PODNEBNE SPREMEMBE

(dodatek)

DRUŠTVO ZA OKOLJSKO VZGOJO EVROPE V SLOVENIJI
FEE DOVES

EKO ŠOLA KOT NAČIN ŽIVLJENJA
SLOVENIJA

DODATEK V ANGLEŠKEM JEZIKU

Članek o »učinku tople grede in toplogrednih plinih« in nekaj zastavljenih vprašanj nanašajoč se na članek v angleškem jeziku

Hey there. This is Eric Simon. When I was born, there were a little over three billion people living on the Earth. But in just my lifetime that figure has doubled to more than six billion people. By any measure, humans are incredibly successful as a species. But six billion people have an enormous impact on the biosphere. One such impact is the topic of today's tutorial: global warming. All animals are consumers, eating other organisms to obtain energy. You extract energy from the food you eat via the process of cellular respiration. In order to keep cellular respiration running, you must obtain oxygen from the air you breathe. This oxygen is used by your mitochondria to break down glucose. A waste product of this process is carbon dioxide, which must be exhaled. You take in oxygen and breathe out CO_2. The carbon dioxide you breathe out is used by plants to perform photosynthesis. Photosynthesis uses sunlight and carbon dioxide to build sugar molecules while releasing oxygen. So plants take in carbon dioxide and release oxygen.

All this is a way to say that you have an intimate relationship with the atmosphere and the global carbon cycle. Humans and other aerobic organisms add carbon dioxide to the atmosphere due to cellular respiration, and plants extract it to use in photosynthesis. Throughout most of human history, the amount of carbon dioxide humans and other consumers released into the atmosphere was balanced by the amount of carbon dioxide removed by producers like plants. That balance shifted about 200 years ago with the beginning of the industrial revolution.

Over the last two centuries, humans have been burning increasing amounts of fossil fuels such as oil, natural gas, and coal. When we combust fossil fuels, we release carbon-rich deposits that have been buried in the ground for millions of years into the air. In addition, we have been removing huge tracts of vegetation by deforestation, so there are fewer plants around to absorb CO_2 from the air. As a consequence of these two activities, the concentration of carbon dioxide in the atmosphere has been increasing. The rise in carbon dioxide levels has been directly measured since the late 1950s and inferred from data earlier than that. Before 1850, the average amount of carbon dioxide in the atmosphere was about 270 parts per million. Today, the CO_2 in the atmosphere is up to more than 370 parts per million. That's a rise of over 35%.

Wait a minute—parts per million—that seems like a very small amount, doesn't it? You no doubt are wondering what the big deal is about. What's a little more CO_2? The big deal is that carbon dioxide is one of the so-called greenhouse gases in our atmosphere. Other important greenhouse gases are water vapor, methane, and ozone. These gases serve a very important role in maintaining life on Earth: they help to warm the planet. Without greenhouse gases, the average temperature on the surface of the Earth would be about 30 degrees Celcius colder than it is now—probably too cold for most complex life to survive.

How do carbon dioxide and other greenhouse gases warm the Earth? The answer can be understood by following the flow of energy through Earth's atmosphere. I think this concept is easier to understand if you think of a greenhouse. A greenhouse is a clear glass or plastic structure that helps plants grow in cold weather by maintaining a warm interior. Sunlight passes through the glass of the greenhouse and warms the surfaces inside. Some of this warmth radiates back, warming the air inside the greenhouse. But the warm air is trapped by the walls of the greenhouse and so cannot escape back out. This is called the greenhouse effect. The consequence is a warm interior.

Let's apply this example to the Earth. Energy enters our biosphere as solar radiation. When this radiation strikes the Earth, it warms the Earth's surface. Some of this warmth is radiated back toward space, heating the atmosphere, the greenhouse gases in particular. The greenhouse gases keep the warmth within the Earth's atmosphere, essentially capturing it like the walls of a greenhouse do.

So that's the big deal. Atmospheric CO_2 has risen by 37% and is predicted to double by mid century if the current rate of increase holds. As an important greenhouse gas, and all other things being equal, rising CO_2 levels will lead to rising global temperatures. How much higher? That is hard to predict with any certainty, but varying computer models estimate a rise of between 2 and 6 degrees Celsius within the next century. What effect will such warmer temperatures have? No one can say for sure, but changes are predicted to include melting ice sheets, less sea ice, rising sea level, eroding shorelines, melting permafrost, and loss of habitat for arctic organisms. Climate models predict increased variability in local weather conditions with more storms, more snowfall (in some areas), and increased variability in rainfall or drought cycles. All of these could have profound affects on agriculture, the distributions of organisms, the integrity of ecosystems, and even human health.

If global warming is occurring, then what is the controversy? The controversy relates to the predicted impacts of global warming, when it will happen, and what to do about it, if anything. Carbon dioxide emissions are the result of fossil fuel consumption. Modern society runs on fossil fuels, so there is a lot at stake. What can we do about global warming? The obvious answer is to cut back on carbon dioxide emissions. The question is: can we cut emissions without sacrificing lifestyle? The answer to this question remains unclear. Science as a human activity is often embroiled in controversy. Science asks questions and we often don't like the answers, especially if the answers require tough solutions. As a citizen-scientist, it is your responsibility to be as informed as possible on controversial issues like global warming. Any solution to global warming or any response to the predicted changes will require support and buy-in from all members of society. We all face this challenge together. If you'd like to learn more about this really fascinating topic and the evidence behind it, you can check out an activity available on your textbook website. It is called "You Decide: Does Human Activity Cause Global Warming?" In this activity, you'll be able to explore the same data that scientists use to make decisions about global warming and form your own opinion.

In any case, study hard, conserve energy, and I hope to talk to you again soon.

QUESTIONS:

Which best describes how the atmosphere's CO_2 content was regulated before the Industrial Revolution?

1. Inputs of CO_2 to the atmosphere resulted from cellular respiration and widespread use of fossil fuels. These inputs were much greater than the uptake of CO_2 by producers.

   - CO_2 was taken up by organisms for use in cellular respiration; a similar amount of CO_2 was released by plants and other producers.
   - CO_2 was released by organisms as a by-product of cellular respiration; a similar amount of CO_2 was absorbed by plants and other producers.
   - CO_2 was released by organisms as a by-product of cellular respiration; photosynthesis contributed additional CO_2 to the atmosphere.

2. The interior of a car gets hot quickly on a warm sunny day. Solar radiation enters through the windows. It is absorbed by the seats and other materials inside the car. Some of it is radiated as heat. Much of the heat is retained by the windows, which let light in but don't let heat out as easily. Now apply this analogy to the global atmosphere. What is the role of CO_2?

   - CO_2 acts like the car seats; it absorbs solar radiation and releases it as heat.
   - CO_2 acts like the car windows; it lets sunlight through, then traps the heat that is radiated by Earth.
   - CO_2 acts like the solar radiation; when it reacts with other greenhouse gases, it becomes a source of heat energy in the atmosphere.
   - CO_2 acts like a white-painted roof on the car, reflecting most incoming solar radiation back out into space and keeping Earth cooler.

3. Today's atmospheric CO_2 concentration is _____.

   - about the same as it was before 1850
   - about 35% lower than it was before 1850
   - about 35% higher than it was before 1850
   - nearly 10 times higher than it was before 1850

4. Most models predict that continued increases in atmospheric CO_2 will cause global temperatures to _____ over the next 100 years.

- stabilize at current values
- increase by at least 20 degrees Celsius
- decrease by 2–7 degrees Celsius
- increase by 2–7 degrees Celsius

5. Policymakers banned the routine use of DDT as an insecticide in the United States, partly because of clear scientific evidence showing that DDT was a threat to wildlife. Today, scientific consensus holds that CO_2 released by human activities promotes global warming. Why haven't U.S. policymakers banned CO_2 pollution?

- CO_2 pollution stems from fossil fuel use, a technology that is central to modern economies. Measures to restrict CO_2 pollution could entail major economic costs and are strongly opposed by many interests.
- There are a few influential special interests who oppose a ban on CO_2, and they have been able to control the policy process.
- The scientists are missing one key piece of evidence: they cannot show that there has been any increase in CO_2 concentration in recent decades.
- They have banned CO_2 pollution. Global warming results from pollution that has already occurred over the past 200 years.