

## It's Not Easy Being Green

**Six degrees** could be all that separates humanity from catastrophe.

Scientists no longer argue about the reality of global warming: it is **here**, and it is **real**. The way humans have approached life on this planet has significantly contributed to a rise in the global temperature, and if we continue to ignore our role, experts warn that we will irreparably damage both our planet and our species.

*“Warmings of six degrees over longer time periods have been associated with some of the most devastating mass extinctions which have ever taken place, so it’s certainly fair to assume that if temperatures soar by six degrees within less than a century, we’re going to face nothing less than a global wipeout” (Six Degrees Could Change the World).*

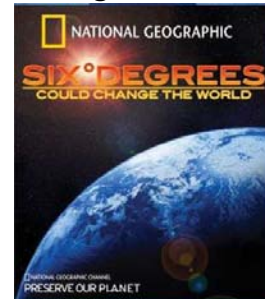
To understand how humans factor into global climate change, the United Nations formed a group of scientists called the Intergovernmental Panel on Climate Change (IPCC). The IPCC reports that **greenhouse gases** responsible for global warming are emitted by humans in a number of ways.

- Combustion of **fossil fuels** in cars, factories, and electricity production
- **Methane** released from landfills and agriculture
- **Nitrous oxide** from fertilizers
- Gases for **refrigeration** and **industrial processes**
- **Loss of forests** that would otherwise store carbon dioxide

Arguably the most damaging greenhouse gas is **carbon dioxide** (CO<sub>2</sub>), which, while it may not be the most potent, is certainly the most globally abundant. CO<sub>2</sub> is released into the atmosphere when we burn fossil fuels. Over the past 250 years, the IPCC reports that human activity has directly contributed to rising levels of CO<sub>2</sub> that far exceed those levels naturally occurring in the environment.

*“Carbon dioxide is the most important anthropogenic greenhouse gas. Its annual emissions grew by about 80 percent between 1970 and 2004. The long-term trend of declining CO<sub>2</sub> emissions per unit of energy supplied reversed after 2000.*

**WATCH:** Six Degrees Could Change the World



From [nationalgeographic.com](http://nationalgeographic.com): “By the year 2100, many scientists believe that the Earth’s average temperature could rise by as much as six degrees Celsius. In a compelling investigation, National Geographic leads a degree-by-degree journey to explore what each rising – and critical – degree could mean for the future of our people and planet.” **Click [here](#) for a clip from the film.**

**EXPLORE:** World at Six Degrees – Interactive



From [nationalgeographic.com](http://nationalgeographic.com): “While there’s no way to predict the future, scientific research and powerful climate models give us insight into what the next century may bring if we continue down the present path of emissions. What follows is a hypothetical look at how our world might change, degree by degree.”

**WHAT THEY ARE SAYING?**

“Global warming is **too serious** for the world any longer to ignore its danger or split into opposing factions on it.” – **Tony Blair**, former Prime Minister of the United Kingdom

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*Atmospheric concentrations of CO<sub>2</sub> in 2005 exceed by far the natural range over the last 650,000 years. There is very high confidence that the net effect of human activities since 1750 has been one of warming” (Climate Change 2007: Summary Report).*

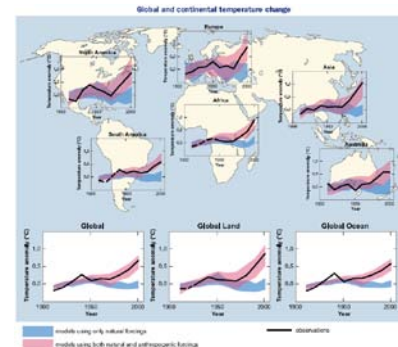
Unfortunately, simply reducing CO<sub>2</sub> emissions may not be the answer to curtailing global warming. While it is true that high concentrations of CO<sub>2</sub> in the atmosphere result in increased global temperatures, there are **benefits to CO<sub>2</sub> saturation** that must be factored into a worldwide climate change strategy.

Perhaps the most important benefit of CO<sub>2</sub> emissions is their ability to counteract the adverse effects of **sulfur dioxide (SO<sub>2</sub>)** emissions, which many experts believe are significantly more devastating to biological diversity and forest health than CO<sub>2</sub>. SO<sub>2</sub> is particularly dangerous because “it can spread through large distances, and its emissions into the atmosphere are large.” In a study of Russia’s forests, experts revealed that 1.3 million hectares have been adversely affected by SO<sub>2</sub> pollution released into the atmosphere from the country’s industrial areas.

*“We report these results to indicate the seriousness of SO<sub>2</sub> pollution for forest health and to highlight the fact that atmospheric CO<sub>2</sub> enrichment can significantly alleviate sulfur dioxide’s adverse biological consequences ... the ongoing rise in the air’s CO<sub>2</sub> content can do much to either totally prevent or significantly alleviate the adverse consequences of anthropogenic SO<sub>2</sub> pollution” (Izrael).*

But global warming is **more than just increased CO<sub>2</sub> levels**. An overall increase in global temperature touches every corner of the globe, every organism that resides on Earth, and every environmental system. As a direct result of human influences:

- It is *very likely* that **sea levels** have risen during the latter half of the 20<sup>th</sup> century
- It is *likely* that **wind patterns** have changed, affecting extra-tropical storm tracks and temperature patterns
- It is *more likely than not* that the risk of **heat waves** and the frequency of **heavy precipitation events** has increased



**Global and Continental Temperature Change:** This chart, created by the IPCC, compares the continental- and global-scale changes in surface temperature (**black line**) with results simulated by climate models using either natural (**blue band**) or both natural and anthropogenic (**red band**) forces. The actual trends in surface temperature change seem to follow the climate models that account for **human influences** closer than the models that only simulate natural forces.



**NEWS:** Feb. 9, 2009 – MSNBC reports **Sulfur dioxide** emitted from volcanoes and from burning fossil fuel is the **primary initiator of global climate change**, according to Dr. Peter L. Ward, a retired US Geological Survey scientist. “Carbon dioxide is a greenhouse gas compounding global warming, but it is not the initiator of climate change,” said Ward.

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#### What are the **impacts** of these global changes?

The **loss of resources** critical for human survival is one of the most devastating casualties of the rise in global temperatures.

*“Climate change is expected to exacerbate resource scarcities. Although the impact of climate change will vary by region, a number of regions will begin to suffer harmful effects, particularly water scarcity and loss of agricultural production. Regional differences in agricultural production are likely to become more pronounced over time with declines disproportionately concentrated in developing countries, particularly those in Sub-Saharan Africa. Agricultural losses are expected to mount with substantial impacts forecast by most economists by late this century. For many developing countries, decreased agricultural output will be devastating because agriculture accounts for a large share of their economies, and many of their citizens live close to subsistence levels” (Global Trends 2025 p.viii).*

In the face of a **growing population epidemic**, resource scarcity is only one of the many challenges the world will face. As countries like India and China become more industrialized, their economies and global futures will increasingly demand more **energy**, thereby further reducing our chances of cutting fossil fuel use and its subsequent effect on global warming.

*“Continued escalation of energy demand will hasten the impacts of climate change. On the other hand, forcibly cutting back on fossil fuel use before substitutes are widely available could threaten continued economic development, particularly for countries like China whose industries have not yet achieved high levels of energy efficiency. Technological advances and policy decisions around the world germane to greenhouse gas emissions over the next 15 years are likely to determine whether the globe’s temperature ultimately rises more than 2 degrees centigrade – the threshold at which effects are thought to be no longer manageable” (Global Trends 2025, p.41).*

How can we ensure that China and India continue to **thrive** without destroying the environment? Can these countries make the transition **away from fossil fuels** without crippling their economies?

#### INTERVIEW

Fareed Zakaria talks **climate change** with Thomas Friedman



**Zakaria:** Explain what you mean by "hot, flat and crowded."

**Friedman:** There is a convergence of basically three large forces: one is global warming, which has been going on at a very slow pace since the industrial revolution; the second – what I call the flattening of the world – is a metaphor for the rise of middle-class citizens, from China to India to Brazil to Russia to Eastern Europe, who are beginning to consume like Americans. That's a blessing in so many ways – it's a blessing for global stability and for global growth. But it has enormous resource complications, if all these people – whom you've written about in your book, *The Post-American World* – begin to consume like Americans. And lastly, global population growth simply refers to the steady growth of population in general, but at the same time the growth of more and more people able to live this middle-class lifestyle. Between now and 2020, the world's going to add another billion people. And their resource demands – at every level – are going to be enormous.

Read the full interview [here](#).

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China and India's increasing demand for fossil fuels not only puts pressure on the world's energy reserves, but the rapid industrialization of these countries guarantees greater environmental **pollution** such as acid rain and deforestation, especially in light of their lax pollution controls. Experts estimate that China's current rate of pulmonary disease is nearly five times higher than that of the United States. As China continues down the path to becoming a global super power, **rising health care costs** for its populations affected by industrial pollution will undoubtedly factor into its economic and policy decisions.

As natural resources and energy reserves are depleted, experts also warn of a massive **climate migration** of populations from the poorest countries who have been displaced by the loss of fresh water and arable farm land.

*"The UK Treasury-commissioned Stern Report estimates that by the middle of the century 200 million people may be permanently displaced 'climate migrants' – representing a ten-fold increase over today's entire documented refugee and internally displaced populations ... the number of migrants seeking to move from disadvantaged into relatively privileged countries is likely to increase. The largest inflows will mirror many current migratory patterns – from North Africa and Western Asia into Europe, Latin America into the US, and Southeast Asia into Australia" (Global Trends 2025, p.53).*

But these are all anthropocentric impacts to global warming; we cannot ignore the devastating consequences that plant and animal species will face as temperatures continue to rise. The **loss of global biodiversity** is argued by many scientists to be the most dangerous consequence we face as we continue to pump greenhouse gases into the atmosphere.

*"The worst thing that can happen ... is not energy depletion, economic collapse, limited nuclear war or conquest by a totalitarian government. As terrible as these catastrophes would be for us, they can be repaired within a few generations. The one process ongoing ... that will take millions of years to correct is the loss of genetic species diversity by destruction of their natural habitats. This is the folly that our descendents are least likely to forgive" (Myers).*

### Learning about **Biodiversity**

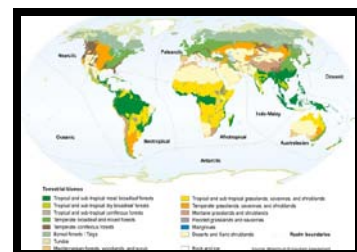


#### **WHAT** is biodiversity?

"Biodiversity reflects the number, variety, and variability of living organisms and how these change from one location to another and over time. Biodiversity includes diversity within species (genetic diversity), between species (species diversity) and between ecosystems (ecosystem diversity)."

#### **WHERE** is biodiversity?

"Life, and thus biodiversity, is essentially everywhere on Earth's surface and in every drop of its bodies of water ... Earth can also be divided into eight **bio-geographic realms** which share a broadly similar biological evolutionary history."



#### **WHY** is biodiversity

**important?** "Ecosystem services are the benefits people obtain from ecosystems. Biodiversity plays an important role in the way ecosystems function and in the many services they provide, including nutrients and water cycling, soil formation and retention, resistance against invasive species, pollination of plants, regulations of climate, as well as pest and pollution control by ecosystems."

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But not all of the impacts of global warming are so straight forward. The **melting of the polar ice caps**, which scientists suggest may happen as early as 2013, could open up expansive energy and mineral resources in the Arctic and potentially shorter shipping routes previously covered in snow and ice.

However, underneath the ice caps, scientists discovered, are 400 gigatons of **methane gas**, which is 20 times stronger than carbon dioxide. A slight rise in the global temperature could cause the gases to “burp” into the atmosphere, and the consequences of a massive release of methane gas could start a chain reaction, termed “**runaway global warming**,” the likes of which scientists believe we’ve seen twice before that resulted in a devastating loss of species.

*“The most recent of these catastrophes occurred about 55 million years ago in what geologists call the Paleocene-Eocene Thermal Maximum (PETM), when methane burps caused rapid warming and massive die-offs, disrupting the climate for more than 100,000 years. The granddaddy of these catastrophes occurred 251 million years ago, at the end of the Permian period, when a series of methane burps came close to wiping out all life on Earth. More than 94 percent of the marine species present in the fossil record disappeared suddenly as oxygen levels plummeted and life teetered on the verge of extinction. Over the ensuing 500,000 years, a few species struggled to gain a foothold in the hostile environment. It took 20 million to 30 million years for even rudimentary coral reefs to re-establish themselves and for forests to regrow. In some areas, it took more than 100 million years for ecosystems to reach their former healthy diversity” (Atcheson).*

**Russia** and **Canada** could actually emerge as global warming’s biggest winners. Russia’s arctic tundra is home to untouched oil and natural gas reserves in Siberia and having the ability to tap into these reserves could potentially provide a huge boost to Russia’s economy. Experts also suggest that climate change could help Canada skirt several serious hurricanes and heat waves in North America in the coming years. Warmer temperatures would also open up millions of square miles of Canadian land to **development**, and longer growing seasons could improve Canada’s **agricultural production**.



**NEWS:** Feb. 8, 2009 – The Times Online reports that the ice caps are melting so fast that the world’s oceans are rising more than twice as fast as they were in the 1970s, scientists have found. **Read the full story [here](#).**

**WATCH: Methane Hydrates: Natural Hazard or Natural Resource?**



**From [YouTube.com](#):** “Explore naturally occurring frozen methane deposits under the sea with renowned geochemist Miriam Kastner and discover whether or not they are a hazard to climate change.” From the series “Perspectives on Ocean Science” at the University of California.



**NEWS:** Jan. 29, 2009 – NATO representatives and lawmakers from alliance nations will meet in Iceland Thursday to discuss security challenges that are likely to arise as the Arctic Circle thaws. **Read the full story from [cnn.com](#) [here](#).**

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Thomas Friedman, the Pulitzer prize-winning author of *Hot, Flat, and Crowded*, writes that the world is in the “Energy-Climate Era,” a product of global warming, global flattening, and global crowding. Facing this era are **five key problems** that, if we choose to ignore them, would undeniably destroy our expectations for peace and security, economic growth, and human rights.

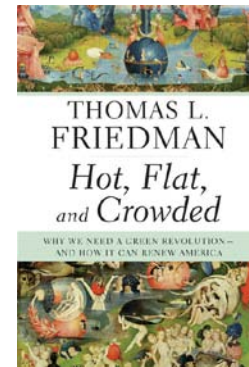
- The growing **demand** for ever scarcer **energy supplies** and **natural resources**
- A massive **transfer of wealth** to oil-rich countries and their petrodictatorships
- Disruptive **climate change**
- **Energy poverty**, sharply dividing the world into electricity haves and electricity have-nots
- Rapidly accelerating **biodiversity loss**, as plants and animals go extinct at record rates

#### Is it **too late** to mitigate rising global temperatures?

Some experts would argue that the answer is **yes**; it is too late to dramatically affect the path we have already set ourselves on in the ways necessary to repair the damage we’ve been doing for centuries. David Holmgren, author of “Future Scenarios,” argues that the only way to truly mitigate the impacts of global warming is through a large-scale **economic recession** paired with radical changes in our behavioral and organizational patterns.

*“There is also very little evidence that mitigation within the context of modern affluent society will radically reduce greenhouse gas emissions in any case. Most of the increases in efficiency and other gains through technology have been countered by increases in emissions elsewhere ... For example; the savings made in reducing house heating costs is typically being spent on something like an overseas holiday by a householder. This suggests that without radical behavioral and organizational change that would threaten the foundations of our growth economy, greenhouse gas emissions along with other environmental impacts will not decline. Economic recession is the only proven mechanism for a rapid reduction of greenhouse gas emissions and may now be the only real hope for maintaining the earth in a habitable state” (Holmgren).*

#### **FOOD FOR YOUR BRAIN:** Suggested Reading



#### From [ThomasFriedman.com](http://ThomasFriedman.com):

“Friedman brings a fresh outlook to the crises of destabilizing climate change and rising competition for energy – both of which could poison our world if we do not act quickly and collectively. His argument speaks to all of us who are concerned about the state of America in the global future. Friedman proposes that an ambitious national strategy – which he calls “Geo-Greenism” – is not only what we need to save the planet from overheating; it is what we need to make America healthier, richer, more innovative, more productive, and more secure ... Friedman sets out the clean-technology breakthroughs we, and the world, will need; he shows that the ET (Energy Technology) revolution will be both transformative and disruptive; and he explains why America must lead this revolution – with the first Green President and a Green New Deal, spurred by the Greenest Generation. *Hot, Flat, and Crowded* is classic Thomas L. Friedman – fearless, incisive, forward-looking, and rich in surprising common sense about the world we live in today.”

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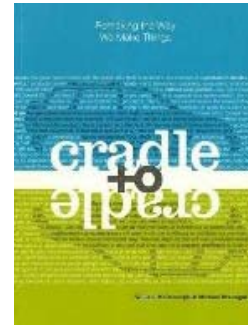
On the other hand, there are experts who argue that the answer is **no**; there might still be hope to sustain our environment despite previously ignoring the destruction we've caused. Two such believers, William McDonough and Michael Braungart, penned the book *Cradle to Cradle* in an effort to supply us with ways in which we can help return the environment to a sustainable state of manageable co-existence. The **cradle-to-cradle** concept is an adaptation of traditional recycling methods that the authors believe could not only save our environment but also create millions of jobs in the process.

*"Our current approach to recycling is that we take bigger and higher quality computers, electronics, boxes, and cars and turn them into lower quality, less sophisticated products – and then we throw them away. It is not really recycling, they say, but "down-cycling" – just slow-motion waste and resource depletion ... They argue that we can and must make every TV set, chair, carpet, piece of furniture, and computer screen out of materials that can be either completely reusable in other products or completely biodegradable, so that they can be used as fertilizer. All product components, they insist, can be designed for continuous recovery and reutilization as biological or technical nutrients – 'eliminating the concept of waste' ... 'Cradle to cradle means, in counterdistinction to cradle to grave, that we close all the cycles, so we don't just send things to landfills and incinerators, we put them into closed cycles so that we can use them over and over again ... And importantly, this creates a massive new opportunity for job creation" (Friedman p.70).*

Friedman proposes another solution to the question of sustainability, particularly when it comes to the built environment. He argues that all you need is **knowledge**.

*"Today we can substitute knowledge for raw materials in so many more ways. No, you can't build a building with computer bits and bytes, like cement bricks and mortar, but with smarter materials and smarter designs you can build a building with a lot fewer bricks and a lot less mortar. You can build a building with tighter windows and a lot better insulation ... You can make buildings that retain heat or cooling so much more efficiently ... All it takes is knowledge. Innovation around sustainable energy and resource productivity is*

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**From Amazon.com:** "Paper or plastic? Neither, say William McDonough and Michael Braungart. Why settle for the least harmful alternative when we could have something that is better – say, edible grocery bags! In *Cradle to Cradle*, the authors present a manifesto calling for a new industrial revolution, one that would render both traditional manufacturing and traditional environmentalism obsolete. Recycling, for instance, is actually 'down-cycling,' creating hybrids of biological and technical 'nutrients' which are then unrecoverable and unusable. The authors, an architect and a chemist, want to eliminate the concept of waste altogether, while preserving commerce and allowing for human nature. They offer several compelling examples of corporations that are not just doing less harm – they're actually doing some good for the environment and their neighborhoods, and making more money in the process. *Cradle to Cradle* is a refreshing change from the intractable environmental conflicts that dominate headlines. It's a handbook for 21<sup>st</sup>-century innovation and should be required reading for business hotshots and environmental activists."

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*our only way out of this problem” (Friedman p.70).*

**How will you harness your **knowledge** to help make your world more **sustainable**?**

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