Plants ‘mop up’ more carbon than expected under lab conditions

March 14 2012

(PhysOrg.com) -- The ability of plants to absorb carbon dioxide emissions from human activity appears to be surprisingly robust as the climate warms, according to groundbreaking research.

The findings come from research which, for the first time, used real plants growing in sealed, climate-controlled cabinets under laboratory conditions to investigate how increasing carbon dioxide and warmer temperatures might affect vegetation and its ability to absorb human emissions of carbon dioxide. The experiments were carried out at the Natural Environment Research Council (NERC) Ecotron facility at Imperial College London.

Currently, trees and other plants mop up around a quarter of the carbon dioxide emissions from human activity. Most plants grow faster with increased levels of carbon dioxide (the ‘CO2 fertilisation' effect) and absorb more carbon as a result. However, there is a concern that as the world warms, plants and soils could start releasing more carbon dioxide than they absorb. Scientists don't know the balance between the temperature-related positive feedback, which would lead to more carbon dioxide and more warming, and the CO2 fertilisation effect - a negative feedback which would slow warming.

Dr. Martin Lukac, now based within the University of Reading's Walker Institute, said: "In our controlled climate cabinets the plants continued to absorb excess carbon dioxide from the model ‘atmosphere' up to a warming of around 2.5 degrees centigrade. So the role plants have in

cleaning up excess carbon dioxide from the atmosphere may be pretty robust - at least at lower levels of warming. We do have to be a bit cautious though in scaling up our single-cabinet experiments to the whole world."

Plants were grown inside airtight perspex boxes with a volume of about 120 litres, sealed to reflect the closed nature of the Earth system. Each box contained a simple, self-supporting ecosystem consisting of a plant, soil and soil microbes and an atmosphere. 15 replicate units were set up with pre-industrial levels of carbon dioxide in the atmosphere (280 ppmv) and pre-industrial carbon ratios in the atmosphere, soil and plant. Carbon dioxide was then injected to simulate emissions from human activity. In some units, temperature was also raised to simulate warming in response to increasing greenhouse gases.

Despite continual additions of carbon dioxide to the cabinets, the levels of carbon dioxide did not rise above around 500pmmv because the plants were so effective at removing carbon dioxide from the model atmosphere. Without plants, the carbon dioxide levels would have reached around 850ppmv. Once carbon dioxide ‘emissions' were stopped, the carbon dioxide level in the internal ‘atmosphere' did not return to preindustrial levels within the three-month timescale of the experiment. All the experiments were done under conditions of plentiful supply of water and nutrients to the plants in order to investigate their maximum potential to absorb carbon dioxide.

Scientists hope that this type of experiment with real plants will complement work done with computer simulations of the carbon cycle. Some computer simulations have suggested a much less robust ability of plants to continue to absorb carbon dioxide emissions from human activity.

Researchers are now looking to repeat the experiments, with the

inclusion of an analogy of the world's oceans - one of the key global systems influenced by and affecting rising CO2 levels.

More information: 'Biotic carbon feedbacks in a materially closed soil-vegetation-atmosphere system', Alexandru Milcu et al., *Nature Climate Change* (2012). www.nature.com/nclimate/journa … ll/nclimate1448.html

Provided by University of Reading