

Is God green?

Climate change and the Scriptures

By Dr. Jim Denison

Global warming is one of the most divisive subjects of our day. Some allege that the entire issue is overblown. Others claim that it is the most crucial moral and practical issue of our time. What are the facts behind the debate? What does the Bible say to this critical subject?

Learning the vocabulary

"Weather" refers to the atmospheric conditions on a given day; "climate" describes these conditions over an extended period such as a decade or more. The "weather" can be good today, but the "climate" can change in ways which are frightening.

"Climate change" is used synonymously with "global warming," but the National Academy of Sciences says that "climate change" is becoming the preferred term. Rising temperatures are the best known symptom of the issue, but they are not the entire problem.

"Climate change" refers to any significant change in measures of climate (temperature, precipitation, or wind) lasting for an extended period (decades or more). It may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun
- Natural processes within the climate system, such as changes in the ocean and its circulation
- Human activities which change the composition of the atmosphere (such as burning fossil fuels) and the land (such as deforestation, urbanization, desertification).

"Global warming" refers to an average increase in the temperature of the atmosphere near the Earth's surface, contributing to changes in global climate patterns. Most people use the phrase to refer to increased emissions of "greenhouse gases."

"Greenhouse gases" have been produced over the last 200 years. Burning fossil fuels produces carbon dioxide. Farming practices and land use changes produce methane and nitrous oxide. Trees remove carbon dioxide, replacing it with oxygen; deforestation lessens this effect in the atmosphere. As a result, greenhouse gases have risen significantly. They prevent heat from escaping to space, similar to glass panels of a greenhouse.

The "greenhouse effect" helps regulate the Earth's temperature. Without these insulating gases insulating the Earth's surface and trapping solar energy which would otherwise escape into space, temperatures would be about 60 degrees colder than they are now and

life could not exist. However, the burning of fossil fuels and deforestation have enhanced this natural greenhouse effect, causing the Earth's average temperature to rise.

"Ozone" (also called trioxxygen) is a molecule consisting of three oxygen atoms. It is found near the ground and also in the upper atmosphere. Its primary significance for climate change and health has to do with its ability to absorb ultraviolet light and energy. It is produced in the atmosphere when ultraviolet light interacts with oxygen.

The "stratosphere" or "ozone layer" exists between six and 31 miles above the ground. In general, the ozone layer is thinner near the equator and thicker toward the poles, and it varies with season, being thicker during the spring and thinner during the autumn in the northern hemisphere. The ozone layer filters out ultraviolet light from the Sun which would be harmful to most forms of life. If the entire ozone layer were compressed to the pressure of air at sea level, it would be only a few millimeters thick.

Has there been global climate change?

Climate change has occurred throughout the Earth's history. Changes in the Earth's orbit and tilt are thought to have led to the Ice Age around 21,000 years ago. Between 900 and 1300 AD, the planet was relatively warm. Cooling of the Sun led to a "little ice age" in the 1400s to 1800s, where global temperatures were cooler than normal. Volcanic eruptions emit aerosols and carbon dioxide into the atmosphere. Aerosols contribute to short-term cooling, but they are soon dissipated. For instance, an eruption in Indonesia in 1815 lowered global temperatures by as much as five degrees.

Volcanoes also emit carbon dioxide. For two-thirds of the last 400 million years, CO₂ levels and temperatures were much higher than the present. However, human activities now emit 130 times as much CO₂ as volcanoes.

We are now in the third climate change period of the last 2,000 years, and by far the most significant. Beyond dispute, the Earth's temperature is climbing. According to data from NASA and NOAA, the Earth's average surface temperature has risen by about 1.2 to 1.4 degrees Fahrenheit in the last century. The eight warmest years on record since 1850 have all occurred since 1998; the warmest was 2005. Temperatures at many individual locations were higher in the last 25 years than at any period of comparable length since AD 900.

What has caused global climate change?

"El Nino" is the strong warming of the Pacific Ocean near the equator; this occurs every two to seven years. Recent El Nino events have been very strong, contributing to record-setting temperatures. We're not sure how much human-induced climate changes might affect El Nino, or the reverse.

Variations in the Earth's orbit and tilt, and in the Sun's heat, have caused climate changes over the Earth's history. But except for the Ice Age, none brought anything like the

devastation we are now seeing. And the human contribution to this crisis is beyond dispute.

The ozone layer

The ozone layer can be depleted by nitric oxide, hydroxyl, atomic chlorine, and atomic bromine. Concentrations of chlorine and bromine have increased significantly in recent years due to the release of large quantities of chlorofluorocarbons (called "freons") and bromofluorocarbons (called "halons") into the atmosphere. They rise into the stratosphere, where they interact with ozone molecules and break them down.

"Freons" were invented in the 1920s, and were used in air conditioning units, as aerosol spray propellants, and in cleaning electronics. They also occur as by-products of some chemical processes. No significant natural sources have ever been identified for these compounds; they are almost entirely manmade. A single CFC molecule takes 15 years to reach the upper atmosphere, where it stays for a century and destroys up to 100,000 ozone molecules. When the effect of these gases was finally understood in the 1980's, they were phased out and have not been produced in large quantity since 1996.

By this time, however, ozone levels over the northern hemisphere were dropping by four percent per decade. Over the north and south poles, much larger seasonal declines have been observed; these are called "ozone holes." The Antarctic ozone hole has increased dramatically; recent ozone levels have dropped to as low as 33% of their pre-1975 levels. As these holes increase in size, more ultraviolet radiation is permitted to reach the Earth's surface. Skin cancers are on the rise, plants are damaged, and plankton populations are reduced. UV rays reaching the Earth's surface also interact with automotive emissions, producing ground-level ozone.

Global warming

Since the Industrial Revolution, "greenhouse gases" have risen significantly in our atmosphere: carbon dioxide by 36%, methane by 148%, and nitrous oxide by 18%. The United States, with five percent of the world's population, produces 60% of the world's carbon dioxide.

Human activity has caused concentrations of carbon dioxide and methane to be higher today than at any point in the last 650,000 years. Carbon dioxide accounts for 60% of total greenhouse gases; its level has been increasing by more than 10% every 20 years. If it continues to grow at current rates, its level in the atmosphere will double or even triple in this century. Most of the global warming average is a direct result of this activity.

What will happen in the future?

Scientists predict an average global temperature increase of 3.2 to 7.2 degrees Fahrenheit by 2100, and even greater warming thereafter. Human emissions of carbon dioxide and other greenhouse gases continue to climb, and remain in the atmosphere for decades. These temperatures will not change uniformly across the globe; polar temperatures are expected to rise even faster than in other places, causing significant melting of the polar

ice caps. As the oceans warm, even more CO₂ is released into the atmosphere, accelerating the problem.

The current warming trend is especially significant as it is proceeding at a rate unprecedented in the past 1,300 years. The last Ice Age saw temperatures drop nine degrees, allowing massive ice sheets to reach as far south as the Great Lakes and New York City. No one knows what an increase of seven degrees would do to the planet, as such a phenomenon is unprecedented in recorded history.

What will happen to nature?

- Hotter temperatures will cause a 40% drop in California's avocado production over the next 40 years.
- The ash tree, from which baseball bats are made, is in danger of disappearing, due to a combination of killer beetles and global warming.
- The Pine Bark Beetle, once controlled by cold winter temperatures, is killing entire Christmas tree forests in British Columbia.
- Rising water temperatures could cause rainbow trout to disappear from the Appalachian mountains over the next century.
- Indonesia estimates that 2,000 of its tropical islands could disappear by 2030 due to rising sea levels.
- Russian bears, unable to hibernate due to hotter winters, are attacking more people.
- Rising ocean temperatures are killing the food supplies of gray whales.
- Giant squids are invading the hotter waters off California and even Alaska.
- In Antarctica, an ice shelf larger than Rhode Island collapsed into the sea in 2002. An ice chunk the size of Manhattan broke off a Canadian ice shelf in 2005.
- Since 1850, the number of glaciers in Glacier National Park dropped has dropped from 150 to 26. Within the next 25 to 30 years, it is likely that none will be left.
- The Mediterranean Sea is becoming much more salty and stagnant, due to faster evaporation and rising temperatures. Many of the sea's plant and animal species are in jeopardy, as is the fishing industry in this part of the world.
- The Great Barrier Reef will disappear within decades as warmer, more acidic seas bleach coral.
- Sea levels will rise. There are 5,773,000 cubic miles of water in ice caps, glaciers, and permanent snow. If all glaciers melted today, the seas would rise 230 feet.
- Global warming will increase significantly if the ice caps melt. They reflect sunlight into space, further cooling the earth. If they are gone, the Earth will absorb more heat and warm more quickly.
- Over the past century, the number of hurricanes which strike each year has more than doubled.

What will happen to our health?

- The World Health Organization estimates that 150,000 people are killed every year by climate-change-related issues.
- Canadian doctors say smog-related deaths could rise by 80% over the next 20 years.
- Heart attacks and other cardiovascular problems are expected to rise, as atherosclerosis develops much more quickly in a warmer environment.
- A Harvard study in 2004 showed that higher concentrations of carbon dioxide in the atmosphere will lead to higher rates of asthma attacks, especially in children.
- The World Health Organization has identified more than 30 new or resurgent diseases in the last decades, fueled by global climate change. As northern countries warm, disease carrying insects migrate north, bringing disease and plague. Known as the "deadly dozen," these diseases include yellow fever, Lyme disease, plague, avian influenza (bird flue), babesia, cholera, Ebola, intestinal and external parasites, red tides, Rift Valley fever, sleeping sickness, and tuberculosis.

What will happen to the nations?

- UN Secretary General Ban Ki-moon charges, "Amid the diverse social and political causes, the Darfur conflict began as an ecological crisis, arising at least in part from climate change."
- A group of 11 former U.S. military leaders released a report in April charging that the 1990s war in Somalia stemmed in part from national resource shortages caused by global warming.
- A report done last year by the British government showed that global warming could cost the world up to 20% of its annual Global Domestic Product.
- A study by the Global Development and Environmental Institute at Tufts University found that ignoring global warming would cost \$20 trillion by 2100.

What can you do?

Many people and countries are taking steps now to reduce greenhouse emissions and slow climate change. They are reducing their dependence on fossil fuels, increasing the use of renewable energy, expanding forests, and making personal lifestyle decisions which improve the environment.

Greenhouse gas emissions can be reduced significantly through a number of simple steps:

- Replace your five most frequently used lights with energy saving bulbs; if every American household did this, we would prevent greenhouse gas emissions equivalent to the emissions from 10 million cars.
- Buy energy efficient appliances and products.
- Replace air filters regularly, and have heating and cooling equipment serviced. Replace old models with high efficiency units.
- Seal and insulate your home.
- Use green power, including solar panels.

- Reduce and recycle trash, and buy recycled products.
- Use a push lawnmower and mulch clippings.
- Use water efficiently. Water your lawn in the early morning; service leaky faucets and toilets (a leaky toilet can use 200 gallons of water a day).
- Tune your car; inflate your tires properly (this can save up to three percent on gas); use public transportation; consider buying a hybrid vehicle.

What does the Bible say about the environment?

The world belongs to its Creator: "The earth is the Lord's, and everything in it, the world, and all who live in it; for he founded it upon the seas and established it upon the waters" (Psalm 24:1-2). How does he intend his creation to be managed?

We begin with the instructions in Genesis:

Then God said, "Let us make man in our image, in our likeness, and let them rule over the fish of the sea and the birds of the air, over the livestock, over all the earth, and over all the creatures that move along the ground." So God created man in his own image, in the image of God he created him; male and female he created them. God blessed them and said to them, "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground." Then God said, "I give you every seed-bearing plant on the face of the whole earth and every tree that has fruit with seed in it. They will be yours for food. 30 And to all the beasts of the earth and all the birds of the air and all the creatures that move on the ground--everything that has the breath of life in it—I give every green plant for food." And it was so (Genesis 1:26-30).

The key words in the text are "rule" ("have dominion," v. 26) and "subdue" ("keep under," v. 28). Both identify man as the ruler or "king" of nature. Since he is created in God's "image" and "likeness," he is God's representative on earth. **Oriental kings were expected to care for their subjects (cf. Ps. 72:12-14), upholding law and justice for all.**

Genesis 2 is God's commentary on Genesis 1: "The Lord God took the man and put him in the Garden of Eden to work it and take care of it" (v. 15). "Take care of it" (*shamar*) is literally "guard" in the Hebrew; the word means to superintend and protect in all ways.

The Old Testament is very specific regarding the obligations inherent in this stewardship. For instance:

- Plants may not be cut down in war (Deuteronomy. 20:19-20).
- The land is to be laid fallow in the seventh year so that it may "rest" and feed wild animals (Exodus 23:10-11; Leviticus 25:2-7).
- Cattle are to be allowed a Sabbath rest (Deuteronomy 5:14).
- Newborn animals must not be removed from their mother in their first week of life (Lev. 22:27-29).
- Oxen are not to be muzzled while at work (Deut. 25:4).

- Proverbs 12:10 is specific: "A righteous man cares for the needs of his animal, but the kindest acts of the wicked are cruel."

One day our planet will be destroyed: "The present heavens and earth are reserved for fire, being kept for the day of judgment and destruction of ungodly men" (2 Peter 3:7). On that day, God will replace the current earth with "a new heaven and a new earth" (Rev. 21:1). But we don't know when this day will come: "A day with the Lord is like a thousand years, and a thousand years are like a day. The Lord is not slow in keeping his promise, as some understand slowness. He is patient with you, not wanting anyone to perish, but everyone to come to repentance" (2 Pet. 3:8-9).

In the meanwhile, we are under biblical mandate to manage God's creation well, to "keep" and protect it. Such environmental engagement is part of our witness to a culture which is increasingly conscious of this priority. Our work to preserve God's creation is the best way to ensure that future generations will be sustained and healthy.

This is a crucial moment in the history of our planet. How will you help?