

climate change and health

John Lockwood presents a scientific and biblical overview



From a biblical perspective, creation care is an integral part of the good news of redemption and new creation in Jesus Christ through the Holy Spirit. One of the lessons Job had to learn was that the created order testifies to the vast wisdom of God and therefore is a motive for praising God. Psalm 19:1 states 'The heavens declare the glory of God; the skies proclaim the work of his hands'.

In the early days of experimental science in the 16th and 17th centuries many people, including distinguished

scientists, saw their pursuit of scientific knowledge as being for the glory of God. A widely held idea was that God's revelation comes in the form of what could be described as two books: God's works (science) and God's word (the Bible). Thus God's creation can be expected to yield some information about the nature of God, and having looked at creation's God, we then look at the created universe with new eyes.

There is now a wide consensus among the world's scientific community that human activities are having an effect on the

climate. Global warming and the resulting impacts are among the most serious environmental problems facing the world community. This article starts by explaining the science behind greenhouse gas induced global warming. It then considers why Christians should be concerned about the human impact on God's creation, followed by a review of the main possible effects on human health.

the natural greenhouse effect

The gases nitrogen and oxygen, which make up the bulk of the



atmosphere, neither absorb nor emit thermal long-wave radiation. Consider an atmosphere consisting *only* of these two gases. As the sun's short-wave solar radiation passes through this atmosphere, about 6% is scattered back to space by atmospheric molecules and about 10% on average is reflected back to space from the land and ocean surfaces. The remaining 84% remains to heat the surface.

To balance this incoming solar radiant energy, the earth itself must radiate on average the

same amount of energy back to space in the form of thermal radiation. Otherwise the earth would show very marked long term heating or cooling. To balance the absorbed solar energy by outgoing thermal radiation, the average temperature of the Earth's surface should be -6°C . This is much colder than is actually observed at 15°C .

This difference can be explained by the fact that, in addition to nitrogen and oxygen, the earth's atmosphere also comprises clouds, water vapour, ozone, and carbon dioxide. These are the principal absorbers of infrared radiation emitted by the earth's surface. Only about 9% of the thermal radiation from the ground surface escapes directly to space. The rest is absorbed by the atmosphere, which in turn reradiates the absorbed infrared radiation, partly to space and partly back to the surface.

This blanketing effect is known as the natural greenhouse effect and the absorbing gases are known as greenhouse gases. It is called 'natural' to distinguish it from the enhanced greenhouse effect due to gases added to the

atmosphere by human activities such as the burning of fossil fuels and deforestation. It needs to be stressed that the natural greenhouse effect (a major regulator of surface temperature) is a normal part of the climate of the Earth and that it has existed for nearly the whole of the atmosphere's history.

human induced CO₂ emissions

Concern about the greenhouse effect arises over two issues: how the natural greenhouse effect may vary with time, and how human activities might enhance the natural effect. Since the industrial revolution, human activities have increased atmospheric trace gases such as carbon dioxide. Before the start of the industrial era, around 1750, atmospheric carbon dioxide concentration had been 280 parts per million (ppm) for several thousand years. It has risen continuously since then, reaching 379ppm in 2005. The annual carbon dioxide growth rate was larger during the last ten years (1.9ppm/yr from 1995-2005) than it has been since the beginning of continuous direct atmospheric measurements (1.4ppm/yr from 1960-2005).

When glacial ice forms, small bubbles of air are trapped within, creating a continuous record of atmospheric composition. By drilling through the Antarctic ice sheet, it is possible to reconstruct atmospheric composition over the last 600,000 years. The present atmospheric carbon dioxide concentration has not been exceeded during the past 600,000 years, and possibly the past 20 million years.

Several lines of evidence confirm that the recent and continuing increase of atmospheric carbon dioxide content is caused by human carbon dioxide emissions, and



in particular fossil fuel burning. These human-induced carbon dioxide emissions enhance the already existing greenhouse effect, causing global warming and fundamental changes in climate.

rising temperatures

Largely as a result of increasing atmospheric greenhouse gas concentrations, global mean temperatures have increased by 0.7°C since around 1900. Over the past 30 years, global temperatures have risen rapidly and continuously (at around 0.2°C per decade) to the warmest level reached in the current interglacial period, which began around 12,000 years ago.

Most climate model calculations show a doubling of pre-industrial levels of greenhouse gases is very likely to commit the earth to a rise of between 2°C and 5°C in global mean temperatures. This level of greenhouse gases will probably be reached between 2030 and 2060.

Long-range climate forecasts lack detail because of the non-linear chaotic nature of climate systems. Warming is projected to be greatest over land and at most high northern latitudes, with Arctic late-summer ice disappearing almost entirely by the latter part of the 21st century.

why the controversy?

Climate change studies in the late 20th century were often

highly controversial, partly because some oil and other commercial companies, to protect their perceived interests, funded campaigns against the results of climate research. Climate research in the 21st century has made considerable advances.

The Intergovernmental Panel on Climate Change (IPCC) comments that warming of the global climate system is unequivocal, in their latest assessment report. This is now evident from observations of increases in global average air and ocean temperatures,¹ widespread melting of snow and ice, and rising global average sea level. The report further comments that continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century.

Clearly carbon dioxide emissions have to be reduced, but 'by how much?' is a recent source of controversy. A 50% reduction of global emissions below 1990 levels by 2050, widely considered to be the

most stringent achievable target, will not avoid major global impacts. It is therefore being suggested that limiting impacts to acceptable levels by mid-century and beyond would require an 80% cut in global emissions by 2050. The UK has recently committed itself to an 80% cut in greenhouse gas emissions by 2050. Such a reduction would require fundamental changes in lifestyles, which many communities and countries would find difficult.

a biblical perspective

There are a number of reasons why Christians should be interested in the environment and in its care. Traditionally these may be described as follows.

1. the earth belongs to God

God created the earth. We encounter this in the very first words in the Bible, but it also pervades the whole of Scripture. As far as the biblical writers are concerned, this is undisputed. God's creation of the world is never the conclusion of an argument, but usually the starting point of other arguments. For example, God speaks through the psalmist of not needing our

sacrifices, 'for every animal of the forest is mine, and the cattle on a thousand hills. I know every bird in the mountains, and the creatures of the field are mine.'² In John 1:3 we read that 'Through him all things were made; without him nothing was made that has been made.' Paul, in Colossians 1:16, emphasises the full extent of what God has created.

2. God sustains the earth

It is not a foreign concept to Christians that God sustains his people in their daily walk with him. There is also a clear sense in the Bible that God's constant involvement is not just limited to people, but it encompasses everything. For example, Paul writes, 'He (Christ) is before all things, and in him all things hold together.'³

3. God created the earth good

The account of the creation in Genesis 1 has as a refrain, 'And God saw that it was good'. The natural environment is not benign because one result of the 'fall' is that the earth is also cursed.⁴ Therefore the whole of creation, not just mankind, is in need of liberation and re-creation.⁵ We now see a fallen creation; nevertheless the earth is still capable of declaring the glory of God. Part of the

meaning of the goodness of creation in the Bible is that creation witnesses to the God who made it, reflecting something of his character.⁶



4. humanity created as stewards

In Genesis we are told 'The Lord God took the man and put him in the Garden of Eden to work it and take care of it.'⁷ From Genesis onwards, men and women have been called to be God's workers in the world, to look after it as he would, and to preserve it. Jesus expresses the essence of the kingdom of God in two commandments: '...the Lord our God, the Lord is one. Love the Lord your God with all your heart and with all your soul and with all your mind and with all your strength.'⁸ and 'Love your neighbour as yourself.'⁹

Each of these commandments has implications with regard to

our concern for the environment. To love God must surely mean also to value his creation as he values it. To love your neighbour must surely also mean not to spoil their environment by polluting it, or pushing them into poverty so that they cannot maintain it. The World Health Organisation



(WHO) estimates the global cost of climate change to be 'up to 5% of the gross domestic product by the end of this century'.¹⁰ They further comment that 'climate change threatens to undermine progress toward the Millennium Development Goals: poverty cannot be eliminated while environmental degradation exacerbates malnutrition, disease and injury'.

impacts on health

An increased frequency of hot extremes, heat waves, and

heavy precipitation is likely. Scientists are confident that, by the middle of this century, many semi-arid areas (eg Mediterranean basin, western United States, southern Africa and northeast Brazil) will suffer a decrease in water resources due to climate change.

1. heat stress

The IPCC considers it very likely that warm spells and heat waves will increase in frequency over most land areas and lead to increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially isolated.¹

The WHO estimates for European Union (EU) countries that mortality increases by '1-4% for each one-degree rise of temperature above a cut-off point'.¹¹ Over 70,000 excess deaths were reported from twelve European countries following the heat wave in summer 2003. In the EU, 86,000 extra deaths are projected every year, with a global mean temperature increase of 3 °C, in 2071-2100.

2. malnutrition

Food security is another area of major concern because of decreasing precipitation and increased frequency of severe drought. Food productivity is

projected to decrease in the Mediterranean area, south eastern Europe and central Asia. Crop yields could decrease by up to 30% in central Asia by the middle of the 21st century leading to a worsening of malnutrition, especially in the rural poor.

3. disease transmission

Already occurring shifts in the distribution and behaviour of insect and bird species are signs that biological systems are responding to climate change. This is leading to significant changes in infectious disease transmission by vectors such as mosquitoes and ticks.

Climate change has a number of health impacts, apart from the three discussed above. The US Centers for Disease Control and Prevention has produced a useful summary table (table 1). It links weather events to health effects and to populations most affected - illustrating the WHO warning that 'health impacts will be disproportionately greater in vulnerable populations'.¹²

what can doctors do?

1. educate

The first step is to educate ourselves about what science and the Bible say about climate

table 1: health impacts of climate change¹³

weather event	health effects	populations most affected
heat waves	heat stress	extremes of age, athletes, people with respiratory disease
extreme weather events (rain, hurricanes, tornadoes, flooding)	injuries, drowning	coastal, low-lying land dwellers, low socio-economic strata (SES)
droughts, floods, increased mean temperature	vector-, food- and water-borne diseases	multiple populations at risk
sea-level rise	injuries, drowning, water and soil salinisation, ecosystem and economic disruption	coastal, low SES
drought, ecosystem migration	food and water shortages, malnutrition	low SES, elderly, children
extreme weather events, drought	mass population movement, international conflict	general population
increases in ground-level ozone, airborne allergens, and other pollutants	respiratory disease exacerbations (COPD, asthma, allergic rhinitis, bronchitis)	elderly, children, those with respiratory disease
climate change generally; extreme events	mental health	young, displaced, agricultural sector, low SES

change. We can then inform our colleagues, churches, and wider society about the health impacts.¹⁴ Our advice to patients also matters; a good diet (less meat, less processed food, local food) and walking or cycling to work not only improve health, but reduce carbon emissions as well.¹⁵

2. moderate

Small changes in lifestyle by many people can add up to a major contribution. So we need to consider our own carbon

footprints. Firstly, review your travel arrangements; for example, are all those flights really necessary? Secondly, assess your energy usage; does your home need more insulation? Thirdly, think about the food you eat. Has it been air-lifted across the world? Can you drink tap water instead of bottled water? A professor of public health argues that our role in addressing climate change is comparable to that in combatting smoking; we should be committed to both, setting a personal example.¹⁶

3. advocate

Many of us will have opportunities to influence the organisations we work for to reduce their carbon footprints. Those who are enthused can join in advocating for local, national and global frameworks to constrain carbon dioxide emissions.¹⁷ For example, you could get involved with the Climate and Health Council.¹⁸ Another starting point is to get your local church to act together by forming an Eco-congregation. The

Eco-congregation movement provides a creation care kit for churches with a simple environmental audit, free resources to encourage action, and an award scheme.

uncomfortable questions

It is easy to look back at Christian slaveholders in the 18th and 19th centuries and ask, 'how could they not see that slavery was incompatible with the gospel?' What did they, and the Christian people who supported them, think they were doing? Will our grandchildren look back at us, as they wrestle with ecological issues, and ask why we could not see the Christian responsibility for stewardship of the earth?

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useful resources

Christian environmental organisations:

- Eco-congregations - www.ecocongregation.org/englandwales
- A Rocha - Christians in conservation - www.arocha.org.uk
- Christian Ecology Link - www.christian-ecology.org.uk
- John Ray Initiative - an educational charity to bring together scientific and Christian understandings of the environment - www.jri.org.uk

articles:

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books:

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