Research shows the response of the carbon cycle to climate change

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Marine and freshwater environments have the potential to release more carbon dioxide (CO2) into the atmosphere in a warmer climate than their land counterparts, scientists at Queen Mary, University of London have found.

In the largest ever analysis of rates of respiration, published online in the journal *Nature* today, scientists compared the temperature dependence of respiration between aquatic and land ecosystems.

Lead author, Dr Gabriel Yvon-Durocher from Queen Mary, University of London explained the context of the research: "In the carbon cycle, photosynthesis by plants absorbs carbon dioxide (CO2) while respiration by animals returns CO2 to the atmosphere. Understanding how rates of respiration of entire ecosystems respond to changes in temperature will be crucial for forecasting future climate change as the planet warms in the coming decades."

In analysing annual rates of respiration across different ecosystems around the world, they found that aquatic ecosystems had a stronger response to temperature changes than land ecosystems.

"Respiration has a higher 'activation energy' than photosynthesis, meaning that it increases more rapidly with increasing temperature. But over a longer time period, the carbon fixed by photosynthesis limits respiration on the land. However, many aquatic ecosystems receive additional carbon from the land, which washes into lakes, rivers,

estuaries and the sea from rainfall. This extra carbon means that respiration in aquatic ecosystems is not limited by photosynthesis and can have a stronger response to temperature than ecosystems on the land," explained Dr Yvon-Durocher.

"These findings demonstrate that aquatic ecosystems have a greater potential to release CO2 to the atmosphere as the climate warms, over long periods of time."

The authors warn that there are many other factors that need to be considered when analysing the links between global warming and changes in the carbon cycle.

"Our research has highlighted the potential of aquatic ecosystems to contribute more CO2 to the atmosphere as global temperatures rise, but we can not definitively say that this will exacerbate the effects of climate change - it merely highlights a new mechanism that must be considered when making future predictions," Dr Yvon-Durocher said.

"Further research should be done to characterise the temperature sensitivities of the other key fluxes mediated by ecosystems that control the levels of greenhouse gases in the atmosphere to make more accurate predictions of future climate change."

More information: 'Reconciling the temperature dependence of respiration across time scales and ecosystem types' will be published online in the journal *Nature* on June 20, 2012.

Provided by Queen Mary, University of London