

## Common Misconceptions about Climate and Climate Change

Misconceptions arise from an individual's inner "mental models". Mental models help us operate in the world even though we have incomplete information about it. When people inappropriately explain information in one of their mind's mental models, they may have difficulty understanding the scientifically accurate concept. Research shows that simply correcting the misconception does not permanently alter it in students' mental models. For a conception to change, a person must realize it is not adequate to explain the world and actively seek the correct concept.

Misconception	Target conception
<p>Global warming is caused by the ozone hole because the hole lets in more radiation.</p>	<p>Global warming is caused by increased amounts of greenhouse gases in the atmosphere. A depletion of ozone allows more UV light to reach the surface, but is not an important factor leading to increased temperature on Earth. Banning of CFCs from spray cans and Styrofoam has caused the ozone hole to stop growing, and it is expected to get smaller.</p>
<p>The atmosphere is big and carbon dioxide makes up a small % of the total gases. We are not adding enough carbon dioxide to make a difference.</p>	<p>Most gases in the atmosphere do not trap heat. Greenhouse gases including carbon dioxide do trap heat. Even though they may make up a relatively small percentage of the atmosphere, the way in which greenhouse gases trap heat adds up to having a large effect.</p>
<p>Weather anomalies can be used as evidence for or against climate change.</p>	<p>Weather and climate are not identical. Weather involves phenomena that last a short period of time. It's what is happening outside, right now.</p> <p>Climate can be thought of as the average weather for a region. Regional climate characteristics give rise to weather. For this reason, there is a link between climate change and weather, including anomalies. But any particular weather event cannot "prove" that climate change is happening.</p> <p>An important source of evidence for climate change comes from observations that <i>average</i> weather (for example, average temperature and precipitation) has changed for a region.</p>
<p>Burning fossil fuels uses them up.</p>	<p>Burning is a chemical process that follows the law of conservation of matter.</p> <p>Carbon stored by plants and fossilized into oil or coal does not disappear when it burns. The process of combustion combines oxygen with carbon, releasing the invisible and odorless greenhouse gas, CO<sub>2</sub>.</p>

Information summarized from presentations by John Madsen, U. of Delaware Dept. of Geological Sciences, Mark McCaffrey, CIRES Education and Outreach, and Chuck Kutscher, National Renewable Energy Laboratory.

*Making Climate Hot: Effectively Communicating Climate Change*  
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<p>The only greenhouse gas emitted by human activities is carbon dioxide from burning fossil fuels.</p>	<p>Several types of human activities lead to significant emissions of greenhouse gases.</p> <p>Burning fossil fuels is one of these. Burning wood for cooking and heating also releases CO<sub>2</sub>. When cement is made from ground up limestone, the hardening process releases CO<sub>2</sub>.</p> <p>Agriculture, including growing rice and raising livestock, leads to the release of increased amounts of methane, another greenhouse gas. HFCs are a group of chemicals synthesized by humans which also act as greenhouse gases.</p>
<p>Humans adding carbon dioxide to the atmosphere is increasing the total amount of carbon in the environment. This might throw the carbon cycle out of balance.</p>	<p>Carbon follows the law of conservation of matter. Human activities have the effect of transferring carbon stored in plants and fossil fuels to the atmosphere. The amount of carbon <i>in the atmosphere</i> (and also in the oceans) is increasing, but the total amount of carbon on earth is staying the same.</p>
<p>Pollution affects the carbon cycle. If the air, for example, is polluted, then this pollution will travel up into the atmosphere and it will travel all along the cycle adding pollutants to the environment.</p>	<p>The matter that moves in the carbon cycle is carbon, though it may be attached to other atoms. For example, it may move through the cycle as carbon dioxide.</p> <p>Other air pollutants, like smog particles, are carried to the ground by the water cycle. Pollutant is a catch-all term. CO<sub>2</sub> is more correctly thought of as a greenhouse gas than as a pollutant.</p>
<p>The carbon cycle and water cycle are linked. Water carries carbon around the cycle.</p>	<p>The cycling of each type of matter (nitrogen, phosphorous, carbon, water) are independent, though they may affect each other. Carbon moves between the atmosphere, the earth, and water due to factors including air pressure, photosynthesis by plants, respiration by plants and animals, and burning of biomass and fossil fuels. In contrast to the water cycle, the carbon cycle is not directly driven by the sun.</p>
<p>Continued burning of fossil fuels is going to cause a catastrophe. All life on earth is going to die out, including humans.  <i>"It's human nature to take time. But there will be a day of reckoning"</i>—Al Gore  <i>"Man has lost the capacity to foresee and to forestall. He will end by destroying the earth"</i> – Rachel Carson</p>	<p>Concern over "pollution" need not be linked to catastrophic scenarios. While continued global warming will have strong impacts on human societies and on ecosystems, a total die-off is very unlikely. Potential mitigation plans exist which would limit sea level rise (for example, to 1 meter), limit species extinction (for example, to 20%), and be accomplished within reasonable world economic and population scenarios by 2100.</p>

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