Why care for the Environment?

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(revised with his agreement by Martin J. Hodson)

Faraday Papers

SUMMARY

Global threats to the environment demand global solutions and sustainability provides the key. This paper surveys this challenge with particular reference to Global Warming, describing the perils of inaction and some strategies for addressing the problem. Those who believe in God as creator and sustainer have a powerful motivation to care for God's earth, and to take action on behalf of the poor, those who suffer most from environmental degradation.

It has always been important to look after our local environment if only so that we can pass on to our children and grandchildren an environment at least as good as we have enjoyed. Today, however, it is not just the *local* environment that is at risk but the *global* environment. Small amounts of pollution for which each of us is responsible are affecting everyone in the world. For instance, very small quantities of chlorofluorocarbons (CFCs) emitted to the atmosphere from leaking refrigerators or some industrial processes have resulted in degradation of the ozone layer; carbon dioxide that enters the atmosphere from the burning of fossil fuels, coal, oil and gas is leading to damaging climate change. Pressures from rapidly increasing world population and from increasing overuse of the Earth's resources are making such environmental problems more acute and exacerbating the damage both to ecosystems and to human communities. The perils of human induced climate change are now recognised much more widely, frequently described by responsible scientists and politicians as probably 'the greatest problem the world faces' and as a 'weapon of mass destruction'. *Global* pollution demands *global* solutions.

The necessary global solutions need to address human attitudes very broadly, for instance those concerned with resource use, lifestyle, wealth and poverty. They must also involve human society at all levels of aggregation – international organisations, nations with their national and local governments, large and small industry and businesses, non-governmental organisations (e.g. churches) and individuals. To take into account the breadth of concern, a modern term that is employed to describe such environmental care is 'sustainability'.

What is sustainability?

Imagine you are a member of the crew of a large space ship on a voyage to visit a distant planet. Your journey there and back will take many years. An adequate, high quality, source of energy is readily available in the radiation from the sun. Otherwise, resources for the journey are limited. The crew on the spacecraft is engaged for much of the time in managing the resources as carefully as possible. A local biosphere is created in the spacecraft where plants are grown for food and everything is recycled. Careful accounts are kept of all resources, with especial emphasis on non-replaceable components. That the resources be *sustainable* at least for the duration of the voyage, both there and back, is clearly essential.

Planet Earth is enormously larger than the spaceship we have just been describing. The crew of Spaceship Earth in July 2018 is 7.6 billion and rising and is also enormously larger. The principle of sustainability should be applied to Spaceship Earth as rigorously as it has to be applied to the much smaller vehicle on its interplanetary journey. Professor Kenneth Boulding, a distinguished American economist, was the first to employ the image of Spaceship Earth. In a publication in 1966 he contrasted an 'open' or 'cowboy' economy (as he called an unconstrained economy) with a 'spaceship' economy in which sustainability is paramount.[1]

Sustainability is a word that not only concerns physical resources, but applies equally to activities and communities. Environmental sustainability is also strongly linked to social sustainability – referring to sustainable communities – and sustainable economics. *Sustainable Development* provides an all-embracing term. The Brundtland Report, 'Our Common Future' of 1987 provides a milestone review of Sustainable Development issues.

There have been many definitions of sustainability. The simplest I know is 'not cheating on our children'. To that may be added, 'not cheating on our neighbours' and 'not cheating on the rest of creation'. In other words, not passing on to our children or any future generation an Earth that is degraded compared to the one we inherited, and also sharing common resources as necessary with our neighbours in the rest of the world and caring properly for the non-human creation.

Crisis of sustainability

The human activities of an increasing world population, together with the accompanying rapid industrial development, are leading to degradation of the environment on a very large scale. However, some deny that degradation is happening; others deny that degradation matters. Scientists have an important role in ensuring the availability of accurate information about degradation and also in pointing to how humans can begin to solve the problems.

Many things are happening in our modern world that are just not sustainable. In fact, we are all guilty of cheating in the three respects I have mentioned. In 2009 a group of scientists led by Johan Rockström suggested that there were nine "planetary boundaries", life support systems for humanity. [2] These were: climate change; biodiversity loss; the biogeochemical cycles of nitrogen and phosphorus; ocean acidification; land use; freshwater; ozone depletion; atmospheric aerosols; and chemical pollution. Worryingly, it was estimated that the boundaries for climate change, biodiversity loss and nitrogen cycling had already been crossed, while others were likely to be crossed soon. All of these issues interact and are intimately linked with each other.

To illustrate these connections let me use the example of deforestation. In 2017, 15.8 million hectares of tropical forest were lost equivalent approximately to the area of Bangladesh. Some is to harvest valuable hardwoods unsustainably; some is to raise cattle to provide beef for some of the world's richest countries. This level of deforestation adds significantly to the atmospheric greenhouse gases carbon dioxide and methane, so increasing the rate of human induced climate change. It is also likely to change the local climate

[1] Kenneth Boulding was Professor of Economics at the University of Colorado, sometime President of the American Economics Association and of the American Association for the Advancement of Science. His article, 'The Economics of the Coming Spaceship Earth' was published in 1966 in 'Environmental Quality in a Growing Economy' pp 77-82.

[2] Rockström, J. et al. (2009) A safe operating space for humanity. *Nature* **461**, 472–475.

close to the region where the deforestation is occurring. For instance, if current levels of deforestation continue in the Amazon, some of Amazonia could become much drier, even semi-desert, during this century. Further, when the trees go, soil is lost by erosion; again in many parts of Amazonia the soil is poor and easily washed away. Tropical forests are also rich in biodiversity. With loss of forests there will be much irreplaceable biodiversity loss.

All these issues present enormous challenges. For much of the rest of this paper I want to address in some detail the world's most serious environmental and sustainability issue – one with which I have been particularly concerned – that of global warming and climate change, explaining the essential roles of both science and faith in getting to grips with it.

The science of global warming

I begin by summarising the basic science. By absorbing infra-red or 'heat' radiation from the Earth's surface, 'greenhouse gases' present in the atmosphere, such as water vapour and carbon dioxide, act as blankets over the Earth's surface, keeping it warmer than it would otherwise be. The existence of this natural 'greenhouse effect' has been known for nearly two hundred years; it is essential to the provision of our current climate to which ecosystems and we humans have adapted.

Since the beginning of the industrial revolution around 1750, one of these greenhouse gases, carbon dioxide, has increased by over 40% and in July 2018 is at a higher concentration in the atmosphere (411 ppm) than for many hundreds of thousands of years. Chemical analysis demonstrates that this increase is due largely to the burning of fossil fuels – coal, oil and gas. If no action is taken to curb these emissions, the carbon dioxide concentration will rise during the twenty-first century to two or three times its pre-industrial level.

The climate record over recent centuries shows a lot of natural variability arising from external factors (such as changes in the sun's energy or the influence of volcanoes) or from internal variations within the climate system. However, the rise in global average temperature (and its rate of rise) during the twentieth century is well outside known natural variability in recent modern human times.The year 2016 is the warmest year in the instrumental record that goes back to 1860. A more striking statistic is that all of the warmest years except 1998 were recorded in this century. There is very strong evidence that most of the warming over the last fifty years is due to the increase of greenhouse gases, especially carbon dioxide.

Over the twenty-first century the global average temperature is projected to rise by between 1.5 and 4 ºC (2.7 to 7 ºF) from its pre-industrial level; the range represents different assumptions about greenhouse gas emissions and the sensitivity of the climate. For *global average* temperature, a rise of this amount is large. The difference between the middle of an ice age and the warm periods in between is only about 5 or 6 ºC. So, associated with likely warming in the twenty-first century will be a rate of change of climate equivalent to say, half an ice age in less than a hundred years – a larger rate of change than for at least 10,000 years. Adapting to this will be difficult for both humans and many ecosystems.

The impacts of global warming

Talking in terms of changes of global average temperature, however, tells us rather little about the impacts on human communities. There will be some positive impacts, for instance an increase in plant growth due to a carbon dioxide fertilization effect and a longer growing season at high latitudes. But most impacts will be adverse[3]. One obvious impact will be due to the rise in sea level (possibly of a metre this century) that is occurring because of the melting of ice sheets and glaciers on land and since ocean water expands as it is heated. This rise will continue for many centuries – to warm the deep oceans as well as the surface waters takes a long time. This will cause large problems for human communities living in low-lying regions. Many areas, for instance in Bangladesh (Figure 1), southern China, islands in the Indian and Pacific oceans and similar places elsewhere in the world, will be impossible to protect and many millions will be displaced.

[3] A well-illustrated account of climate change and its impacts is that of Al Gore*, An Inconvenient Truth*, New York: Rodale (2006).

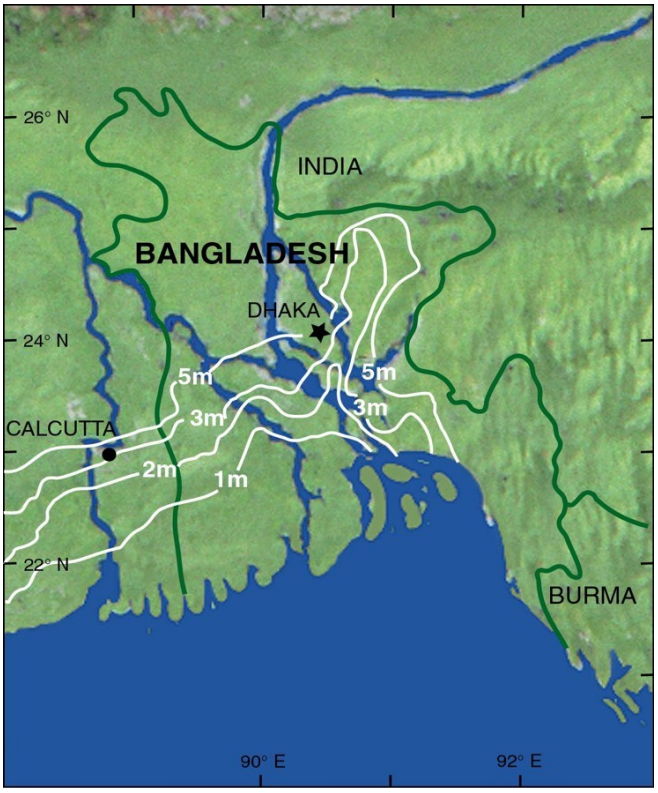

Figure 1 Land affected in Bangladesh by various amounts (in metres) of sea level rise. 48% of its population live less than 10 metres above sea level. Adapted from Milliman, J.D., Broadus, J.M., and Gable F. (1989) Environmental and Economic Implications of Rising Sea Level and Subsiding Deltas: The Nile and Bengal Examples. *Ambio* **18**, 340-345.

There will also be impacts from extreme events. The extremely unusual heat wave in central Europe during the summer of 2003 led to the deaths of over 20,000 people.

Water is becoming an increasingly important resource. A warmer world will lead to more evaporation of water from the surface, more water vapour in the atmosphere and more precipitation on average. Of greater importance is the fact that the increased condensation of water vapour in cloud formation leads to greater release of latent heat of condensation. Since this latent heat provides the largest source of energy driving the atmosphere's circulation, the hydrological cycle will become more intense. This means a tendency to more intense rainfall events and also less rainfall in some semi-arid areas. Since, on average, floods and droughts are the most damaging of the world's disasters, their greater frequency and intensity is bad news for most human communities and especially for those regions such as south-east Asia and sub-Saharan Africa where such events already occur only too frequently. It is these sorts of events that provide some credence to the comparison of climate with weapons of mass destruction.

Sea level rise, changes in water availability and extreme events will lead to increasing pressure from environmental refugees. It is now clear that the relationship between human migration and climate change is much more complex than was once thought, and that poor people often do not have the capability to migrate.[4] However, there is little doubt that if we do not take prompt action to limit climate change we could see mass migrations later this century.

In addition to the main impacts summarised above are changes about which there is less certainty, but if they occurred would be highly damaging and probably irreversible. For instance, large changes are being observed in Polar Regions. Loss from the Greenland ice sheet increased significantly from 34 Gt yr^{-1} over the period 1992-2001 to 215 Gt yr^{-1} during 2002-2011.

Can we believe the evidence?

How sure are we about the scientific story I have just presented? It is largely based on the assessments by the world scientific community carried out through the work of the Intergovernmental Panel on Climate Change (IPCC)[5]. I had the privilege of being chairman or co-chairman of the Panel's scientific assessment from its beginning in 1988 to 2002.[6] This period involved the production of the 1st, 2nd and 3rd assessment reports. Many hundreds of scientists from many countries were involved in its work. No assessments on any other scientific topic have been so thoroughly researched and reviewed. The IPCC has continued its work with the 5th assessment report being released in 2013 and 2014.

[4] Piguet, E, Pecoud, A., De Guchteneire, P. eds (2011) *Migration and Climate Change.* Cambridge University Press, Cambridge.

[5] See the IPCC web site www.ipcc.ch. My book, Houghton, J. (2015) *Global Warming: the complete briefing*, 5th edn., Cambridge University Press, Cambridge is strongly based on the IPCC reports.

[6] See Houghton, J. (2013) *In the Eye of the Storm.* Lion Hudson, Oxford. pp. 126-207.

Unfortunately, there are strong vested interests that have spent tens of millions of dollars on spreading misinformation about the climate change issue.[7] They first denied the scientific evidence and more recently have argued that its impacts will not be large, or that it is too expensive to do anything and that there are more important problems. The scientific evidence cannot support such arguments.

International agreement required

Global emissions of carbon dioxide to the atmosphere from fossil fuel burning were about 10 billion tonnes of carbon per annum in 2017. Unless strong measures are taken they will reach two or three times their present levels during the twenty-first century and climate change will continue unabated leading to warming of 4°C or more (Figure 2). To halt climate change during the twenty-first century, emissions must be reduced very rapidly. It is essential that all countries join the international agreements being negotiated under the United Nations Framework Convention on Climate Change (FCCC). The UN climate change meeting in Copenhagen (COP15) in 2009 was largely seen as a failure, but it was there that nations agreed to take actions to keep global warming to 2°C above the pre-industrial temperature. The meeting in Paris (COP 21) in 2015 was much more successful and the nations agreed to try to keep warming below 1.5°C. [8] Before the meeting individual nations were invited to submit their plans for reducing carbon emissions, so called Nationally Determined Contributions (NDCs). When all the NDCs were added up to produce a global figure it was clear that the world is nowhere near on target to meet the 2°C target and even less so 1.5°C. However, the Paris Agreement envisaged a ratcheting mechanism whereby nations submitted revised NDCs every five years. The hope is that as technology improves nations will become bolder in their carbon emissions cuts, and gradually we will approach the levels needed to remain below 2°C. Certainly, since the Paris Agreement we have seen a massive deployment of renewable technology, while coal production is in a global slump.

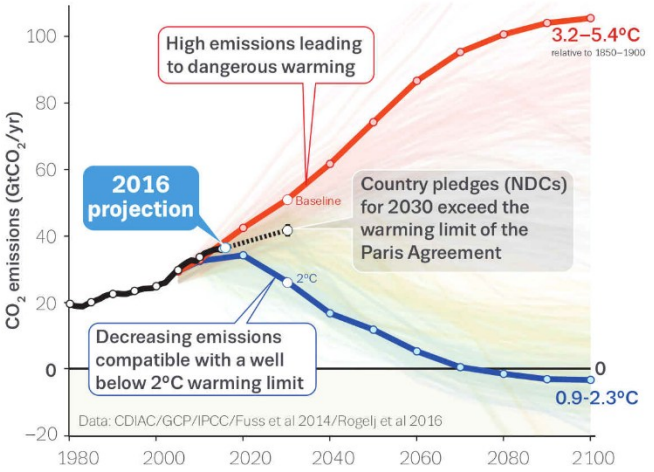

Figure 2. Global emissions of carbon dioxide from fossil fuel burning (in billions of tonnes of carbon) up to 2016 and as projected to 2100. The red curves refer to various 'business as usual' assumptions and the blue curves are those that would lead to the global temperature remaining below 2°C.[9]

What actions can be taken?

Three sorts of actions are required if such reductions are to be achieved. First, there is energy efficiency. Very approximately one third of energy is employed in buildings (domestic and commercial), one third in transport and one third by industry. Means are available to double the efficiency of energy use in all three sectors, in many cases with significant savings in cost. Secondly, a wide variety of non-fossil fuel sources of energy are available for development and exploitation, for instance, biomass (including waste), solar power (both photovoltaic and thermal), hydro, wind, wave, tidal and geothermal energy. Thirdly, there are possibilities for sequestering carbon that would otherwise enter the atmosphere either through the planting of forests or by pumping underground (e.g. in oil and gas fields). The opportunities for industry for innovation, development and investment in all these areas is

[7] For more on climate scepticism see: Hodson, M.J. & Hodson, M.R. (2015) *The Ethics of Climatic Scepticism.* Grove Books, Cambridge.

[8] Hodson, M.J. (2015) Paris, Paris- COP 21, a personal reflection and review. *A Special JRI Briefing* https://www.jri.org.uk/wp/wp-content/uploads/Paris2015.pdf (accessed 26 July 2018)

[9] Figure taken from a Global Carbon Project 2016 infographic and used with permission. See http://www.globalcarbonproject.org/ (accessed 10 August 2018)

large. Technology Transfer from developed to developing countries is also vital if energy growth in developing countries is going to proceed in a sustainable way.

Stewards of Creation

People often say to me that I am wasting my time talking about environmental sustainability. 'The world' they say 'will never agree to take the necessary action.' I reply that I am optimistic. One reason I give is that I believe that God is committed to His creation and that we have a God-given task of being good stewards of creation[10].

What does Christian stewardship of creation mean? In the early part of Genesis, we learn that humans, made in God's image, are given the mandate to exercise stewardship/management care over the earth and its creatures (Gen. 1: 26, 28 & 2: 15). We therefore have a responsibility first to God to look after creation – not as we please but as God requires – and secondly to the rest of creation as ones who stand in the place of God.

We are only too aware of the strong temptations we experience, both personally and nationally, to use the world's resources to gratify our own selfishness and greed: not a new problem, in fact a very old one. In the Genesis story of the garden, we are introduced to human sin with its tragic consequences (Genesis 3); humans disobeyed God and did not want him around any more. That broken relationship with God led to broken relationships elsewhere too. The disasters we find in the environment speak eloquently of the consequences of that broken relationship.

Those of us in the developed countries have already benefited over many generations from abundant fossil fuel energy. The demands on our stewardship take on a special poignancy as we realise that the adverse impacts of climate change will fall disproportionately on poorer nations and will tend to exacerbate the increasingly large divide between rich and poor. Our failure to be good stewards is a failure to love God and a failure to love our neighbours, especially our poorer neighbours in Africa and Asia. The moral imperative for the rich countries is inescapable.

Some Christians tend to hide behind an earth that they think has no future. But Jesus has promised to return to earth – earth redeemed and transformed. In the meantime earth awaits, subject to frustration, awaiting its final redemption (Rom. 8: 20-22). Our task is to obey the clear injunction of Jesus to be responsible and just stewards until his return (Luke 12: 41-48). Exercising this role provides an important part of our fulfilment as humans. In our modern world we concentrate so much on economic goals – getting rich and powerful. Stewardship or long-term care for our planet and its resources brings to the fore moral and spiritual goals. Reaching out for such goals could lead to nations and peoples working together more effectively and closely than is possible with many of the other goals on offer.

New Attitudes

Not only do we need goals, we also need new attitudes and approaches in the drive towards sustainability – again at all levels of society, international, national and individual.

For instance, sustainability will never be achieved without a great deal more sharing. Sharing is an important Christian principle. John the Baptist preached about sharing (Luke 3: 11), Jesus talked about sharing (Luke 12: 33), the early church were prepared to share everything (Acts 4: 32) and Paul advocated it (2 Cor. 8: 13-15). The opposite of sharing – greed and covetousness – is condemned throughout scripture. At the individual level, a lot of sharing often occurs. At the international level it occurs much less as is well illustrated by the most condemning of world statistics – that the average flow of wealth in the world is from the poor to the rich.

One of the biggest 'sharing' challenges faced by the international community is how emissions of carbon dioxide can be shared fairly between nations. Currently great disparity exists between emissions by rich nations compared with poorer ones. Expressed in tonnes of carbon per capita per annum in 2014, they vary from about 4.5 for the USA, 1.8 for the United Kingdom, 2.0 for China 0.5 for India, and 0.1 for Bangladesh. Furthermore, the global average per capita, currently about 1.35

[10] See Berry, R. J. (ed.) *Environmental Stewardship*, T & T Clark (2006); Bauckham, R. (2010) *Bible and Ecology*. DLT, London; and Bell, C. & White, R.S. (eds) (2016) *Creation Care and the Gospel: Reconsidering the Mission of the Church.* Hendrickson, Peabody.

tonnes per annum, must fall substantially during the twenty-first century. Contraction & Convergence, a proposal by the Global Commons Institute[11] is that emissions should first be allocated to everybody in the world equally per capita, then transfer of allocations be allowed through trading between nations. The logic and the basic equity of this proposal is in principle quite compelling – but is it achievable? A further aspect of sharing, increasingly recognised by aid agencies, is to share our skills with the third world – for instance in science and technology.

You may ask, 'but what can I as an individual do?' There are some actions that all of us can take[12]. For instance, we can ensure our homes and the appliances or the car we purchase are as energy efficient as possible. We can buy 'green' electricity, shop responsibly, use public transportation, car-share more frequently and use our bikes where feasible. We can become better informed about the issues and support leaders in government or industry who are advocating or organising the necessary solutions. To quote Edmund Burke, a British parliamentarian of 200 years ago, 'No one made a greater mistake than he who did nothing because he could do so little.'

Partnership with God

We may feel daunted as we face the seemingly impossible challenge posed by care for the environment and the need for sustainability. But an essential Christian message is that we do not have to carry the responsibility alone. Our partner is none other than God Himself. The Genesis stories of the garden contain a beautiful description of this partnership when they speak of God 'walking in the garden in the cool of the day' – God, no doubt, asking Adam and Eve how they were getting on with learning about and caring for the garden.

Just before he died Jesus said to his disciples, 'Without Me you can do nothing' (John 15: 5). He went on to explain that he was not calling them servants but friends (John 15: 15). Servants are given instructions without explanation; as friends we are brought into the confidence of our Lord. We are not given precise prescriptions for action but are called to use the gifts we have been given in a genuine partnership. Within the creation itself there is enormous potential to assist us in the task; the pursuit of scientific knowledge and the application of technology are an essential part of our stewardship. Both need to be approached and used with appropriate humility.

An unmistakeable challenge is presented to the world-wide Christian church to take on the God-given responsibility of caring for the environment. It provides an unprecedented mission opportunity for Christians to take a lead and demonstrate love for God the world's creator and redeemer, and love for our neighbours wherever they may be – remembering the words of Jesus, 'From everyone who has been given much, much will be demanded' (Luke 12: 48).

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[11] Contraction & Convergence http://www.gci.org.uk/index.html (accessed 27 July 2018)

[12] Valerio, R. (2008) *L is for Lifestyle.* IVP, London. .

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