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Environmental Justice

David Yencken

When I was a judge for a writing prize on climate change, I came across and was impressed by an essay by Stephanie Foster, then a Year 12 student. An excerpt follows.

> Opening Address at the International Climate Change Conference — 16th February 2109. Speaker: Stephanie Foster, President of the United States of Australasia.
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> Good evening, honourable guests and fellow delegates and welcome to our 100th conference. We are gathered to review the current state of global climate change and to present our continuing efforts to rebuild the environment ... The radical and devastating climate changes our generation has seen are due to the mistakes made by past generations … The debate still rages: were our forebears aware of the inevitable consequences of their actions? Did they not have an inkling of what impacts their unsustainable actions would have in the future? … My contention, ladies and gentlemen? No civilisation can know what is happening and not act. … Thus, our forebears could not have known what the consequences of their actions would be. If only they had the knowledge that we possess now. … It is inconceivable that they would knowingly have caused the devastation and chaos we have inherited from them.

How can we, who belong to older generations, answer Stephanie Foster's terrible ironic questions? Any response needs to begin by asking what do we know about climate change today.

What Do We Know About Climate Change?

The most authoritative overall evidence of climate change is derived from the Intergovernmental Panel on Climate Change (IPCC), a body comprising the world's leading climate scientists. Four Assessment Reports have been completed respectively in 1990, 1995, 2001 and 2007. The most recent Assessment Report 'Climate Change 2007' is composed of four volumes and is available on the IPCC's website. In March 2009, the International Alliance of Research Universities held a Climate Change Congress in Copenhagen to assemble new scientific and other data that had become available since the publication of the IPCC's 4th Assessment report. The Congress brought together the most distinguished climate change scientists, together with economists, political scientists, epidemiologists, sociologists and philosophers. A later report, 'The Copenhagen Diagnosis', published in November 2009, written by 26 leading climate scientists from across the world, confirmed these findings and added further evidence. These three reports provide us with current up to date information on the science of climate change.

What do these reports tells us? The IPCC 2007 report states that it is now possible to say with high confidence that the global mean temperature has risen by 0.8 degrees since 1750. The concentrations of greenhouse gases, far exceeding pre-industrial averages, are primarily due to fossil fuel usage and land use change and agriculture. Human activity is nearly certainly the main cause of recent climate warming (expressed as 90 per cent certainty in the report). Numerous long-term changes in regional climate have been observed including reduced sea ice in the Arctic, changes in precipitation, ocean salinity, wind patterns and weather extremes including drought, heavy rains, heat waves and intensity of tropical cyclones. In the next 20 years warming of about another 0.4 degrees is inevitable. Higher carbon dioxide concentrations have led to increased ocean acidity (Pittock, 2009).

A key finding of the Copenhagen Congress held in 2009 was that many climate indicators are reaching levels near the top of the IPCC range of possible scenarios. Some indeed are moving in excess of IPCC possible projections. Increasing ice loss from Greenland and Antarctica and from melting glaciers suggest a one metre sea level rise over the next century nearly double the IPCC estimate. Recent observations of surface ocean temperatures show that global warming is estimated to be 50% higher than estimated by the IPCC. Ocean warming contributes to sea-level rise due to the thermal expansion of water. It also leads to changes in ocean chemistry and acidification.

Of particular significance were the Congress's warnings about thresholds for dangerous climate change. It noted that the most commonly cited threshold is 2 degrees warming above pre-industrial levels. The Congress report, however, cited recent research that showed that there could be very significant impacts with temperature rises below 2 degrees. The 2 degree threshold would, for example, be inadequate to prevent serious threats to water resources and many ecosystems and to avoid increases in extreme weather events. Atmospheric carbon dioxide levels are already at the level predicted by the IPCC to lead to global warming between 2 and 2.4 degrees and are still rising.

'The Copenhagen Diagnosis', released later in 2009, confirmed these findings and added further evidence. The most significant findings of the Diagnosis reports were that:

- Global carbon dioxide emissions from fossil fuels are surging. Even if they were stabilised today, in just 20 years there would be a 25% probability of warming exceeding 2 degrees. Every year of delayed action increases the chance of exceeding 2 degrees warming.
- Recent global temperatures demonstrate human warming. Even over the last ten years, despite a decrease in solar forcing, the trend continues to be one of warming. There are no significant changes in the underlying warming trend.

- There is an acceleration of the melting of ice-sheets, glaciers and ice-caps. There is new evidence that both the Greenland and Antarctica ice-sheets are losing mass at an increasing rate.
- There has been rapid Arctic sea ice decline far beyond the expectations of climate models.
- Current sea level rises are some 80% above past IPCC projections. Global sea-level is likely to rise at least twice as much as projected by the IPCC and may exceed one metre with an upper limit of 2 metres by 2100.

Overall, the Diagnosis report warns that delay in action risks irreversible damage. Several vulnerable elements in the climate system (e.g., continental ice sheets, Amazon rainforests, West African monsoon) could be pushed towards abrupt or irreversible change if business-as-usual warming continues. The risk of transgressing critical thresholds (tipping points) increases strongly with ongoing climate change. The turning point must therefore come soon. To stabilise climate, a decarbonised global society — with near zero emissions of CO2 and other greenhouse gases — needs to be reached well within this century. Developed nations will have to reduce emissions by between 80–95% by 2050.

Critical to projections about the future is our understanding of the past. According to the European Science Foundation, the single most important source of information about past climate change and the associated composition of the atmosphere are the two large ice caps of Greenland and Antarctica. The Foundation further notes that the analysis of polar ice cores is the most powerful means of determining changes in climate over the last few climate cycles. In *The End of the Long Summer* Dianne Dumanoski describes two such field studies carried out in 1993, one by a US and the other by a European team. Ice cores were drilled nineteen miles apart through the Greenland ice sheet. From these cores and from subsequent drillings, records of the Earth's climate over the past 110,000 years were recovered. The evidence closely matched. The ice cores revealed three striking pieces of information. The

first was that the Earth has experienced long glacial epochs interrupted by much shorter, warmer interglacial periods. The second was that the stable temperate climate of the last 11,700 years in which human civilisation has developed is an aberration in the Greenland climate record. The third and perhaps the most significant finding was that the climate does not move from one condition to another in a slow and measured way. It changes in abrupt fits and starts. This is the normal pattern. Dramatic temperature changes can take place in extraordinarily short periods of time.

More recent ice core drilling under the European Project for Ice Coring in Antarctica (EPICA) has sought to add to information gained from these surveys and from an earlier drilling in Antarctica. The questions EPICA is examining are:

- Are the rapid climatic changes of the last ice age cycle global events or are they restricted largely to parts of the Northern Hemisphere where geographic conditions may favour them?
- Are these rapid changes unique to the last glacial cycle or did they occur in previous cycles as well?
- Is the relatively warm stable climatic period of the last 10,000 years an exception for the last 500,000 years?
- Do the transitions from the glacial to warm periods and back again always follow the same pattern or is a variety of mechanisms involved?
- Are climate changes always triggered in the Northern Hemisphere or is the opposite sequence possible?
- How are climate changes coupled between the two hemispheres?

Evidence from EPICA ice cores suggests that current carbon dioxide levels of 385 parts per million and methane levels of 1,700 parts per billion are not only higher than at the start of the Industrial Revolution but are far above the highest levels reached in the last 800,000 years.

What Don't We Know?

The climate system is extraordinarily complex so there are very many things that we don't know and can never accurately predict. But there are matters of substance that must now be taken into account as we look towards the future. Ever since James Lovelock proposed his Gaia theory to sceptical colleagues there has been increasing attention paid to the idea that planet Earth is a dynamic self adjusting system, in his description almost a living system in itself. Other work on complex systems has made it clear that scientists and their models cannot tell us in what way the Earth will respond to past and future disturbances. As Dumanoski has commented, if we cannot predict, then we had better beware of the dangers awaiting us. We need to be especially mindful of time lags, thresholds and feedbacks.

- *Time lags* are important because there is typically a slow response time between the initial environmental disturbance, its development and the point where it triggers a significant collapse. This does not mean that the collapse will only take place gradually. It may well be that the collapse will be precipitous when it comes. It is now clear that massive changes have taken place at extraordinary speed in the past.
- *Thresholds* are important because systems can appear to be relatively unresponsive until a threshold or tipping point is reached. Then abrupt and irreversible change can take place. Recently 28 international scientists, including three Australians, have collectively set out to determine thresholds that must not be crossed if humans are serious about saving a planet hospitable for humans. The group has identified nine areas: climate change; biodiversity; stratospheric ozone; land-use change; ocean acidification; fresh water distribution; the nitrogen and phosphorus cycles; aerosol loading and chemical pollution. The aim of the study has been to determine what thresholds must not be crossed to keep the world sustainable. For climate change the scientists have estimated that it is a carbon concentration of no more than 350 parts per million

(already exceeded) and for biodiversity it is the loss of only 10 species per million each year.

- *Feedbacks* are described by Dumanoski as 'nature's wild cards and an essential feature of the non-linear behaviour of the planet'. She notes that they can act as a brake or as an accelerator. An example of positive feedback is the loss of sea ice in the Arctic. Sea ice has disappeared at a rate very much greater than predicted in computer models in the last IPCC report because the models had not taken into account the albedo effect. The albedo effect refers to the large difference in reflectivity of white surfaces (snow and ice) and darker surfaces. When snow and ice melt the darker open water absorbs much more of the sun's heat thereby amplifying warming. Feedbacks are wild cards because they may lead to unexpected tipping points beyond which irreversible change takes place.

In the Light of What We Do Know How Serious is the Problem?

Every piece of scientific evidence, and the evidence is now extensive, tells us that the problem is very serious indeed, in some people's eyes a genuine threat to human civilisation. Profesor Kevin Anderson, Director of the Tyndall Centre for Climate Change Research, has, for example, been recently reported (Scotsman, 29 November 2009) as saying that he believes that 90% of the world's population will be wiped out if temperature increases reach 4 degrees.

However we may judge the evidence and its implications - and it is much to be hoped that more and more people will examine the expert scientific evidence very carefully - it is surely only prudent to take a risk assessment approach. In the face of the collective judgement of the world's leading climate scientists it must be sensible to minimise the risks of runaway climate change and all its potential consequences. The three key pieces of evidence are:

- Climate change is taking place at a discernible and increasing rate.

- There are clear, measurable and damaging physical changes associated with global warming that are already evident.
- Human activity is nearly certainly the main cause of recent climate forcing (90% certainty in the 2007 IPPC report).

Why Don't We Act?

Is it lack of rational scientific evidence?

As illustrated above, lack of scientific evidence is now an implausible and inadequate explanation. From the time the Intergovernmental Panel on Climate Change was established in 1988 by the World Meteorological Organization and the United Nations Environment Programme there has been an international body producing regular authoritative reports on the science of climate change, on mitigation and adaption options and on related issues.

Furthermore, major scientific congresses such as the International Alliance of Research Universities Climate Change Congress, held in Copenhagen in March 2009, and the Essex Conference prior to it, regularly bring together leading climate scientists to present the latest scientific findings.

Is it because of scientific scepticism?

Scientific scepticism does play a large part. The sceptics argue that scepticism is fundamental to scientific progress and in so saying they are plainly right. But, as Nobel Laureate Peter Doherty has pungently commented, there is a big difference between scepticism and denial, especially denial of available empirical evidence exhaustively reported in the peer reviewed scientific literature when there is no or virtually no peer reviewed literature to the contrary. This is an important point because most of the books written by climate sceptics are written by people who have not done recent climate research themselves nor submitted their arguments for peer review, or, if they have, have had them rejected.

Climate-change sceptics and deniers, especially those in positions of power, are regularly supported by corporate lobbyists. The lobbyists and the large firms behind them support

think tanks writing and disseminating climate sceptical material and provide funding for books and literature that other publishers do not want to touch because they know from the comments of their expert reviewers that the material and arguments do not represent mainstream science.

The corporate lobbyists do not limit their activities to the receptive audiences of climate sceptics and deniers. A major part of their effort is devoted to persuading governments and oppositions that strong climate action will damage the economy and especially the sections of the economy in which they operate. Recent reporting of the extent of the lobbying activity in Australia over the introduction of the Carbon Pollution Reduction Scheme is just one example.

The media play an important part too, not so much because the media are essentially biased — bias of all kinds does of course exist — but more because there is an unwritten rule of thumb in many media organisations that both sides of an argument have to be reported. But when expert scientific opinion so overwhelmingly supports the view that climate change is happening at an alarming rate and that human action is the major cause, such reporting often gives quite inappropriate weight to the arguments of climate sceptics. It is as if every time the theory of evolution is discussed creationism has to be mentioned and described in equal detail.

Long-held beliefs are also famously difficult to change. Climate change challenges many of the dominant belief systems of our times, especially economic beliefs. It is hardly surprising that there is such ferocious opposition from powerful minorities. Climate change is, moreover, an extremely complex phenomenon. Sceptics can always find some piece of evidence to support their viewpoints. With such huge numbers of researchers involved, mistakes will also be made no matter how rigorous the system. There have been two such recent embarrassments that have been seized upon by climate sceptics. The first, dubbed Climategate, involved the theft of thousands of emails and documents from a server at the University of East

Anglia Climatic Research Centre and their release onto the web for public viewing. Another issue has concerned the statement in the 2007 IPCC Report that the 15,000 Himalayan glaciers were melting faster than any others in the world and might be completely gone by 2035. In this instance a speculative statement by an Indian scientist, not supported by detailed research, appears to have found its way into the IPCC's report without any peer review being carried out to test the claims.

Mistakes of these kinds, however, embarrassing, can serve their purpose by forcing scientists preparing reports to check their findings very carefully. They should also make bodies such as the IPCC tighten up their procedures to ensure that material that has not been thoroughly peer reviewed is excluded from all their reports. What the mistakes do not justify is their misuse by climate sceptics to imply that they cast doubt on the vast amount of thoroughly researched and peer reviewed data about changes in atmospheric and climatic conditions or to imply that there is some kind of conspiracy among scientists to concoct evidence about global warming.

Is it because we have neglected the cultural contexts in which climate change debates take place and the influence of widely different cultural norms and belief systems?

For a long time it was assumed that the rational presentation of scientific evidence on climate change would be sufficient to change opinion and to initiate effective action. Now, there is increasing recognition that this is not the case. In his book *Why We Disagree about Climate Change*, climate scientist Mike Hulme examines the social meanings of climate, the nature of science as it is now understood, the influence of values and beliefs, what we fear, the communication of risk, different interpretations of sustainable development and alternative approaches to climate governance. He shows how varied are our responses in each of these contexts and to what degree they are shaped by different personality traits, cultural norms and belief systems. In a recent BBC opinion piece Hulme and Jerome Ravetz illustrate these arguments as they apply to science itself:

> The classic virtues of scientific objectivity, universality and disinterestedness can no longer be claimed to be automatically effective as the essential properties of scientific knowledge. Instead, warranted knowledge — knowledge that is authoritative, reliable and guaranteed on the basis of how it has been acquired — has become more sought after than the ideal of some ultimately true and objective knowledge. Warranted knowledge places great weight on ensuring that the authenticating roles of socially agreed norms and practices in science are adequately fulfilled — what in other fields is called quality assurance. And science earns its status in society from strict adherence to such norms.
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> For climate change, this may mean the adequate operation of professional peer review, the sharing of empirical data, the open acknowledgement of errors, and openness about one's funders.

This is not an argument of climate sceptics but of dedicated scientists who are deeply concerned with the communication of properly authenticated science — warranted climate change science — and the full engagement of citizens in full recognition of their widely different beliefs and assumptions. There are two special messages here, the first for scientists that they should show their peer reviewed evidence, openly acknowledge errors and be transparent with the public, and the second for climate sceptics, that they should equally openly admit whether their claims do or do not come from peer reviewed research and be transparent about the sources of their funding.

Is it a failure of environmental education?

Environmental education was given a sharp new emphasis at the Earth Summit (United Nations Conference on Environment and Development) held in Rio de Janeiro in 1992. UNESCO was given responsibility for implementation of the plan of action for education, training and public awareness. In 2002, the United Nations General Assembly designated the period 2005 to 2114 as a Decade of Education for Sustainable Development (ESD).

In 2009, UNESCO released its mid decade review to take stock of what has been accomplished in the first five years of the Decade. In the Review document there is discussion about the interpretation of ESD, noting that there is no one correct interpretation for it. Rather it suggests that it can be seen as the sum of the diverse ways to arrive at a learning society in which people learn from and with one another and become more capable of withstanding setbacks.

These are fine ambitions and provide a useful conceptual framework for the education of young people and for lifelong learning. But could not the great variety of definitions and approaches mean that ESD is a weak concept? UNESCO says not, arguing that the multiplicity of interpretations allows for key challenges to be addressed in different ways appropriate to different cultures and local circumstances. There is weight to this argument but there is an essential question that needs to be asked in every application of ESD: Is environmental education explaining with sufficient clarity in what way the climate is changing and stressing with sufficient urgency the threats to life on Earth and to human civilisation? If it fails to do that, then education is failing us.

Is it because we have paid insufficient attention to institutional mechanisms that will help to change political, economic and personal behaviour?

Anthony Giddens argues that we do not yet have a politics of climate change and that we urgently need one. Core to such a policy, he says, are four underlying principles. The first is a redefined role for the state since without state planning and direction and strategic intervention where it is required it will be impossible to bring about the changes we will need. The second is collaborative political action. Climate change policies and programs cannot any longer be looked at as left/right issues. All political parties must work together. It also goes without saying that to deal with a global problem of this nature international collaboration is also essential. The third is the development of climate policies that generate the greatest

possible competitive advantage to those, countries, regions, public bodies and firms that make use of or respond to them. Giddens's final principle is the right to development for poorer countries that have not been responsible for problems of climate change and urgently need help to raise their living standards.

Implicit in Giddens's arguments is that we have paid far too little attention to the institutional mechanisms that are needed for political, economic and personal behaviour change.

Is it a failure of international institutions?

Climate change is par excellence a global problem. It is already affecting every country and every region. In the future it will likely affect every human being in some way and many people in very severe ways. This is not to speak of its effect on other living things. But as the United Nations Climate Change Conference, held in Copenhagen in December 2009, has all too painfully shown, there are very many problems that need to be overcome before we are likely to see effective global action.

United Nations meetings require unanimous agreement. Given the number of countries involved and the disparity of their sizes, wealth, governance systems and ideological orientations and the differences in their vulnerability to climate change and dependency on fossil fuels, achieving such agreement is no small feat. A second major issue is responsibility for current problems. Clearly developed countries which have been the main emitters and have enjoyed substantial benefits from their high carbon economies should take the main responsibility. But not all developed countries have seen it like this, the US and Australia in the past being the main culprits. Even when there is acceptance of this principle there will always be a lot of hard bargaining about targets for developed and developing nations. Third, there is the question of fairness. This has several dimensions. One is compensation for mitigation and adaptation. The amount of compensation was a critical issue at Copenhagen. Another is setting a just long term goal. Justice should require that developed countries reduce their

emissions while strongly encouraging growth in poorer countries, to achieve by such a process of contraction and convergence more equal entitlements of all people. Fourth is the influence of domestic politics. The United States's position at Copenhagen was, for example, significantly constrained by Obama's assessment of the possibility of support from the US Congress. Fifth is the question of verification. This was a major sticking point because China refused to accept full international monitoring of its actions. Finally, there was clear evidence at Copenhagen of countries jostling for competitive advantage. China again seems to have been the main culprit.

Success at future meetings requires that leaders and negotiators come with a committed global perspective, downplaying their roles as representatives of national interests.

Is it a failure to recognise that dominant paradigms have to change?

There is little chance that human societies will be able to make the changes needed to avoid catastrophe of some kind unless dominant economic, political, social and personal paradigms change. This is profoundly difficult to achieve for all the reasons discussed above. Most of us are comfortable with the status quo — even if it is not serving us particularly well — and fearful of major change.

As a pointer to some of the major drivers of environmental degradation, Dumanoski makes the striking observation that:

> In the last two centuries while the human population increased more than sixfold from one billion to more than six billion, energy use has escalated more than eighty fold and the world's economy (measured in 1990 dollars) has grown roughly 68-fold.

From such figures we can see that it is not just population on which we need to concentrate but on energy, especially energy derived from the burning of fossil fuels, and on economic growth itself.

In 1992, Herman Daly, a former World Bank senior economist, proposed a formula for all economic activity that involved three sequential stages:

1. Assuring that the scale of human activities is ecologically sustainable;
2. Distributing resources and property rights fairly both between the current generation of humans and between this and future generations and also between humans and other species; and
3. Efficiently allocating resources, as constrained by 1 and 2 above, including market and non-marketed resources, especially natural capital and ecosystem services.

When together with such a set of steps, he also argued for no growth policies in developed countries to tackle environmental problems, he was howled down by economic colleagues.

Today, this idea is being revisited with more and more sophistication by other economists. A recent, highly praised example is *Prosperity without Growth: Economics for a Finite Planet,* a book by Tim Jackson.

It is hard to believe that the changes needed to meet the carbon reduction targets now being called for can be brought about without major paradigm shifts. How seriously are we examining all such challenges to dominant paradigms?

Intergenerational Equity

Climate change is a classic case of the need for intergenerational equity (justice for future generations). There will be many examples of new problems brought about by climate change that we will be asked to face in the immediate future. Already we are seeing rising sea levels, the extreme weather events, the droughts, the wild fires and torrential rain described by Stephanie Foster. But, however horrific for those who experience them, these will be of relatively minor consequence compared to those that human societies are likely to face in the future even under the most optimistic scientific scenarios. No communities will be spared.

Will I be affected, probably not because I will not live long enough to see the serious changes happening. Will my children be affected? Yes they possibly will be but it is hard to tell how

quickly severe climate change will hit. Will my grandchildren be affected? Yes, most likely, but it is my great-grandchildren and their descendants and the great-grandchildren and descendants of others alive around the world today who face the bleakest future.

Climate change is a classic case of the need for intergenerational equity for another reason. All societies and communities will not be affected equally. There is widespread agreement that it is the poorest of the poor who will suffer the most. Already many are eking out the meanest living exhausting their natural resources to sustain themselves. A key message of the Climate Change Congress in Copenhagen in March 2009 was that much sharper attention needs to given to the equity issues associated with climate change and that societal transformation of poor countries to deal with climate change needs to be high on the world's agenda.

An Oxfam Briefing Paper issued in September 2009 argues that climate related shocks are affecting the lives of millions of poor people with increasing frequency and severity. It further states that:

- by 2015, the average number of people affected each year by climate-related disasters may have grown by over 50% to 375 million;
- by 2030, the number of people suffering hunger and illness due to creeping climate change, such as shifting rainfall patterns, could reach 310 million, with nearly half a million deaths; and
- by 2050, climate change may force 200 million men, women and children to migrate.

In the light of these threats, Oxfam states that it is imperative that the international community makes a new commitment to fund adaptation to climate change. This funding must be additional to the current target of 0.7% of GDP for overseas aid already agreed as the necessary contribution of rich to poor countries.

People do undoubtedly discount the future. Most of us are focused on the present — on its problems, joys and promises. Climate change, moreover, seems a remote risk that will primarily affect future rather than current generations. Intergenerational equity, although a principle of long standing in environmental discourses, is still an unfamiliar concept and habit of thinking and behaviour for the majority of the population. But that is a viewpoint that does not dig very deeply. Very few people are entirely careless about the physical world that will be bequeathed to subsequent generations. At the heart of intergenerational equity is the principle that we hold the natural environment as a sacred trust that we have a duty to hand down to following generations in a state not less diminished than the one that we have enjoyed. This is not a new concept. It has deep roots in all religious traditions. It has a long tradition in international, civil and traditional law. The principle is given expression in many UN documents, such as the Earth Charter and Universal Declaration of Human Rights. Most significant of all these instruments is the UNESCO Declaration on the Responsibilities of the Present Generations Towards Future Generations.

How then should we approach environmental intergenerational equity? First, there needs to be an appropriate balance between intragenerational and intergenerational equity, what is just today and what is just for the future. One cannot be considered without the other. Neither should one be at the expense of the other. One useful way to look at this relationship is to see it as a partnership between generations, ours, those that have preceded ours and all others to follow.

Edith Brown Weiss has proposed three underlying principles for intergenerational equity. The first is the conservation of options for current and future generations. The second is the conservation of the quality of the planet now and in the future. The third is the principle of access to the legacy of past generations, each generation providing its members with equitable access to this legacy and conserving that access for future

generations. These principles together require that we leave the Earth in a condition that is no less productive and supportive of living things than that which we inherited.

Each generation should preserve the greatest possible natural diversity because diversity offers multiple options which in turn provide scope to weather unforeseen events and circumstances. It therefore provides robustness. The need for the protection of biological diversity (genes, species and ecosystems) is a long-established scientific principle. Biodiversity is in itself the subject of an important International Convention, the Convention on Biodiversity Protection. Biological diversity has value to present and future generations. It encourages ecosystem productivity and ensures natural sustainability for all life forms. It maintains healthy ecosystems that can better adapt to and recover from disasters such as climate change, ensures diversity of life, provides the greatest opportunities for beneficial discoveries for human beings and assists economic development. These principles of environmental justice have never been more important than they are today.

What Should We Do?

In the face of all this evidence what should we do? Simply to list the reasons for not acting will not enable us to look Stephanie Foster squarely in the eye. She and others of her and later generations will turn on us and say: 'You knew what the science was telling you and its conclusions were clear cut. You analysed what the impediments to effective action were so you were fully aware of what you had to do. You understood clearly the moral and other arguments for acting with justice towards present and future generations. Natural and social scientists of your generation wrote telling books, such as Jared Diamond's *Collapse: How Societies Choose to Fail or Succeed* and Ronald Wright's *A Short History of Progress*, illustrating what happens to human societies that fail to change and adapt. Humans have shown that they are infinitely ingenious in other contexts why not in this one, the one that matters above all others?' And Stephanie and the members of her generation will be right.

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David Yencken is Professor Emeritus at The University of Melbourne and Patron of the Australian Conservation Foundation. He was previously Chairman of the Australian Heritage Commission and Secretary for Planning and Environment, Government of Victoria. His most recent books are *Resetting the Compass: Australia's Journey towards Sustainability* and *Into the Future: The Neglect of the Long Term in Australian Politics*.