Nitrogen rain makes bogs contribute to climate change

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High levels of nitrogenous compounds can make bogs give off more carbon dioxide, thereby adding to the greenhouse effect. This has been shown by the plant ecologist Hakan Rydin in an article published this week in the *Proceedings of the National Academy of Sciences*.

The increasing levels of carbon dioxide in the air are leading us to expect climate change with higher temperatures in the future. The principal cause is the combustion of fossil fuels, but there are other processes that can lead to increases in carbon dioxide as well. For thousands of years, plants in peat bogs and other fens have absorbed carbon dioxide from the air for their photosynthesis, binding it in the form of layers of peat that can reach depths of 10 meters. Such binding of carbon dioxide serves as a carbon trap and can counteract the release of carbon dioxide to some extent.

“Now there are signs that indicate that nitrogenous compounds in the air make peat bogs start to give off more carbon dioxide than they bind, and that they may tip over from being a carbon trap to being a carbon source, thereby aggravating the greenhouse effect instead,” says Håkan Rydin, professor of plant ecology, who directed the study.

The amount of carbon contained in peat layers is equivalent to 40-50 percent of the total amount of carbon dioxide in the atmosphere. The most important peat-forming plants are bog mosses (NOT the same as the reindeer lichens used in advent candle settings). Bog mosses have several unique properties. They soak up water like sponges, making the

environment waterlogged and low on oxygen, which counteracts their being degraded by microorganisms and leads to the accumulation of plant remains in the form of peat. Another reason peat is formed is that bog mosses produce organic substances, such as polyphenols, that make them difficult to break down. They are therefore highly deficient in nutrition and are directly impacted by the amounts of nitrogen found in precipitation as a result of air pollution.

In the present study, a network of scientists show, from samples taken from bogs in Europe with varying levels of nitrogen in the precipitation, that bog mosses growing in areas with higher levels of nitrogen form smaller amounts of polyphenols and are therefore more susceptible to degradation by microorganisms than those growing in areas with low levels of nitrogen, such as the Nordic countries. This increased degradation entails that bogs give off more carbon dioxide to the atmosphere.

They have also found that precipitation with high levels of nitrogen promotes the growth of grass and sedge, which also occur on bogs. These plants do not add to peat build-up in the same way as bog mosses. All in all, this means that bogs can aggravate the greenhouse effect in areas with high levels of nitrogen in precipitation, by both giving off more and binding less carbon dioxide.

Source: Uppsala Universitet

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