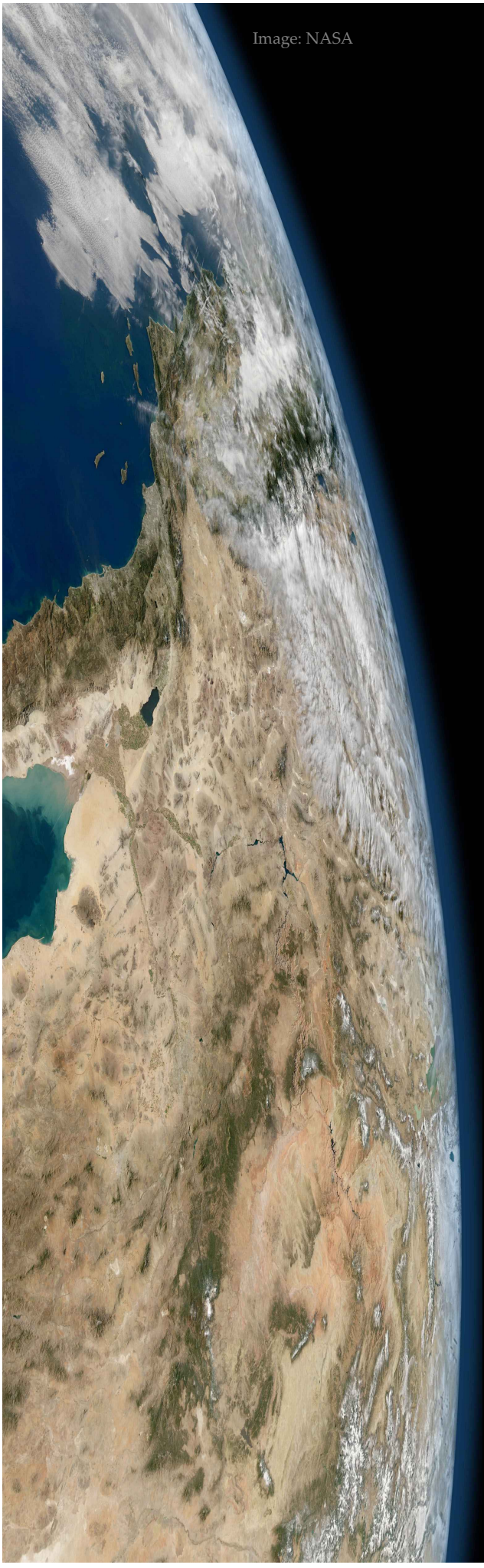

Image: NASA

Ecospheres Project

Earth Campaign

Bulletin 1. September 2012

Research & planetary stewardship.

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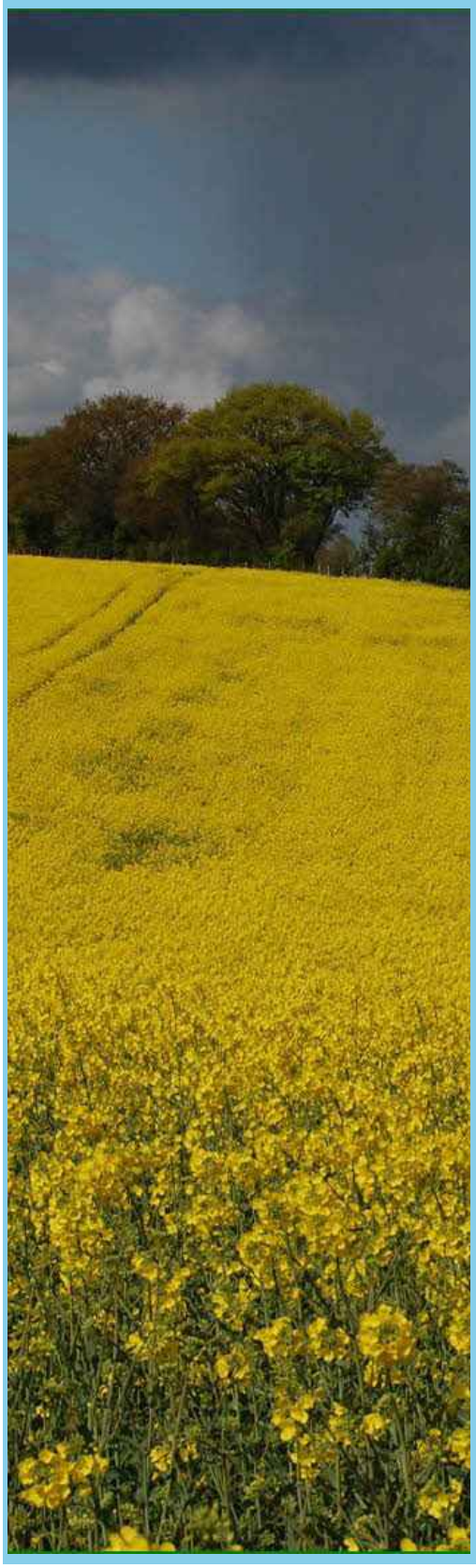
1. Introduction.

There is a growing understanding that there must be urgent and effective action to protect the global environment. The Earth Campaign is the vehicle through which my colleagues and I are making our own contribution to this effort. In this first Earth Campaign Bulletin, I explain why we have chosen to launch a campaign to support research into Earth systems, and why we would value your support.

2. Why do we need a campaign for research?

The determined work of existing campaigns is essential and we salute them. Our civilisation has brought benefits unparalleled in human history, yet at the same time, its expansion has created a global environmental crisis. Scientific organisations have presented a sobering picture of our escalating impact on our world, but there is a very real danger that we shall do too little, too late. Many campaign bodies are fighting hard to get that message across to politicians.

There is, however, an aspect of the crisis which has not received the same emphasis. There is a danger that whatever actions we do take to protect our environment may be based upon inadequate knowledge of how the Earth works, or of the risks associated with new technologies developed to combat environmental problems. Our knowledge needs to expand as fast as the threats which we are creating for ourselves. If it does not, schemes devised to safeguard our world may backfire.



3. Brinksmanship and planetary boundaries.

We are presently supporting > 7 billion people with climate-sensitive food production systems. Year by year, as population grows, this exercise in brinksmanship is becoming increasingly difficult.

Sanderson *et al.* (2002, p. 891) pointed out: "*we appropriate over 40% of the net primary productivity (the green material) produced on Earth each year (Vitousek et al. 1986; Rojstaczer et al. 2001). We consume 35% of the productivity of the oceanic shelf (Pauly and Christensen 1995), and we use 60% of freshwater run-off (Postel et al. 1996).*" Discussing the prospects for future agriculture, Foley *et al.* (2011, p. 337) reported: "*Altogether agriculture occupies about 38% of Earth's ice-free land (croplands cover 1.53 billion hectares and pastures 3.38 billion hectares), with much of the remaining area unsuitable for farming. (p. 338) " . . . worldwide agriculture has already cleared or converted 70% of the grassland, 50% of the savanna, 45% of the temperate deciduous forest, and 27% of the tropical forest biome . . . 70% of global freshwater withdrawals (80-90% of consumptive uses) are devoted to irrigation*". Moreover, whilst 80% of aquifers are not over exploited, the area needed to sustain human groundwater use and ecosystems is $(131.8 \pm 24.9) \times 10^6$ km^2, 3.5 ± 0.7 times the area of hydrologically active aquifers. Most excess water consumption is in the U.S.A., China, Pakistan, Iran, Mexico and Saudi Arabia; 1.7 billion people live in areas under threat.

In their assessment of biodiversity conservation in relation to the Millennium Development Goals, Sachs *et al.* (2009) recognised that the relationship between poverty and biodiversity was complex. For example, voluntary reduction of human birth rates could reduce population pressure and assist reduction of poverty and biodiversity conservation. At the same time, they argued, policies of trade-liberalisation might reduce prices in those countries importing food, thus reducing pressure on natural habitats. However, the situation was not as simple as this, because the promotion of food production in food-exporting countries might then encourage pressure on ecosystems.

Moreover (Sachs *et al.*, 2009, p. 1,502): *"Action is urgently needed to identify and quantify the links between biodiversity and ecosystem services on the one hand, and poverty reduction on the other, while taking into account the global, regional, and local drivers regional, and local drivers of biodiversity loss in poor areas. . . . Poverty alleviation and biodiversity agendas need to be jointly presented to policy-makers."*

The World Food Programme, together with the International Food Policy Research Institute, the New York University Center on International Cooperation, the Grantham Institute at Imperial College London, U.K., and the Walker Institute, University of Reading, U.K., has produced a report (Parry *et al.*, 2009), considering the potential impact of climate change. It was publicised in relation to the December 2009 *Climate Conference* in Copenhagen. It was estimated that (p. 5): *"By 2050, the number of people at risk of hunger as a result of climate change is expected to increase by 10 to 20 percent more than would be expected without climate change; and the number of malnourished children is expected to increase by 24 million – 21 percent more than without climate change. Sub-Saharan Africa is likely to be the worst affected region."* Flagged up also (p. 10) was the urgent need for: *"reversing the 50 percent decline in public spending on agricultural research and development over the last 15 years and scaling up extension services to get cutting edge technologies and techniques to hundreds of millions of farmers".*

Calling for a systematic study of agricultural operations worldwide, Jeffrey Sachs and a team of 24 other authors (Sachs *et al.*, 2010, p. 558) declared boldly that *"Agriculture must be transformed. Although global food production is increasing, today's farming systems undermine the well-being of communities in many ways. For instance, farming has destroyed huge regions of natural habitat and caused an untold loss of ecosystem services, and it is responsible for about 30% of greenhouse-gas emissions. . . . to feed the global population expected by 2050, more than 1 billion hectares of wild land will need to be converted to farmland if current approaches continue to be used."*

At the same time as we are exploiting an ever-increasing percentage of the Earth's natural resources, we are also undermining the natural environment, and so reducing its inherent capacity to support our civilisation. Concern has focussed on boundaries and tipping points, beyond which modification to the global environment could prove problematic or dangerous.

Up until tipping points are reached, environmental parameters would change in a linear fashion in response to human activity, but at tipping points, undergo abrupt change. Lenton *et al.* (2008) sought to identify possible tipping points and outlined their concerns (p. 1,792-1,793): "*Society may be lulled into a false sense of security by smooth projections of global change. Our synthesis of present knowledge suggests that a variety of tipping elements could reach their critical point within this century under anthropogenic climate change. The greatest threats are tipping the Arctic sea-ice and the Greenland ice sheet, and at least five other elements could surprise us by exhibiting a nearby tipping point. . . . It seems wise to assume that we have not yet identified all potential policy-relevant tipping elements. Hence, a systematic search for further tipping elements should be undertaken, drawing on both paleodata and multimodel ensemble studies. Given the large uncertainty that remains about tipping elements, there is an urgent need to improve our understanding of the underlying physical mechanisms determining their behaviour, so that policy makers are able "to avoid the unmanageable, and to manage the unavoidable"."* The quote was from the title of the report of the *Scientific Expert Group on Climate Change* (2007).

Rockström *et al.* (2009) argued that conditions during the Holocene (the last 11.7 kyr), during which civilisation arose, should be used as a guide to identify planetary boundaries within which civilisation may operate safely. They considered climate change; rate of biodiversity loss (terrestrial and marine): interference with N and P cycles: stratospheric ozone depletion; ocean acidification; global freshwater use; change in land use; chemical pollution; and atmospheric aerosol loading. They concluded (p. 475) that: "*Although we present evidence that three boundaries have been overstepped, there remain many gaps in our knowledge. We have tentatively quantified seven boundaries, but some of the figures are merely our best guesses. Furthermore, because many of the boundaries are linked, exceeding one will have implications for others in ways that we do not as yet completely understand. There is also significant uncertainty over how long it takes to cause dangerous environmental change or to trigger other feedbacks that drastically reduce the ability of the Earth system, or important subsystem, to return to safe levels.*"

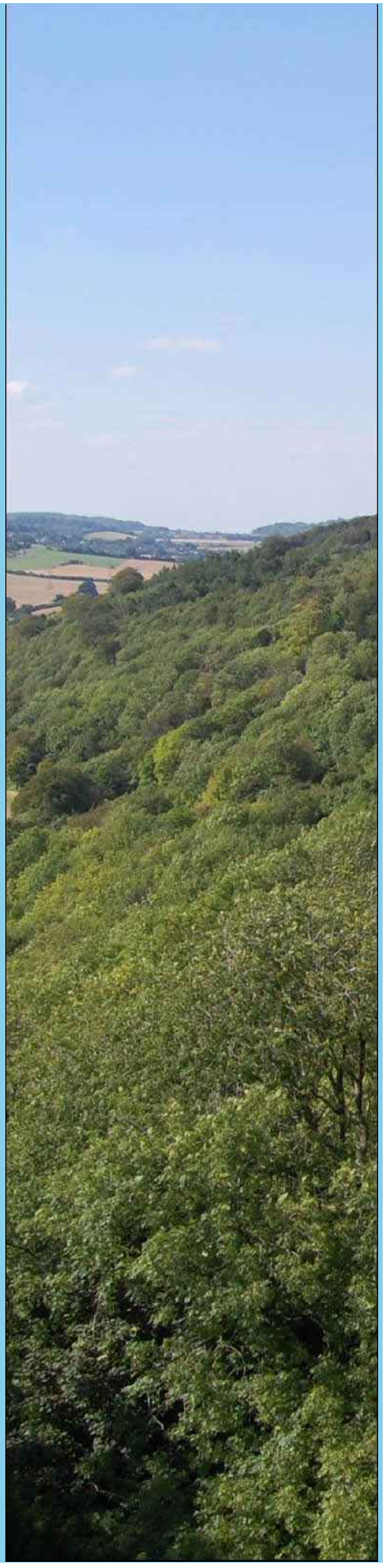
Lewis (2012, p. 417) considered that the concept was "*conceptually brilliant and politically seductive*" yet he highlighted flaws and warned that: "*using it uncritically could unwittingly undermine Rio's twin goals of environmental stewardship and ensuring a good life for everyone.*"

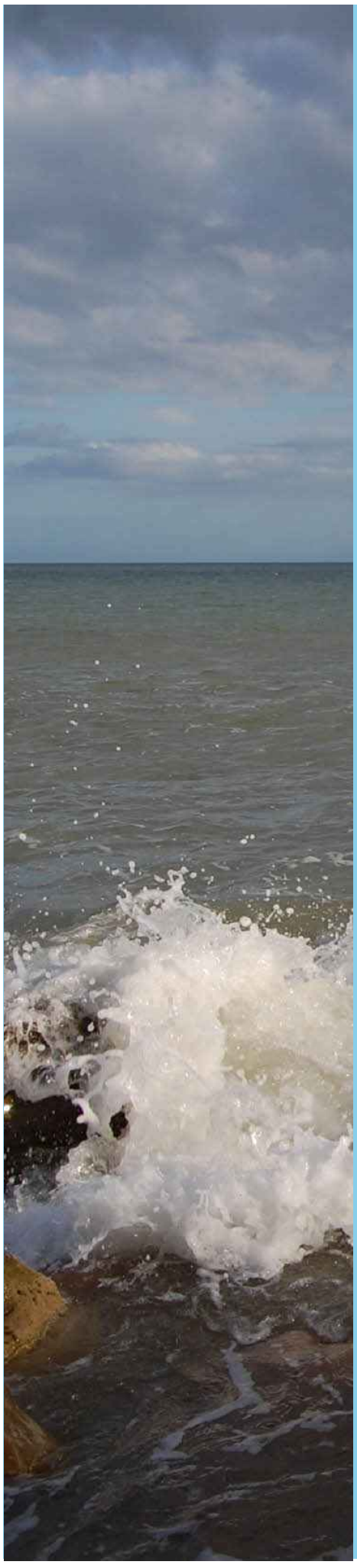
As for climate change driven by release of greenhouse gases through human activity, *The joint science academies' statement: Global response to climate change: (2005)* - from the national scientific bodies of Brazil, Canada, China, Germany, India, Italy, Japan, Russia, United Kingdom, and the U.S.A. - highlighted the need to (p. 2): "*Mobilise the science and technology community to enhance research and development efforts, which can better inform climate change decisions.*" U.K. *Royal Society policy document 27/05* observed (p. 1): "*Much is made of the uncertainties involved in the science of climate change. Many aspects are uncertain and global investment is required in the science so as to better inform decisions.*"

4. In the absence of effective research, "planetary stewardship" is a meaningless slogan.

The concept of "*planetary stewardship*" has been presented as an alternative to the destructive exploitation of the global environment for short-term gain. It has achieved worldwide popularity and it carries a sense of moral imperative. It conveys the implication that our activities should be conducted with foresight and with responsibility towards the Earth's natural life support systems. Our civilisation depends upon these systems for its existence, and so planetary stewardship translates directly into responsibility towards human communities. Unfortunately, a desire to safeguard the Earth cannot, no matter how heart-felt, transform us into planetary stewards any more than a desire to relieve the suffering of the sick amounts in itself to a medical qualification.

Responsible stewardship will require us to expand our working knowledge of our planet and ongoing development of reliable networks for monitoring Earth processes. We do not need more research before we can be sure that a human-driven global environmental crisis is real. Well-documented degradation of our environment is taking place on a broad front, on every scale from the local to the planetary. If we are to safeguard ecosystems and human communities, however, we will need well-funded programmes of research, enabling us to tighten the accuracy of our predictions about looming environmental change, and to develop new technologies and agriculture techniques. As illustrated by the selection of quotes above, shortfalls in our knowledge of our home planet are substantial and they are being emphasised by authors of papers published in main-stream peer-reviewed scientific journals and reports.





5. Good will combined with ignorance is dangerous.

According to an old saying, the road to hell is paved with good intentions. History provides thought-provoking examples of how the creation of good will in the corridors of power is, by itself, insufficient to ensure beneficial outcomes. For instance, there was no lack of eager political will behind urgent attempts to eradicate London's 19th Century cholera epidemics, but good intentions were hampered by a prevailing model of the disease being transmitted by smell (Cadbury, 2005).

Much concern has focussed on the dangers of ill-considered global-scale geoengineering as a means to reverse climate change. A report seeking "*a clarification of the scientific and technical aspects of geoengineering*" was produced under the auspices of the UK Royal Society (Shepherd *et al.*, 2009). Reviewing this document, Brumfiel (2009, p. 19) noted the danger of potential "*disastrous side effects*" and reported "*Because the science and policy surrounding geoengineering is so complex, any potential scheme would take decades to put into practice, says John Shepherd, an Earth scientist at the University of Southampton, UK, who chaired the report. "These things may help us get out of a fix later in the century," he says. "But we have to do research now.""*

Some past disasters alert us to the hazards of future technological fixes for global climate, because they resulted from *de facto* attempts at regional geoengineering. The transformation of most of the Aral Sea (once the world's fourth largest lake at 68,000 km^2) into a desert followed a Soviet initiative to *improve* the human environment by diverting the waters that fed it for irrigating fields. Regional agricultural capabilities were enlarged, but at the cost of a major fishing resource. Micklin (2007) provided a helpful discussion.

In the capitalist world, the 19th Century theory that "*rain follows the plow*" became linked to calls for the United States to fulfil a manifest destiny. An optimistic model in which the initiation of agriculture would, by itself, modify deserts into well-watered landscapes, encouraged colonists to mistake a natural wetter episode for a permanent change brought about by their own efforts in areas of America later to be afflicted by the notorious 1930s "*Dust Bowl*" and other episodes of drought. Agricultural practices contributed to the Dust Bowl (Cunfer, 2002; 2008 thought their role to have been over-emphasised for political purposes), but so did natural cycles of drought (Gill & Lee, 2006), and these could be exacerbated by anthropogenic climate change (Romm, 2011).

6. Sceptics cannot sidestep the need for research.

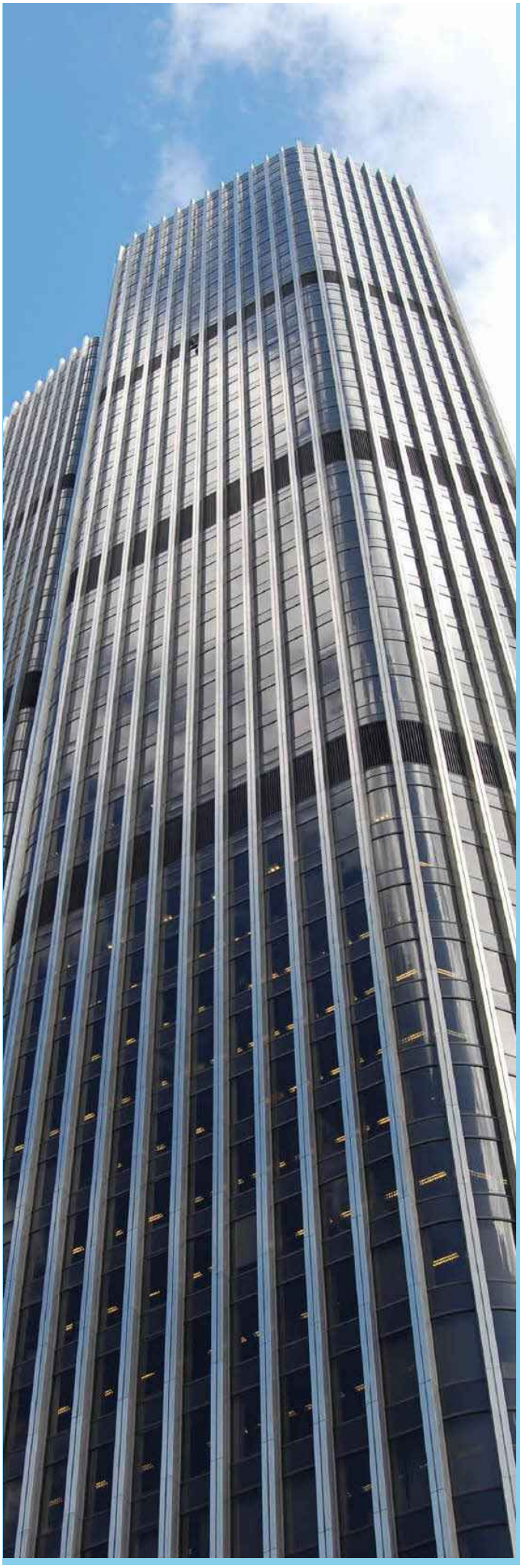
Sceptics and counter-advocates often cite work reinforcing predictions of anthropogenic climate change as "*warmist*" or "*alarmist*." One newspaper piece (Hamilton, 2009, p. 36) made the accusation that: "*Many academics on the eco-gravy train try to ignore or suppress data tending to undermine their pet theories.*" His targets were "*taxpayer-funded global warmists*" whose "*research grants and jobs depend on a continuation of the hysteria*".

If such claims were true, there would be a danger that governments were committed to needless and substantial economic and social disruption to avoid non-existent threats. However, given our responsibility to support over 7 billion people, the science of climatology would, as a matter of urgent priority have to be made fit for purpose. If it rested to any serious extent upon fraud and inadequate models, it could be corrected only with a massive research input and through a transparently objective process. The fair requirement of major scientific journals that authors must declare any financial interests relevant to their conclusions means that a sceptical Global Warming Policy Foundation (formed 2009) has, through its decision not to identify sponsors, disqualified itself from participating in any such process.

In reality, it is hard to see how fatal flaws in standard climate models would, if they were genuine, provide in themselves a rational reason to adopt, as a default position, complacent and optimistic assumptions about rates and magnitudes of anthropogenic or natural climate change.

7. Essential research is being neglected.

Neglect to fund programmes that could deepen our understand of the Earth, is another way of taking our planet and the health of our civilisation for granted. Astonishing examples of culpable neglect can be cited. They include the failure of the U.S.A., the world's wealthiest economy, to maintain its own fleet of ice-breaker vessels in working order, the threat posed by funding cuts to Canada's Arctic research capabilities, and the failure of the Russian Federation to announce an unequivocal decision to protect a unique collection of fruiting plants (whose genetic diversity could help to ensure food security in the face of climate change) from a housing development.



8. A coming-of-age test for civilisation.

The environmental challenge is a coming-of-age test for our civilisation. Graduating to true planetary stewardship will be tough, because (beyond any political-diplomatic issues of international co-operation), Earth systems, and our relationships with them, are awesomely complex.

We have a daunting amount to learn and we must tackle that task successfully if we are to earn ourselves a more secure tenancy of the Earth. There is little time for us to serve our apprenticeship as planetary stewards, and the time-scale will shrink proportionately as our impact on the world expands. We have no guarantee of success and every possibility of failure. We have a hard struggle ahead of us.

We human beings have demonstrated that we have the intelligence and inventive capabilities to initiate a global civilisation fuelled by exploitation of natural resources. However, we have not demonstrated foresight in developing long-term strategies for the survival of civilisation. Many resources are limited, and our negative impact on the global environment, which cannot absorb limitless damage, has escalated. Now, confronted by one of the greatest challenges which our species has ever faced, we must become cleverer.

We must devise means to pursue the development of our technological civilisation whilst, at the same time, safeguarding the world upon which it depends. If we fail to make this our priority, then the next few decades may well see us blundering through a succession of “fixes” that precipitate us into worse crises than that which we face already.

Both public and politicians must understand that our relationship with our planet involves a level of reality more fundamental than the financial realities that are internal to human societies.

Research into Earth systems is not a luxury in which societies can indulge in times of affluence and downsize in times of austerity; it is about our long-term survival. Nor would it make sense to decrease our research expenditure should environmental problems begin to undermine our economies, because that would further reduce our capacity to respond. A token commitment to research will not help. Filling the research gap is a responsibility that must be met in actuality; it cannot be accomplished through sloganeering or manufactured appearances as feature so prominently in advocacy and politics.

Healthy research programmes providing sound data and effective answers to environmental problems are a pre-requisite of planetary stewardship. Through safeguarding human communities, research can make a fundamental contribution to global social justice.

9. An invitation to support the Earth Campaign.

We are inviting workers in relevant disciplines to participate in our campaign, which complements the efforts of existing campaigns. We welcome comments for publication which would raise awareness amongst public and policy makers of how:

a) inadequacies in our knowledge of specific Earth processes may compromise our ability as a civilisation to devise the most constructive and best informed ways to respond to the challenges of climate change and other environmental threats;

b) funding and other requirements in key areas must be met on relevant time-scales in order to clarify aspects of natural processes, the human impact on Earth systems, and the impact of natural and anthropogenic environmental change on human societies;

c) governments have a duty to improve long-term planning for civilisation's needs;

d) workers in the Earth sciences can communicate more effectively with both public and politicians, given that the promotion of environmental literacy will be necessary if the layperson is to make informed decisions about science-based policies which are being adopted by governments in the face of anticipated climate change.

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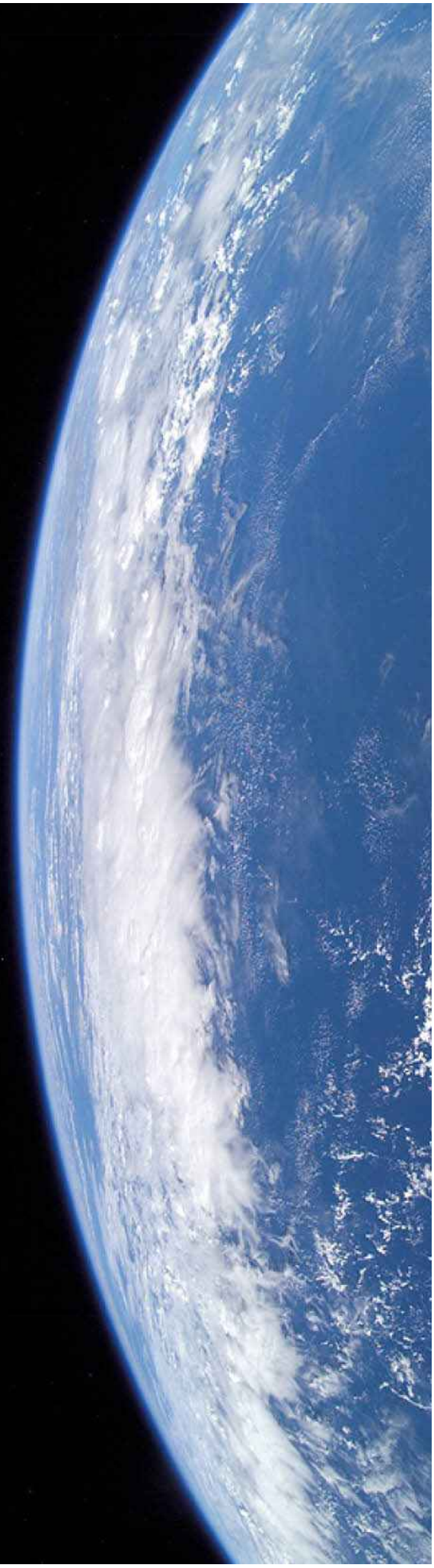

Image: NASA

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