The more we understand where we have come from, and our kinship with all life on earth, the better our chance of avoiding the disasters our hubris looks set to engender.

Jenny Wanless

Nuclear power

...nuclear power only reduces the greenhouse impact of producing electricity if there are rich deposits of uranium ore. Once they are exhausted, so much conventional energy will be required to produce nuclear fuel from the low-grade deposits that the process will release more carbon dioxide than burning gas to generate the same amount of electricity. The known resources of high-grade uranium ore are equivalent to about 20 years use at the present rate, with nuclear power producing about 10 per cent of the world's electricity. So the conclusion is clear: the resources simply do not exist to allow nuclear power to replace other forms of electricity production, even if nuclear power were seen as environmentally and socially acceptable.

Ian Lowe, A Big Fix, 2005

Nature and Society

ISSN: 1038-5665

Editor: Jenny Wanless

Publisher: Nature and Society Forum 2007

Nature and Society© is the journal of the Nature and Society Forum, GPO Box 11, Canberra ACT 2601, and is published six times a year.

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Where we are:

Our rooms are in the South West Wing of Weston Creek Primary School, Minns Place, Weston, ACT.

By car: from Civic, follow the signs to Weston from the Tuggeranong Parkway and continue to Weston by veering left from the traffic lights at the Cotter Road turnoff. This takes you along Streeton Drive for one kilometre, then turn left into Hilder Street (there is a small signpost pointing along Hilder Street). Drive around behind the school into Minns Place and then into the car park. Our rooms are down the slope to the left of the school building – about 40m from where you'll park your car. Follow the sign to 'Sustainability Groups'.

There is space for three or four cars for disabled access close to the entry. There are ramps over the kerb from this small parking space and entry to our building is without steps.

By bus: The 126 bus route from Central Canberra and walk 200m.

By bicycle: The office is adjacent to the western trunk cycle path between Civic and Tuggeranong.

The obvious lesson to be learnt by developed nations about the Angkor story is that climate change, population pressures, and over-use of natural resources can bring sophisticated societies to an end. It's a lesson that becomes gloomier each time it is re-learnt.

Richard Stone, University of Sydney, 2006

Forthcoming NSF meetings

For the latest information visit our website www.natsoc.org.au and click on "What's On".

21 February 2007 – Origins of the Nuclear/ greenhouse impasse: a view from the earth and anthropological sciences.

Venue – The Emeritus Faculty, ANU; 7:30pm

Dr Andrew Glikson will explore aspects of the ongoing mass extinction of species in terms of prehistoric evolution, the emergence of civilisation and the advent of modern science. The imbalance created between the innovative powers of an overgrown neocortex on the one hand, and the mammalian brain on the other hand, leads to an impasse which threatens advanced life forms. Random creativity results in often destructive technological determinism. The consequence of these developments – the combined climate crisis and nuclear paradigm – threaten an anthropogenic mass extinction. However, the strongest force on Earth remains the life force, which has survived for four billion years despite catastrophes such as volcanic activity, tsunami, asteroid/comet impacts, ice ages and greenhouse effects.

Dr Glikson is an earth ecientist from the Australian National University. His work focuses on the early history of the Earth, including mass extinctions and the philosophy of science. His current research includes the effect of early asteroids and comets on evolution and the role of *Homo sapiens* in recent terrestrial evolution.

21 March 2007 – This year we are trying a variant on the monthly discussion meetings (see next page). In February, and then in every second month, we shall have a guest speaker as usual. In the alternate months we shall have a roundtable discussion on a predetermined topic associated with what NSF does, how it might do better and what new directions we might take. These meetings will help guide the NSF board. The first of these, in March, will be on the proposed strategic plan for NSF. A copy of the interim plan will be sent to you shortly, together with a copy of the Earth Charter, as its principles are endorsed in the proposed plan. Members who cannot attend the meeting are welcome to send in their comments and suggestions, for consideration by those present at the meeting.

Venue – NSF rooms (see left); 7:30pm

Signs of hope for sustainability in 2007

Brendan Mackey,
Chair Nature and Society Forum Board

The Preamble to the Earth Charter argues that we '*… stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise'*. As we look around locally, national and globally, it is easy to despair at the environmental degradation, the ongoing war and violence (with over one trillion dollars spent annually on the world's military), poverty, increasing loss of biodiversity, deforestation, and of course global warming.

However, if we peer beyond the gloom there are increasing signs of hope that the world is making the phase shift towards a more sustainable, just and peaceful world. Everywhere, in all sectors, at all levels, we find committed individuals and organisations who are working hard to bring about the real changes sustainability demands. The Nature and Society Forum is one such sign of hope. Unlike a conventional social club, where the members join for the benefits the club provides them, NSF exists as a vehicle for members to contribute to meeting the challenges of sustainability.

> *In fact, practically all desirable features of modern life were once utopian visions made real by visionaries who worked systematically to achieve their dreams of a better world. Similarly, anyone who thinks about the impact of our choices on other species, on future generations and on the less privileged of this generation, has a moral responsibility to work towards a sustainable future.*
>
> *Ian Lowe*
> *A Big Fix, 2005*

In my work as a professor of environmental science at the Australian National University (and related activities such as being a member of the Earth Charter International Council), I am in contact with cognate community sustainability organisations throughout the world; such as the Center for Humans and Nature (USA) and Centre for Science and Environment (India). Although these organisations do great work, we perhaps do not sufficiently appreciate the quality of NSF's intellectual capital and just how much the organisation achieves largely on a voluntary basis. The quality of NSF's output is without doubt world class, and on a par with comparable international organisations. This is why I joined NSF and why I am honoured to chair its newly formulated board in 2007.

As I hope you are all aware, the organisational structure of NSF has now changed, with the Management Committee being replaced by a Board. The role of the Board is to provide leadership in strengthening governance processes for NSF in keeping with the expansion of its mission, as well as continuing the important management role of the previous Management Committee. The new Board has a primary responsibility for ensuring NSF has the reach, profile and impact that is commensurate with its vision and intellectual capital.

Over the last few months, the NSF Board has been focused on our organisation's strategic plan. We have considered our vision and mission; and have arrived at a set of strategic objectives for 2007/2008. We have identified new opportunities for our beloved journal; and, have agreed on a major innovation for 2007 – every second month the public seminar is replaced with a *Members' Workshop* (the first of these will be on 21 March).

We are now in the final stage of the strategic planning process which involves determining the best approach to managing and integrating NSF's major projects: (1) Social Change; (2) The Australian National Sustainability Initiative (ANSI); (3) SEE-Change and (4) the nomination of the ACT as a Biosphere Reserve. We must find ways of avoiding duplication of effort and cross-signalling to external interested parties. We need to share resources and create a stronger team and membership base with an influential voice. We must find the common ground that will allow us to work together and enable real change to take place. The March *Members' Workshop* will focus on the draft strategic plan. We are inviting members to come along, discuss the plan, and identify ways that, through working together, it can be implemented.

NSF has a unique contribution to make in advancing sustainability, with our integrative focus on 'Healthy People, Healthy Planet', innovative thinking, connections across sectors, and long term commitment to education as a prime catalyst of social change. NSF can be a much needed sign of hope for sustainability in 2007 and beyond. I look forward to working with you in the coming years to make this vision a reality.

A Big Fix

We live in interesting times indeed, times which will affect the future of human civilisation and of all life on this planet for a very long time. For many decades environmental thinkers have been warning of dangers ahead, and now an increasing number of scientists are adding their warnings. The list of dangers is long: climate change, soil degradation, lack of water and polluted water, destabilisation of land and marine ecosystems, mass extinction, the decline of the age of oil. For the most part these warnings have been either disputed or ignored.

Now at last, as the evidence is becoming irrefutable, it seems that many people accept that the problems are real. The Stern Report, detailing the economic reasons for action, is partly responsible. So too is Al Gore's *An Inconvenient Truth* which has reached a mass audience in a way that has not been achieved by other means. With this growing acceptance has come some action, not least by some of the state governments in the USA, appalled by the lack of action by their federal government.

> *We should always remember that the future is not somewhere we are going, it is something we are creating.*
>
> *Ian Lowe*
> *A Big Fix, 2005*

In Australia there has been even less action, although some local governments are beginning to act. It almost passes belief that in a country suffering the water shortages and the drought-fuelled bushfires we are experiencing, most governments are still urging population growth.

In Ian Lowe's book *A Big Fix: radical solutions for Australia's environmental crisis* the author analyses the problems of achieving worthwhile change. As he says, there are three basic problems with the present economic system, one being its emphasis on growth, another its neglect of the long term, and the third its failure to incorporate the impact on natural systems into how much things cost. So the economic system sees no need for change. Anyway, it indulges in econo-mysticism, thinking that suitable price systems can solve any problem.

In addition to the economic obstacles, there are others. One is the problem of technical hubris, another the role of the mass media, which are reluctant to antagonise advertisers. One obstacle that is frequently mentioned is that not enough is known, knowledge is incomplete; but this is really a furphy. Quite enough is known to take sensible action, for example, energy efficiency and a major uptake of solar technologies would be a good beginning, and a win-win situation for everyone other than the major polluters.

Unfortunately short term thinking is inherent in our political systems. Politicians just want to win the next election. They and the public keep hoping that something will turn up, a technical break through will avert the worst dangers. Anyway, the future can look after itself.

Lowe suggests that there are four steps in achieving change. The first is discontent with the present system. Then there needs to be a vision of a better alternative. The third step is a view of a way to get there, a visible pathway. Lastly it is necessary to have a genuine commitment to achieve the goal.

The goal we should strive for in Ian's own words is a HEALTHIER society. This will be **H**umane, take an **E**cocentric **A**pproach, use a **L**ong **T**ime **H**orizon for planning purposes, be **I**nformed about the consequences of our choices on natural systems, be **E**fficient in its use of natural resources, and be **R**esourced. Resourced in this context means that it will have made the transition from fossil fuels that are limited or unacceptably polluting to the abundant flows of renewable energy.

If we can use the current discontent with the growing inequity in society, and the realisation that it is unsustainable in the long term, to point the way to a HEALTHIER world, then surely we can get society heading in that direction, with a commitment to work for the good of future generations.

A Big Fix; radical solutions for Australia's environmental crisis, by Ian Lowe (2005), is one of the Public Interest Series, a joint venture by the Australian Collaboration and the publishers Black Inc.

This small book provides a good summary of the current situation, the environmental situation, the need for sustainability and what that would mean. It is well worth reading and would be helpful to any groups who are trying to find the way forward, such as the SEE-Change groups.

Jenny Wanless

Spaceship Earth in trouble

Imagine you are on a futuristic intergalactic space ship, millions of miles away from base, with fuel running out and toxic fumes leaking into the cabin. The ship's on-board scientists investigate the problem, warning the only solution is to stop the leaks, design new technology and apply non-toxic energy sources.

In 1986 Wallace Broecker, the famous marine scientist of Columbia University, wrote: "The inhabitants of planet Earth are quietly conducting a gigantic environmental experiment … we play Russian roulette with climate and no one knows what lies in the active chamber of the gun".

Ever since land plants emerged on Earth some 425 million years ago (represented by *Cooksonia, a* small plant with sporangia-bearing bifurcating axes), a fundamental change has transpired in the terrestrial environment. The progressive build-up of a combustible carbon-rich layer and its buried equivalents has allowed episodic release of CO_2 and CH_4 to the atmosphere. This has resulted in potential tinder-box conditions on land surfaces during periods of maximum solar irradiation. By contrast volcanic eruptions and asteroid and comet impacts had mixed effects, including cooling by dust and sulphur aerosols and heating by greenhouse gases.

> *Happiness or "feeling good" is how selfish genes direct our behaviour ... We are just fancy robots that make up enormously complex excuses for our behaviour.*
>
> *Jay Hanson*
> *Internet, 19 December 2006*

Such episodes occurred repeatedly through Earth history, triggering severe atmospheric disturbances and mass extinctions, for example, at 374, 267, 251, 210, 65 and 54 million years ago. During the 54 million years-old greenhouse event (Paleocene-Eocene Thermal Maximum), attributed to large scale methane and CO_2 release, temperature rises exceeded 7^{O}C.

The last such event, the *Younger Dryas* (11.5 thousand years ago), involved temperature increases of over 5^{O}C, accompanied with catastrophic melting of North American ice sheets, causing retardation of the Gulf Stream and consequent freezing conditions in Europe. In the wake of rapid sea level rises by almost 120 metres (likely reflected in the story of Noah's flood) the onset of the Holocene allowed previously nomadic hunter gatherers to settle and develop irrigation systems in well watered river valleys of the Middle East and China, where civilisation was born. According to Walter Ruddiman, deforestation and agriculture enhanced CO_2 release from biomass, prolonging the Holocene—also, thus, called the *Anthropocene*.

From the mid-19th century, internal combustion resulted in the rise of greenhouse gas concentrations in the atmosphere and of temperature, accelerating from the mid-1970s. These rises are a large factor to over an order of magnitude higher than those of the last interglacial greenhouse global warming episodes, which resulted in sea level rise as high as 120 metres.

If natural greenhouse events, triggered by a combination of elevated solar irradiance and release of carbon from land surfaces, were precipitous enough, consider a greenhouse event perpetrated by the combustion of hundreds of billions of tons of carbon and hydrocarbons stored in geological strata during several hundred million years of Earth evolution.

Evidence that a runaway greenhouse process is already in force (see table next page) comes from:

1 Rise of atmospheric CO_2 levels (mid-19th century - 280 ppm; 1998 - 365 ppm; 2003 - 381 ppm)

2 Rise of the growth rate of CO_2 (1880-2000: +0.57 ppm/year; 2000-2005: +1.8 ppm/year)

3 Increase in atmospheric methane (1860-2000: from 750 to 1750 ppb)

4 Sharp temperature rises, in particular since the 1970s (land +1.1, sea +0.3, air +0.5^{O}C)

5 Melting of ice caps (NASA satellite detection of ice loss of 152 km^3/year from 2002; submarine detection of Arctic sea thinning by c.40 per cent).

6 Development of CO_2 emitting land sources at the expense of CO_2 sinks, due to a combination of rising temperatures, droughts, land clearing and fires.

7 Acidification of oceans (pH declining by -0.1 during the 20th century).

8 Decrease in the CO_2-buffering capacity of the oceans by rising temperatures and acidity.

The accuracy of some of the predictions is bound to change with further measurements, but there is no basis for questioning the sound nature of the science, nor of the professional integrity of hundreds of climate scientists. Unfortunately, the observations made in numerous scientific papers, including reports by major research organisations, including CSIRO, NASA, NOAA, Hadley Research Center, and the IPCC are all too credible.

That climate change accelerated from the mid-1970s places the responsibility on our own generation. We owe it to future generations, and we owe it to other living species, to discontinue the use of the atmosphere and the hydrosphere of this precious planet as open sewers.

Table 1. Mean and change-rates of temperature anomalies, atmospheric CO_2 and CH_4 levels, and sea level changes during the end-glacial, Holocene, 1860-2000 and 2000-2005.

	Temperature anomaly °C	**CO_2 ppm and change rates**	**CH_4 ppb and change rates**	**Sea level (metres) and change rates (cm/year)**
17-10 kyr	+9°C+0.0012 °C/year	180 -260 ppm +0.011 ppm/year	350-650 ppb+0.04 ppb/year	-120 to –60 metres +0.85 cm/year
10-7 kyr	-	-	-	-50 to –4 metres +1.53 cm/year
Holocene 10-0.15 kyr	-0.0017°C	265 to 255 ppm(decline)	215 to 185 ppb(decline)	7 kyr to 1860: +4 m+0.058 cm/year
1000-1850	-1.5°C-0.0018°C/year	-	-	-
1860-2000	+0.8°C +0.0057 °C/year	280-360 ppm +0.57 ppm/year	750-1750 ppb +7.1 ppb/year	+20 cm +0.14 cm/year
1910-1945	+0.45°C +0.013 °C/year	-	-	-
1945-1975	Fluctuates/stable	-	-	-
1975-2000	+0.4 °C +0.016 °C/year	-	-	-
2000-2005	+0.15-0.3°C +0.03-0.06 °C/year	+1.8 ppm/year	-	+3.4-3.7 cm +0.29-0.33 cm/year

Data sources: US National Oceanic and Atmospheric Agency; Goddard Institute of Space Science; NASA; CSIRO.

Andrew Glikson, Department of Earth and Marine Science, Australian National University

Post Armageddon

I have a post-Armageddon vision. We and all other large animals are gone. Rodents emerge as the ultimate post-human scavengers. They gnaw their way through New York, London and Tokyo, digesting spilled larders, ghost supermarkets and human corpses and turning them into new generations of rats and mice, whose racing populations explode out of the cities and into the countryside. When all the relics of human profligacy are eaten, populations crash again, and the rodents turn on each other, and on the cockroaches scavenging with them. In a period of intense competition, short generations perhaps with radioactively enhanced mutation rates boost rapid evolution. With human ships and planes gone, islands become islands again, with local populations isolated: ideal conditions for evolutionary divergence. Within five million years, a whole range of new species replace the ones we know. Herds of giant grazing rats are stalked by sabre toothed predatory rats. Given enough time, will a species of intelligent, cultivated rats emerge?

Richard Dawkins, The Ancestor's Tale, 2004, p 154

‘Is your trip necessary?’

During World War II, petrol for civilian use was tightly rationed. People were urged to make more efficient use of their cars and to double up whenever possible. At the same time, prominent posters urged everyone to ask the most important question: ‘Is your trip necessary?”’ Now that a paralysing collision between the growth of aviation and concerns about the global and local environments is becoming more apparent, it is timely to once again ask the question.

The incentives and encouragements to travel—especially overseas air travel—arrive regularly in my mailbox. My credit card points scheme encourages me to take rewards by flying to London or Paris, touring the UK and Ireland, or ‘taking the kids to Disneyland.’ ‘The world is your oyster,’ I’m told. Likewise the motoring organisation I’m a member of has an active promotion scheme for travelling the world, for example by touring Europe or Canada and Alaska. Additional options appear in the Odyssey Ed-Ventures catalogue, with its associated educational opportunities. It offers me 14 nights in Egypt or 24 nights in China, including the Yangtze Gorge and the Great Wall of China.

Take the average domestic power tool. However much DIY we plan on doing, the truth is we throw these away after using them, on average, for just 10 minutes. Most will serve ‘conscience time’, gathering dust on a shelf in the garage, but the end is inevitable: thousands of years mouldering underground.
A power tool consumes many times its own weight of resources in its design, manufacture, packaging, transportation and disposal, all for a shorter active lifespan than that of the average mayfly.

Ed Douglas
New Scientist, 6 January 2007

Things have certainly changed from the days of Thomas Cook. In the developed world, international travel over long distances has become less exceptional, more mundane and even routine. People travel in some cases to sustain family ties and other personal relationships at a distance (hence George Monbiot’s reference in his 2006 book *Heat* to ‘love miles’). In other cases, regular international travel for holidays is an assumed part of the annual routine of family life.

International travel is also often an increasingly prescribed and extended part of one’s education and working life, or used for attending sports or other leisure activities. The sheer weight of advertising underlines the fact that long-distance air travel has become embedded in the lives of individuals, households and organisations.

Sustainable transport academic Professor John Whitelegg observes that distance has been transformed into a commodity that is consumed at an increasing rate, using large amounts of energy and large amounts of public expenditure. Another important element is the growing number of tourists. The driving force behind global tourism and air travel is primarily the global economic system—indeed increased economic globalisation assumes increasingly mobile societies. In contrast with 697 million international tourist arrivals (i.e. arrivals from abroad) in 2000, the World Tourism Organization expects the number of arrivals to reach one billion by 2010 and 1.6 billion by 2020.

Although a number of community and environmental organisations have highlighted the ecological implications of this growth, perhaps more surprising is the role taken on this issue by two official bodies in the UK, namely the Sustainable Development Commission and the Royal Commission on Environmental Pollution. The Royal Commission, for example, has consistently flagged that ‘emissions from aircraft are likely to be a major contributor to global warming if the present increase in air traffic continues unabated.’ In a special report entitled *The Environmental Effects of Civil Aircraft in Flight*, it expresses deep concern about the global impacts of the rapid growth in air travel.

One estimate by the commission suggests that if air travel expansion in the UK goes unchecked, aviation will be costing about a quarter of the UK’s climate change budget by 2020, and by 2050 this could have risen to over half or even three quarters of the budget. (The calculations assume that the rest of the economy moves along the commonly quoted pathway towards a 60 per cent reduction in emissions by 2050. They also use the three times factor for enhanced radiative forcing that applies to aviation emissions at altitude.)

A typical adaptive approach is to improve aircraft efficiency. For example, Boeing’s new 787 will burn 20 per cent less fuel than the 767 it will replace. The promotion of the large Airbus A380 is also linked to its lower fuel consumption characteristics.

However, the efficiency improvements both per aeroplane and per passenger kilometre are small when compared with the effects of the expected growth. More and more people travelling by air

basically means more airport capacity, more flights, and more pollution.

Air travel is typically forecast by the aviation industry to grow at 4 to 5 per cent a year for the next 10 to 15 years. In areas such as the Asia-Pacific, growth rates of 7 per cent a year are tipped until the 2020s. Canberra Airport celebrated a 6 per cent increase in passenger movements in a year with an item entitled "Passenger numbers soar" in the February 2006 issue of its newsletter *The Hub*. Sydney Airport's master plan predicts a near trebling of passenger numbers (to 68.3 million) between 2003 and 2023. Aircraft manufacturers like Boeing and Airbus are planning for significant growth in air travel, with plans to sell substantial numbers of aircraft to China, for example.

The juxtaposition of such planned growth with increasingly dire reports about climate change is nonsensical. In essence, the growth-oriented visions for aviation held by the aviation and tourism industries run directly counter to the deep cuts in greenhouse gas emissions that are required to address global warming. Does the aviation industry think it is excluded from the need for deep cuts in emissions? As Prof. Ian Lowe says in his book *Living in the Hothouse* (p. 202): 'Now that we have reached the point of perturbing the global climate, it is a dangerous illusion to think that our impacts can be expanded still further with impunity.'

> *... consumerist culture instead idolises novelty. We know we can't buy happiness, but the chance to remake ourselves with glossy, box-fresh products seems irresistible. When the novelty fades we simply renew the excitement by buying more stuff.*
>
> *Ed Douglas*
> *New Scientist, 6 January 2007*

Jack Saporito, part of an alliance of residents concerning Chicago O'Hare Airport in the USA (http://www.areco.org/), suggests that many activists are fighting the wrong battles. The major problem is growth—not noise or emissions, because noise, emissions etc. grow proportionally with the growth in flight numbers.

Governments typically view tourism as a way of boosting the economy and therefore ignore its environmental and greenhouse impacts. Given that a broader ecological framework in relation to tourism is only just emerging, it is thus not surprising that the environmental ramifications of tourist travel, and air travel in particular, have been neglected. Recent work suggests that air travel for tourism has a very significant environmental impact, particularly with international and long-distance flights.

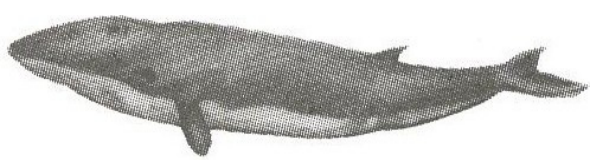
The task of reframing tourism presents a significant challenge. Not only does it challenge the assumptions underlying economic globalisation. Two generations of OECD citizens have become accustomed to relatively inexpensive long-haul travel, with leisure travel accounting for up to 80 per cent of air travel. Environmental considerations generally rank low in consumer criteria for choosing a holiday destination and the means for getting there, and tourism marketing rarely seeks to provide information on the environmental impacts stemming from air travel.

George Monbiot in his book *Heat* highlights the contradiction between intention and action when it comes to flying. When challenging his friends about their planned weekend in Rome or their holiday in Florida, he comments: "They respond with a strange, distant smile and avert their eyes. They just want to enjoy themselves. Who am I to spoil their fun? The moral dissonance is deafening" (*The Guardian*, 28 February, 2006).

The growth of aviation worldwide is very much part of global consumer capitalism, which is high-growth, high-energy, and ecologically unsustainable. A huge reduction in international air travel is essential. The British royal commission outlines a range of policy actions that can be used to moderate and reduce demand. Clive Hamilton of the Australia Institute emphasises that a radical transformation of ourselves is also needed.

A few years ago writer Robert Dessaix wrote an article called *Wanderlust*, in which he suggested that the 'quest for salvation' and 'knowledge of the world' have been the driving forces behind travel for millennia (*The Australian*, 9 February, 2000, Review of Books, pages 9-10). However, Dessaix suggests the modern versions have often become trivialised. The current and projected high-energy and high-numbers model for global air travel adds in significant ethical dimensions as discussed so well by Monbiot. He concludes: 'It has become plain to me that long-distance travel, high speed and the curtailment of climate change are not compatible' (*Heat*, p. 188). Hence the question: Is your trip necessary?

Murray May



Birds, sustainability and society

In this time of greatly heightened awareness of the challenge posed to human sustainability by global warming, it may be tempting to dismiss birds as a sideshow to the big picture. Yes they can be colourful and sweet voiced – nice to have around like lots of other living creatures but not of much direct concern for human sustainability. Nothing could be further from the truth.

In Australia at least, some environmental scientists have found that birds are most useful indicators of the state of the environment. In addition to their appearance, Australian birds have distinctive songs which can be readily used to identify them and estimate their numbers, even when they may be out of sight. The density and species richness of a bird population can be relatively quickly assessed by people with the required identification skills. Studies in pastoral areas in New South Wales have already demonstrated the value of reintroducing more trees and shrubs into the landscape. The increased numbers and species of birds found in such plantings can play a key role in making these landscapes more sustainable. Birds reduce insect pest numbers, for example.

We must recognise that we have no future at all even as a species, still less as a civilisation, unless we allow our natural systems to deliver breathable air, drinkable water, nutritious food, waste disposal services, a sense of place, biological diversity, cultural identity and spiritual sustenance.

Ian Lowe
A Big Fix, 2005

It is not just farming districts that may benefit from birds. In our cities, a healthy population of birds in parks and gardens is a good indicator of the health of our urban landscapes. Canberra demonstrates this clearly. Uncommon species such as the beautiful gang-gang cockatoo can still be found close to the city centre. There is enough good quality bushland vegetation there for them to breed and feed.

Becoming involved in birdwatching is a way in which anyone can make a valuable contribution to sustainability. Records can be kept by individuals of birds visiting their garden. These records can be forwarded to bird clubs such as, in Canberra, the Canberra Ornithologists Group (COG). The clubs can consolidate individual data records into useful broad scientific data, identifying trends in the populations of individual bird species.

A further way you can help both the birds and the environment is through the sympathetic management of any land for which you are responsible, such as a garden and/ or perhaps a rural block or some land at the coast. Birds depend directly or indirectly on vegetation – trees, shrubs and grasses – for survival. The trees planted in gardens birds use are also contributing to sustainability by taking carbon out of the atmosphere as they grow. Perhaps of most benefit to birds in the garden is to grow as far as possible local native species of plants, which have been a food source for the local birds for millennia.

The end result might just be something singing 'Egypt' to you in the garden in Canberra. You are likely to have attracted a crescent honeyeater.

Ian Anderson

Words or action?

Every morning when I wake up I ask myself whether I should write or blow up a dam. Every day I tell myself I should continue to write. Yet I'm not always convinced I'm making the right decision. I've written books, good ones, and people have read them. At the same time I know it's not a lack of words that's killing salmon, but rather the presence of dams.

Anyone who lives in this region and knows anything about salmon knows the dams must go. And anyone who knows anything about politics knows the dams will stay, at least for now. Scientists study, politicians and businesspeople lie and delay, bureaucrats hold sham input-output meetings, activists write letters and press releases, I write books and articles, and still the salmon die. It's a cosy relationship for all of us but the salmon.

Derrick Jensen
Endgame, 2006, p381

Japan and whaling

'... environmental issues attract almost no media attention at all in Japan. ... the ordinary Japanese are environmentally conservative at best; at worst, completely ignorant. For example, the Japanese tend to believe that the supply of fresh water is unlimited. ... They also have little knowledge of environmental and related political issues.'

Whaling a short tradition in Japan, Canberra Times, 26 December 2006, by Tets Kimura and Sandra Egege. Tets Kimura is an Australian journalist originally from Japan.

Curbing the peak

Providing generating capacity to cover peak electricity loads is very expensive; in fact it accounts for up to 45 per cent of the cost of electricity. Yet these loads may occur on only a few days per year. If the peaks could be cut back, less total capacity would be needed, reducing costs and greenhouse emissions.

There are several ways to reduce peak demand. One such is a smart meter being trialled in Queanbeyan by Country Energy. The in-house meter uses a traffic light system to warn householders of the costs they are incurring. A green light shows that the shoulder rate of seven cents per kWh is being charged. An orange light indicates the peak rate of 19 cents and a red light shows it has gone up to the critical peak rate at 39 cents. Householders may well decide to defer turning on the dishwasher or washing machine at such times. Unfortunately the smart meter plus display costs a thousand dollars per unit.

The problems that exist in the world today cannot be solved by the level of thinking that created them.

Einstein

In South Australia, where 92 per cent of homes have air conditioning, electricity usage is particularly inefficient. There a direct load control on air conditioners and pool pumps is being trialled. It turns off the compressor for ten minutes every hour, but allows the fan to keep running. Residents don't even realise that the unit is off, and feel no difference, yet the peak load is reduced.

Industry can make big savings by being aware of critical peaks. A South Australian cement firm, Adelaide Bryant, has found that it can cut off its kilns for a certain time when an alarm system warns that peak demand has pushed up the price of electricity.

In Melbourne one energy aggregator has started to pay people to turn off their power. If it cuts three per cent from peak power, it gets a satisfactory reduction in cost.

Industry's ability to turn off power for short periods is 'money for jam'. Industry would embrace such demand-side response if the idea got attention from government and policy makers, but so far no support has been forthcoming.

Peak demand is largely caused by air conditioners (and the expectation of residents and builders that these are necessary). Better building would ensure they were not needed.

ABC Radio National, Background Briefing, 5 Nov 2006

Comment on 'The microbiology of global warming'

Here we provide two comments on Walter Jehne's article in our December edition. In our next edition we will publish Walter's response to these and other comments received from readers.

Comment 1

I was interested to read Walter Jehne's thought-provoking article in the last issue of *Nature and Society* in which he summarised his views about global warming. He is extremely critical of the work and conclusions of the Intergovernmental Panel on Climate Change, the CSIRO and other groups of climate scientists; and he puts forward some interesting ideas which, we are given to understand, are shared by an unnamed 'group of concerned independent scientists'.

I do not have the scientific competence to make any judgement about the soundness of Walter's arguments. For example I am not in a position to assess his particular interpretation of the Vostok ice core data. He writes that '… the Vostok data fundamentally questions [sic] the validity of our simplistic assumptions about the causal relationships between increasing CO_2 levels and global warming'. He concludes that increases in carbon dioxide concentration in the atmosphere are a symptom rather than a cause of global warming.

However, from material available on the Internet I get the clear impression that, while the Vostok data show a high association between carbon dioxide concentrations in the atmosphere and temperature, they do not, because of the difficulties in precisely dating the air and ice samples, allow a definitive judgement about cause and effect. It is still a contentious issue whether the increases in carbon dioxide concentration precede temperature increases, or vice versa – or whether they increase synchronously.

Walter emphasises the important role of biological processes in the evolution of our planet's climate. Especially interesting is his central hypothesis that bacteria from forests play a very important role as hygroscopic nuclei causing the formation of clouds that reflect sunlight and so have a cooling effect. Deforestation would clearly reduce this effect, and reforestation would increase it.

I certainly look forward to the eventual publication of detailed documentation that is being prepared by Walter and his colleagues.

There is, however, one thing that puzzles me.

I note that Walter refers to what he calls the 'real cause' of global warming, and he implies that he and the group of concerned independent scientists have found it. As I mentioned, he suggests that the increase in atmospheric concentration of carbon dioxide is a symptom, rather than a cause.

However, I find it difficult to understand this rejection of carbon dioxide as a key causal factor in climate change. My reasons are as follows:

1. It seems to be universally accepted that, if it were not for the natural greenhouse effect, the world would be 33-34 ºC colder than it is (see the Nova website of the Australian Academy of Science and the websites of IPCC, and CSIRO and many others). As far as I am aware, Walter and the group of concerned independent scientists do not dispute this.
2. Carbon dioxide accounts for only 15-20 per cent of this natural greenhouse effect (Walter agrees). Most of the natural greenhouse effect is due to water vapour.
3. 15-20 per cent of 33-34 ºC is 4.9-6.8 ºC. In other words, carbon dioxide accounts for 4.9-6.8 ºC of the 33-34 ºC.
4. Therefore if the amount of carbon dioxide in the atmosphere were to be doubled, then surely we could expect the global temperature to increase by a further 4.9-6.9 ºC.

Earlier generations of scientists would have treated the weather and the chemical composition of the atmosphere as givens too. Now we know that the atmosphere, especially its high oxygen and low carbon content is conditional upon life. So our thought experiment must allow for the possibility that in successive reruns of evolution the atmosphere might vary under the influence of whatever life forms evolve. Life could thereby influence the weather, and even major climatic episodes, such as ice ages and droughts. My late colleague, W.D.Hamilton, who was right too many times to be laughed away, suggested that clouds and rain are themselves adaptations manufactured by micro-organisms for their own dispersal.

Richard Dawkins
The Ancestor's Tale, 2004, p 483

I find it difficult to reconcile these four points with Walter's assertion that increases in carbon dioxide may primarily be a symptom, not a cause, of global warming. To my way of thinking, if points 1 and 2 are correct, then an increase in carbon dioxide in the atmosphere would indeed be a 'real cause' of global warming.

So I am yet to be convinced that carbon dioxide it not a real cause of global warming. This is not to say, of course, that other human-induced changes are not also influencing the climate, such as those suggested by Walter – as well, for example, as the important changes associated with 'global dimming'.

Comment 2

Although I do not agree with all of his arguments or statements, it was refreshing to read Walter Jehne's article (December 2006) in which, among other things, the current conventional wisdom of attributing the process of global warming virtually entirely to CO_2 is challenged. Stephen Boyden and I had an exchange of comments in *Nature and Society* in October and December 2004 and March 2005, an exchange which, among other things, made me thing about global warming more analytically and extensively than I had previously.

Apart from my own scepticism about the reliability of estimating temperatures in the distant past, I must endorse Walter's questioning of the significance of correlations of past atmospheric temperatures and CO_2 as a determinant of or a significant contributor to those temperatures. Correlations in themselves do not distinguish between cause and effect and there are circumstances in which an increase in temperature could cause concentrations of atmospheric CO_2 to rise. For example, a rise in temperature (in some ranges) might stimulate a greater increase in metabolic rates of microorganisms and poikilothermic animals than in rates of photosynthesis.

On page 9, column 2, a comment is made about "... the exponential increase in CO_2 emissions since the 1970s ...'. But the next paragraph states that, in the past decade, the concentration of atmospheric CO_2 has increased at an annual rate of 2.5 ppm. Clearly the rate of increase is arithmetic, not exponential.

Walter correctly identifies changes to the earth's surface (I would add, since the advent of agriculture) as a contributor to global warming. The two most significant components of that change are undoubtedly deforestation, with the associated loss of cooling by 'evapotranspiration', and the construction of cities and roads – especially bitumen roads which, when heated by the sun, act as very effective hotplates.

In the general context of the significance of forests in global temperature regulation, an argument is

advanced about the role of bacteria, principally *Enterobacter aerogenes* (previously known as *Aerobacter aerogenes*) released from trees and contributing to cloud formation. The article says 'over 1 billion tonnes of such organic nuclei are produced and released into the upper atmosphere annually'.

This is an example of a statement that needs to be substantiated with supporting references. A billion tonnes of *E. aerogenes* would amount to about 1.5 x 10^{27} bacterial cells. To put that number into some sort of perspective, it is a bacterial count that would 'normally' be found in 15 billion tonnes of human faeces. Of course the species are different in the two situations and I put 'normally' in quotes because doing counts on that amount of poo is not a common practice. But I find it very difficult to accept the claim that bacteria from the leaves of trees can be discharged into the atmosphere at such a rate.

What continues to intrigue me, however, both in Walter's essay and virtually every other article on global warming that I have read, is the absence of any acknowledgement, let alone assessment, of the effect of the heat of combustion on atmospheric temperature. There are many uncertainties and variables in attempting to quantify this effect (and probably more in trying to quantify the role of CO_2), but even the simplest estimates point to real significance.

Over the past century surface air has temperature is estimated to have risen globally by 0.6ºC. Recent global estimates indicate rates of about 0.17ºC/ decade (1). The amount of fossil carbon burnt in 2003 was estimated at 6 gigatonnes. Taking the quantity at face value and, to simplify by assuming the carbon was distributed equally among anthracite coal, decane, hexane and pentane, the amount of heat produced would have been 74 billion G.calories. Without any correction for adiabatic cooling or the latent heats of evaporation and condensation of water, that amount of heat has the capacity to cause an annual increase in atmospheric temperature of 0.067ºC. In other words, it had the theoretical capacity to raise temperature at more than ten times the rate observed over the previous century. And none of that makes any allowance for the heat of bushfires.

As I said above, there are many uncertainties in all of these assessments but, even acknowledging those uncertainties, the figures, as well as simple logic, indicate that the heat of combustion should be taken very seriously. Yet nowhere in government policy or public thinking generally is there any significant attention given to anything but 'greenhouse gases'. For that reason Walter Jehne's article is to be welcomed, but he should also recognise the direct impact of burning anything.

Duncan Brown

1. References for sources of this and related information are cited in my articles in *Nature and Society* of October-November 2004 and February-March 2005.

> *There is much that we are unsure about in science. Where science scores over alternative world views is that we know our uncertainty, we can often measure its magnitude, and we can work optimistically to reduce it.*
>
> *Richard Dawkins*
> *The Ancestor's Tale, 2004*

Even today money is a language for translating the work of the farmer into the work of the barber, doctor, engineer, or plumber. As a vast social metaphor, bridge, or translator, money – like writing – speeds up exchange and tightens the bonds of interdependence in any community. It gives great spatial extension and control to political organisation.

Marshall McLuhan
Understanding Media, 1964

Correction

The review of Peter North's *State in Fear* in our last edition should have been attributed to Nick Goldie, not Jenny Goldie.

Farrago

Fungal soil cleaners

Coal burnt in thermal power plants produces ash containing heavy metals including zinc, lead, arsenic, cadmium and mercury. Indian scientists are pioneering the remediation of soil polluted by such metals, using naturally occurring mycorrhizal fungi.

The TATA Energy and Resources Institute in Delhi is collaborating with the Centre for Cellular and Molecular Biology at Deakin University to find a genetic solution to the problems associated with such contaminated soils.

They have found that specific heavy metal transporters present in the fungi move metals into inaccessible regions of the cells, intracellular structures called vesicles. They have identified six new genes from fungi grown in contaminated areas of India. Now they will match the active genes with different types of heavy-metal soil contamination.

To produce enough of the heavy metal-resistant mycorrhiza, the fungus is grown in a root culture in the laboratory. Spores from these can be transmitted to grow new cultures. Then the fungus is used to infect plants that will be grown in dykes that have been constructed at the contaminated area. With the help of the fungi the plants will grow where previously no plants would grow.

This technique is entirely natural. It does not involve genetic engineering, instead it relies on understanding the natural processes and investigating plants and fungi that occur in contaminated sites.

Australasian Science September 2006

Humanity and cities

Nowadays most of us live in cities. That means most of us live in an insulated cell, completely cut off from sensory information or sensory experience that is not of our own manufacture. Everything we hear, taste, smell, touch is a human artifact. All the sensory information we receive is fabricated, and most of it is mediated by machines. I think the only thing that makes it bearable is that our sensory capacities are so diminished – just as they are in all domesticates – that we no longer know what we're missing. The wild animal is receiving information for all the senses, from an uncountable number of sources, every moment of its life. We get it from only one – ourselves. It's like doing solitary in an echo chamber. People doing solitary do strange things.

John A Livingstone, quoted in Derrick Jensen's *Endgame*, 2006, p 438

Is there meaning to life? What are we for? What is man? The point I want to make now is that all attempts to answer that question before 1859 are worthless and that we are better off if we ignore them completely.

George Gaylord Simpson (paleontologist and one of the architects of the so-called "modern evolutionary synthesis") 1969

The rain follows the trees

A team of scientists from Murdoch University working on Western Australia's south coast have reported finding a link between different vegetation types and rainfall. Working along the number one rabbit-proof fence near Lake King they have found that cloud formation is affected by the type of vegetation on the ground below. They have found that rain clouds form above dark green swathes of native vegetation on one side of the fence more readily than above the pale coloured crops such as wheat on the other side.

Cactoblastus circumnavigation

In 1926 Australia imported a moth from Argentina in an attempt to control the prickly pear which was overrunning huge areas in Queensland. Cactoblastus proved so good at this job that it has gone down in history as one of the most successful biocontrol agents ever. Following its success here the insect was taken to South Africa to control introduced cacti there.

Next, some Caribbean islanders decided they did not like their native cacti, so imported Cactoblastus. Now we get to the worrying part. The moth entered Florida in 1989 and recently it has been found on a Mexican island only eight kilometres off shore. Mexican officials are very worried. They treasure their cacti, and the prickly pear appears on their national flag. If Cactoblastus gets to work on the mainland, it could devastate millions of hectares, turning the semi-arid landscape into a total desert.

The Canberra Times 18 December 2006

Climate sceptics

So what explains the staying power of the [climate change] sceptics' argument?

One possibility is that they're right. But I think the real reason is that subconsciously many of us hope they're right. If Mr Blair really believed climate change was a bigger threat than terrorism, for example, wouldn't he devote more of his energies more urgently to it?

Furthermore, wouldn't you and I change our lifestyles more than the bits around the edges we've done so far?

I think most of us have an inner George Bush, or a part which is in denial and believes it can't be as bad as all that, that surely something will turn up.

Peter Barron
Editor of BBC Newsnight
22 September 2006

Oil ree

Sweden plans to be oil free by 2020. Sweden has already agreed to phase out nuclear energy; now they are going to do the same for oil.

At present Sweden gets 26 per cent of its energy from renewable sources. Many Swedish homes are heated by wood-fired boilers, geothermal energy or waste heat. Drivers of non-petrol powered cars get exemptions from tolls and parking fees. Ethanol based fuel is only one third the price of petrol.

Yes! a journal of positive futures. Issue 38, summer 2006

Yes! reports many encouraging stories from around the world. It also provides evidence that many Americans are challenging their federal government by taking community action to reduce dependence on oil and to create self-sufficiency in their food supply.

On the day you read this the same volume of trade will take place as occurred in the whole of 1949. We now make as many phone calls in a day as were made in the whole of 1983.

Ed Douglas
New Scientist, 6 January 2007

Chernobyl's Legacy

It is now over twenty years since the disaster at the Chernobyl nuclear power station, yet there are still 36 upland areas in Norway where sheep have to be monitored for contamination.

Recent wet weather led to the growth of an unusual abundance of mushrooms, which the sheep happily ate. Previous research had shown that fungi take up more radioactivity from the soil than do other plants, so controls had to be imposed on the slaughter of the sheep for human consumption.

New Scientist 28 October 2006

The conservatism of science

I want to stress that science is a very conservative field. It works within accepted theories and is very slow to change. For example, we now know that the two crucial pieces of research that showed CFCs to be depleting the ozone layer were denied support by the conservative processes of science; the research was done only because the scientists concerned had access to limited amounts of discretionary funds that allowed them to do the work.

Lawyers are very reluctant to call scientists as expert witnesses in court cases because any competent scientist can see enough complexity and uncertainty to be very unwilling to give a simple 'yes' or 'no' answer.

Our understanding of the complex natural systems of the Earth is still primitive: a contemporary US biologist memorably described it as 'islands of understanding in an endless sea of mystery'.

Ian Lowe
A Big Fix, 2005

Humans of geological significance

Ian Lowe summarised the report of the International Geosphere-Biosphere Program in 2004 as follows.

Human activity is measurably altering the great natural cycles of the planet; the carbon cycle, the nitrogen cycle, and the water cycle. Different human activities are interacting to cause effects that cascade through the Earth System in complex ways. Key environmental parameters are well outside the range of normal variability.

The scale of the human population combined with our use of resources makes us a force of global significance. 'We are now a significant geological agent, shaping the future of the Earth.'

Nature and Society Forum

Contributions for the next edition of *Nature and Society* are invited now from all members. They should be sent to the editor, Jenny Wanless, 22B Jensen St, Hughes ACT 2605, ph 02 6281 3892, by 15 March 2007.

Contributions may be sent on paper or electronically. This journal was prepared using Microsoft Word and PageMaker 7.0.2.

Items in *Nature and Society* do not necessarily reflect the opinions of the majority of the Forum members, but are published in the hope of stimulating thought and discussion.

Jenny Wanless and Keith Thomas prepared this edition together with the named contributors; Jenny and Keith also contributed the unattributed items and provided the quotations.

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