

3-2008

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Recommended Citation

Tickell, Crispin (2008) "John E. James Distinguished Lecture: Environment on the Edge," *Mercer Law Review*: Vol. 59 : No. 2 , Article 6.

Available at: https://digitalcommons.law.mercer.edu/jour_mlr/vol59/iss2/6

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Environment on the Edge

The Seventh Annual John E. James Distinguished Lecture

**Walter F. George School of Law
Mercer University
Macon, Georgia
September 18, 2007**

by Sir Crispin Tickell*

Given the title of my lecture this evening, you may wonder how our environment could be on the edge. On the edge of what? I suppose the answer I shall give is: the edge of radical change. In doing so, I shall dwell on the vulnerability of the Earth and the still greater vulnerability of our species and the society we have created for ourselves.

Current alarms over the prospects for climate change have made more people aware of the limited, ephemeral, and precarious character of the present environment. Our whole being is within a wafer-thin atmosphere surrounding the surface of a planet as it turns in space at exactly

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the right distance from the Sun for life as we know it. Sun, planet, and life itself are middle-aged with a beginning, a middle, and an end. As humans, we are tiny parts of a life-system whose complexity passes, and always will pass, our understanding.

That system is highly vulnerable. It is just that the shortness of our lives and the narrowness of our perspective on the past mean that we are mostly unaware of change and, until now, have scarcely noticed the pressures on the environment. But the last couple of centuries have seen an extraordinary stretching of our understanding of space and time. We can now look beyond the solar system, beyond our galaxy, beyond billions of other galaxies, back to the big bang which initiated the universe we know. As for time, we can now look beyond the last 1000 years, beyond the beginnings of civilization, beyond the patch of varying warmth in the last 12,000, beyond the many spasms of the ice ages, and further back to the origins of the Earth itself.

During these almost unimaginable stretches of time, the environment has been on many edges. From outside the Earth, there have been big hits from space and the changing relationship between the Earth and the Sun (wobble, tilt, and orbit); and from within it, there have been the slow movement of tectonic plates on the Earth's surface, vulcanism and earthquakes, drastic changes in climate, the rise and fall of sea levels, and not least—the influence of life itself.

First let us look at what comes from outside. The objects from space that hit the Earth almost continuously range from the very small to the very big. The smallest are the daily hail of tiny objects. There was a fine shower of them at the end of last month. The biggest was the object which hit the young Earth more than 4 billion years ago and led to the creation of the Moon. Perhaps most famous was the Chicxulub event some 65 million years ago, which caused, or at least contributed to, the extinction of the dinosaur family. Extinctions of this magnitude are a disaster for some but an opportunity for others. Indeed, the rise of the mammals, with humans a last-minute arrival among them, would not have happened without Chicxulub.

More recent was the Tunguska event of 1908, which destroyed some 2000 square kilometres of forest in Siberia. Had it struck Atlanta, there would have been nothing left. Then there was the Peekskill object, which stove in the back of an old Chevrolet in upstate New York in 1992, and the spectacle of the comet Shoemaker-Levy colliding with the planet Jupiter two years later. The Tagish Lake event followed in 2000. It caused a loud bang, a shower of fragments, and an electromagnetic pulse leading to a temporary loss of power transmission on the ground below. Only last year, an asteroid sailed past the Earth at a distance

slightly further away than the Moon. The next big one—Apophis—coming in our direction is timed for 2036. It is very unlikely to hit us.

Within the Earth system, tectonic plate movements can sometimes have dramatic effects. One example is the joining of North and South America some 4 million years ago, each of which led to big changes in the direction of ocean currents and in climate worldwide. More recent was the eruption of Mount Toba in Indonesia over 70,000 years ago, which put enormous quantities of volcanic dust into the atmosphere, helped trigger a renewal of glacial conditions, and may even have affected human evolution.

By comparison, the eruptions of Mount Tambora in 1815, which led to the famous “year without a summer,” that of Krakatoa in 1883, that of Mount St. Helens in 1980, that of El Chichon in 1982, and that of Mount Pinatubo in 1991, each with its specific global effects, were relatively minor.

Earthquakes are part of the same pattern. Mostly their effects, however destructive, are local. During the last century, each year there were an average of twenty earthquakes, measuring seven or more on the Richter scale. Most loss of life is associated with the tsunamis, which, as in the last couple of years, can surge across the oceans doing enormous damage. Recently there has been concern about the possibility that part of the Cumbre Vieja volcano in the Canary Islands might collapse into the sea, causing a huge tsunami which could hit the east coast of the United States.

Then there are the over-turnings in the living world. Extinctions, for whatever reason, are an essential element in evolution. Few ecosystems or species last more than a few million years. Recently it has been demonstrated how, operating on Darwinian principles, organisms tend to create and maintain the living environment most favourable to them. Thus, they can offset and mitigate the consequences of catastrophes through complex systems of feedback.

The living system on the Earth's surface behaves as a single, self-regulating system, comprised of physical, chemical, biological, and even human components, operating within fairly wide limits. In a phrase this is Gaia theory, or Earth system science. At present, we are pressing Gaia hard without fully understanding the consequences.

Over the last 40,000 years, the human impact on the Earth has slowly, and then rapidly, increased. A periodical visitor from outer space would find more change in the last 200 years than in the preceding 2000 and more change in the last 20 years than in the preceding 200. The association between humans and their environment, including the microworld in and around them, has changed at every stage of human evolution: from hunter-gatherers to farmers, from country to city

dwellers, and from tribal groups to complex hierarchical societies. Before the industrial revolution began some 250 years ago, the effects of human activity on the environment were local, or at most regional, rather than global. Now the impact is indeed global and not least on other species.

This ability to influence other species has given us a profound conceit of ourselves. Yet our use of other species is coupled with an amazing ignorance of how natural systems work, their awe inspiring interconnectedness, and our total reliance on natural services. There have been some thirty urban civilizations before our own. All eventually crashed. Why? The reasons range from damage to the environmental base on which they rested to the costs in human, economic, and organizational terms of maintaining them.

The idea may be hard to accept, but in its long history, the Earth has not been in this situation before. In the words of the title of a recent book on environmental history, we confront *Something New Under the Sun*.¹ This point was well brought out in a declaration published by some 1500 scientists from the four great global research programmes at Amsterdam in July 2001.² They stated squarely that:

The Earth is currently operating in a no-analogue state The accelerating human transformation of the Earth's environment is not sustainable. Therefore, the business-as-usual way of dealing with the Earth System is not an option. It has to be replaced — as soon as possible — by deliberate strategies of good management . . . while meeting social and economic development objectives.³

There are six main factors which are pushing the environment towards the edge. Briefly, they arise from human population increase; degradation of land, consumption of resources, and accumulation of wastes; water pollution and supply; energy production and use; destruction of biodiversity; and climate change in its many aspects and impacts.

Of these factors, population issues are often ignored as somehow too embarrassing or mixed up with religion; most people are broadly aware of land, resource, and waste problems, although far from accepting the remedies necessary; water issues, both fresh and salt, have had a lot of publicity and already affect most people on this planet; how we generate

1. J.R. McNEILL, *SOMETHING NEW UNDER THE SUN: AN ENVIRONMENTAL HISTORY OF THE TWENTIETH CENTURY WORLD* (2001).

2. The Amsterdam Declaration on Global Change, http://www.sciconf.igbp.kva.se/AMS_DECLARATION.pdf (last visited Jan. 25, 2008) (emphasis omitted).

3. *Id.*

energy while fossil fuel resources diminish and demand increases is another conundrum; damage to the diversity of life on which our species critically depends has somehow escaped most public attention; and climate change with all its implications for atmospheric chemistry is now broadly understood, apart from those who do not want to understand it. All these factors are interlinked, and all represent pressure on the natural environment.

There is now a seventh factor recent in human experience. The effects remain mostly to be seen. They arise from the introduction of new technologies. Damage from chlorofluorocarbons to the atmospheric ozone layer, which protects ecosystems from harmful ultraviolet radiation from the Sun, was the first to receive major public attention. The eventual result was to establish international agreements to ban the manufacture and use of chlorofluorocarbons.

But this may only be the beginning. In a recent book by the President of the Royal Society (the British equivalent of the U.S. National Academy of Sciences), Lord Rees explored the dangers arising from human inventiveness, folly, wickedness, and sheer inadvertence.⁴ He had particularly in mind the ramifications of information technology, nanotechnology, and nuclear experimentation. His conclusion was to give our civilization only a fifty percent chance of survival beyond the end of this century.⁵

What then are we to expect? Are we capable of establishing a lasting relationship of mutual benefit to the living Earth and those of its unruly inhabitants who are ourselves? How are we to recognise that the last 200 years or so have been a bonanza of inventiveness, exploitation, and consumption which may not continue? All successful species, whether bivalves, beetles, swallows, or humans, multiply until they come up against the environmental stops, reach some accommodation with the rest of the environment, and willy-nilly restore some balance.

In fact, most of the solutions to the problems we are causing are well known. Take population increase. The overall rate is still rising, but in several parts of the world it is levelling off. The main factors are improvement in the status of women, better provision for old age, wider availability of contraceptive devices, lower child mortality, and better education, especially for girls and young women.

Take degradation of land and water. We know how to look after them both if we try. We do not have to exhaust top soils, watch them erode into the sea, rely upon artificial aids to nature, eliminate the forests with their rich variety of ecological functions, or pollute the water, fresh

4. MARTIN REES, *OUR FINAL HOUR* (2003).

5. *Id.* at 8.

and salt. We already accept the need for conservation and for better understanding of the complexity of living systems, well brought out in the Millennium Ecosystem Assessment published in 2005.⁶ Some, at least, are aware of the risks of high technology and are trying to cope with them.

We do not have to consume often irreplaceable resources at the present epic rate. As someone recently remarked, it took around 200 million years to lay down the coal, oil, and gas on which our society currently depends. We are consuming them over a period of around 200 years. Thus, each single year we consume a million tons of fossil fuel deposit. This is profoundly affecting the chemistry of the atmosphere.

This brings me to what many believe to be the greatest problem of all: climate change. Here, the science is becoming ever clearer and more precise. It relates primarily to the buildup of greenhouse gases in the atmosphere, now at their highest levels in 650,000 years. We are heading back to the conditions of around 125,000 years ago when the relationship between land and sea was very different. All this has been well brought out in the reports of the three Working Groups of the Intergovernmental Panel on Climate Change.⁷ A synthesis report will follow shortly.

What serious dispute remains about climate change relates mostly to the distinction between natural change and human-driven change. The one invariable element in climate is its variability. We are now better aware of the fluctuations of the past in and out of relative heat and cold, including the brief but relatively rapid cooling (some 12,000 years ago) and the marked warming (the so-called "runaway greenhouse effect" some 55 million years ago). We have to watch the state of the Amazonian rain forest; the direction of ocean currents, particularly in the North Atlantic; the release of methane from beneath the tundra and the ocean bed; the pattern of the Indian monsoon; and the state of the Arctic and Antarctic ice sheets.

Today there can be no doubt that human driven change is affecting everything, and the results for society are becoming evident. In a few words, these results include changes in weather everywhere with a different distribution of rainfall and drought and more extreme events such as storms, heat waves, and hurricanes; more melting of the Arctic and Antarctic icecaps and the surrounding sea ice (last year I visited Svalbard to see things for myself); increasing sea level rise from the

6. See generally Millennium Ecosystem Assessment, <http://www.maweb.org> (last visited Jan. 25, 2008).

7. The full reports are available on the Intergovernmental Panel on Climate Change website, <http://www.ipcc.ch>.

current two millimeters a year upwards; acidification of some upper layers of the ocean with its effects on marine biology; and changes in ecosystems generally, including insects and microorganisms. So far as humans, with their increasing population, are concerned, we can foresee changes in human health; changes in water distribution; changes in agriculture and food supplies; changes affecting urban infrastructure (sewage, buildings, and public services); changes in population movement, including increased numbers of refugees; and changes in patterns of business, industry, transport systems, insurance, banking, and planning.

What are we to do about all this? In order to concert action, we need institutions for the purpose. The United Nations is basically an association of sovereign states, even if real sovereignty is leaking away from them all the time. Beyond and above the international debating society that is the United Nations General Assembly is the Security Council for the regulation of peace and war. Much of its role is reactive, and its scope for taking action to head off conflict is limited. Then there is the International Court of Justice, to which few states now risk submitting their disputes; the various specialized agencies and associated bodies; then the multilateral corporations, the banks, the media controllers, the drug empires, the criminal syndicates, and others, essentially outside the current system; the nongovernmental organizations which, though not accountable except to their members, try to represent citizens' interests; and now, increasingly, the information systems of the Internet and the World Wide Web, also outside the system.

There is a particular imbalance. On the one hand, we have the World Trade Organization, the International Monetary Fund, and the World Bank, which are all institutions with real mechanisms for influencing government policy. They are much stronger on trade and finance than on the environment and tend to be driven by vested interests looking for short-term profitability. On the other hand, the two hundred or more existing environmental agreements are dispersed and poorly coordinated, with different hierarchies of reference and accountability, and look principally to the long term. In the critical area of climate change, there is the Framework Convention, the Kyoto process, and the new cooperation between the G8+5 countries who together account for most of the problem. I have long argued for the creation of a World Environment Organization to balance—and be a partner of—the World Trade Organization. The last director of the World Trade Organization took the same view. If ever we are to cope with the consequences of the environment going over the edge, we shall need something of this kind.

So at the moment, neither public understanding of how and why environment is on the edge nor the mechanisms for coping with the results yet exist. Nor have we yet reckoned with the indirect effects. High among them is the understandable desire of most poor countries to follow the industrial countries in exploiting natural resources to the full, raising living standards, and participating in the consumer culture that is characteristic of the mindset of most modern society. Yet in many ways this is an impossibility. In 2001 humanity's ecological footprint exceeded the Earth's biological capacity by about twenty percent.

The division between the world's rich and the world's poor is a prime and a growing source of insecurity for all. At present, about twenty percent of the world's people consume seventy percent and eighty percent of its resources. The division between rich and poor is not only between countries but also within them. New elites in such countries as India and China are now acquiring similar purchasing power to the middle classes in industrial countries. The contrast is increasingly between small numbers of globalized rich and large numbers of localized poor.

Some economists suggest that market forces will eventually bring their version of development to all. The trends in subsequent United Nations Development Programme Reports, especially that of 1999, suggest the opposite. Living conditions have certainly improved for many people over the last 250 years, and most people are living longer. But with ever-rising population and increased pressure on resources, it is hard to see how this can continue. Our ability to respond to change is constantly being diminished. More people than ever are fleeing poverty, water and food shortages, health problems, storms, floods, and droughts, and by most reckonings the number of environmental refugees will greatly increase. In a world where the Internet lets knowledge travel ever wider, ever faster, inequalities in living conditions are becoming more generally perceived and felt.

The most difficult and perhaps painful requirement is to learn to think differently. Somehow we have to bring the factor of environmental costs into our economics. In addition to the traditional costs of research, process, production, and so on, prices should reflect the costs involved in replacing a resource or substituting for it and the costs of the associated environmental and human problems. As has been well said, markets are superb at setting prices but incapable of recognizing costs. In both the short term and even more the long term, any economy is a wholly-owned subsidiary of the environment.

In this field, the Chinese seem to be ahead of the rest of the world in seeking to introduce new methodologies to assess the implications of what they call "clean green growth," and the heavy penalties involved in

failing to do so. A paper published by the State Environment Protection Administration and the National Bureau of Statistics in Beijing last year brought out the artificiality of measuring wealth and well-being by simple GDP or GNP calculation.⁸ The conclusion in the *China Daily* that day was an editorial headed *The Greener the Better*.⁹ But even in China the arguments between the centre and the provinces, and in some cases between different government departments and agencies, have been vigorous and have delayed action.

Accepting all the difficulties, we still need to work out what should be done. Looking over all the problems on the environment, I have my own list of priorities, for what it is worth. A particular hazard is that here we do not know where the edges of change really are. There are certain tipping points for example, over: (1) the direction of the North Atlantic Ocean currents; (2) the state of the Amazonian rain forest; (3) the melting of the Greenland ice sheets; (4) the drying out of the Siberian peat bogs; and (5) the frequency and intensity of El Niño and La Niña.

We might not realize we were over the edge until it had long been passed.

We need urgent action on climate change. Like Sir David King, the British Government's Chief Scientific Advisor, I think that it represents "the most severe problem that we are facing today—more serious even than the threat of terrorism."¹⁰

Urgent action on energy policy in all its aspects is now essential. So much has been said on this that I will not repeat it. But subservience to drivers of gasoline driven cars or calling for new airports does not suggest that all politicians have yet understood what is at stake. Corporate leaders are in many cases ahead of them. I doubt whether technical wheezes—mirrors in space, windmill extractors, iron sprays in the oceans, cloud whitening, and the rest—could ever do much to help. They could create more problems than they solved. But I am in favour of taxation of carbon emissions and, of course, carbon capture and sequestration. I am also in favour of an independent and impartial review of the true costs of all sources of energy, including nuclear.

We need to do far more to inform public opinion, not least in the financial and investment communities. Here, many initiatives are pending with the support from industries and businesses likely to be

8. STATE ENVIRONMENT PROTECTION ADMINISTRATION AND NATIONAL BUREAU OF STATISTICS IN BEIJING, REPORT ON THE IMPACT OF THE ENVIRONMENT ON THE ECONOMY ("GREEN GDP") (Sept. 7, 2006) (on file with author).

9. Op-Ed., *The Greener the Better*, CHINA DAILY, Sept. 9, 2006, at 4.

10. David A. King, *Climate Change Science: Adapt, Mitigate, or Ignore?*, 303 SCIENCE 129, 176-77 (2004).

affected. The insurance industry is very much aware of the problems, and the Association of British Insurers produced an excellent paper on the subject last June.¹¹

As I have already said, we need to look again at economics and the way we measure wealth, welfare, and the human condition in terms of the Earth's good health.

We need to apply the principles of common but differentiated responsibility, accepting that industrial countries have much bigger responsibilities for what has gone wrong as well as what has gone right and should give the example in their domestic policies.

For other countries, we need to help them make best use of their resources and particular circumstances, avoiding any universally applicable blueprint for improvement in their condition.

We need to do far more to understand natural ecosystems and promote conservation. The Millennium Ecosystem Assessment¹² may have been alarming about the effects of current destruction of biodiversity, but it was only a beginning. We are still ignorant of our own ignorance.

We need to make better use of technology and its myriad applications. We also need to understand the hazards, particularly over pollution. Risks are hard to assess. The short term must not be allowed to defeat the long term.

We need to focus on the needs and attitudes of coming generations: in short, give new direction to the educational process. The process in an industrial country, as in any other country, is rightly called capacity building.

All involve the ability to accept accelerating change, to learn to think differently, and ultimately to behave correspondingly. We all suffer from the disease of what has been called conceptual sclerosis. Change is rarely linear. There are sudden breaks, unforeseen thresholds, and uncomfortable shocks.

This brings me to prospects for our future. If present trends continue, we may well push the environment over the edge with consequences including potentially unfavourable conditions for ourselves. But let us assume that we survive this century. In peering further ahead, it may be useful to jump a few hundred years, accepting that our ability to look even twenty years ahead is extremely limited. If statistical projections from the past have value, there will certainly have been some sudden disruptions before 2500, whether volcanic explosions, earthquakes, impacts of extraterrestrial objects, or even destructive wars using

11. ASS'N OF BRITISH INSURERS, ADAPTING TO OUR CHANGING CLIMATE 1, 1-4 available at http://www.abi.org.uk/BookShop/ResearchReports/Climate_Change_FINAL.pdf.

12. Millennium Ecosystem Assessment, *supra* note 6.

unimaginably horrible weapons. Ecosystems will be drastically changed, as after extinction episodes in geological history. Human health will be affected by the development and spread of new pathogens.

How our successors, if there be such, will react to these new circumstances we cannot predict. We must always expect the unexpected. But it is hard to believe that there will be anything like current human numbers in cities or elsewhere. Their distribution will almost certainly be very different. It has been suggested that an optimum population for the Earth in terms of its resources would be nearer to 2.5 billion rather than, as now, 6.2 billion, and possibly rising to between 8 and 9 billion later this century. Communities are likely to be more dispersed without the daily tides of people flowing in and out of cities for work. People may even wonder what all those roads were for.

There is also the possibility, however sinister, of differentiation of the human species. H.G. Wells invented Eloi and Morlocks (those up above and those down below),¹³ and at the time, more than a century ago, it seemed an amusing fantasy. No longer. Recently Lee Silver has written about "reprogenetics," or a division of humans into "GenRich" and "Naturals."¹⁴ Redesigning humans has become a real possibility. Through genetic manipulation, humans could well split into distinct varieties and over time into subspecies.

Then there is the development of information technology. On the one hand, humans may take enormous advantage from such technology and thereby be liberated from many current drudgeries. Soon, cars will book themselves in for servicing, hospitals will consult online diaries before scheduling an appointment, and trawlers will sell their catch at market before reaching port. All this seems unimaginable while elsewhere others still trudge miles to collect fuel, wood, and water.

On the other hand, humans may become dangerously vulnerable to technological breakdown and thereby lose an essential measure of self-sufficiency. Already, dependence on computers to run our complex systems and reliance on electronic information transfer are having alarming effects. Here, industrial countries are far more vulnerable than others. Just look at the effects of single and temporary power cuts. More than ever, individuals feel out of control of even the most elementary aspects of their lives.

The implications for governance reach equally wide. Already, there is a movement of power away from the nation-state: upwards to global institutions and corporations to deal with global issues; downwards to

13. H.G. WELLS, *THE TIME MACHINE* (1895).

14. LEE M. SILVER, *REMAKING EDEN: CLONING AND BEYOND IN A BRAVE NEW WORLD* (1998).

communities of human dimension; and sideways by electronic means between citizens everywhere. There is a wide range of possibilities, including forms of dictatorship and disaggregation of society. The problems of politics will be as difficult as they are today: how to ensure greater citizen participation without creating chaos, how to establish forms of accountability to ensure that governance is by broad consent, and how to establish checks and balances to protect the public interest and ensure enforcement without abuse.

Working together, we may merit our survival. But our long-term prospects cannot be assured.

I sometimes wonder how long would it take for the Earth to recover from the human impact. How soon would our cities fall apart, soils regenerate, the animals and plants we have favoured find a more normal place in the natural environment, the waters and seas become clearer, the chemistry of the air return to what it was before we polluted it? Life itself, from the top of the atmosphere to the bottom of the seas, and even below that, is so robust that the human experience could become no more than an episode.

Above all, let us remember how small and vulnerable we are as creatures of a particular environment. We are like microbes on the surface of an apple, on an insignificant tree in an insignificant orchard, among billions of other insignificant orchards stretching over horizons beyond our sight or even our imagining.