

# Soil contributes to climate warming more than expected

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The climatic warming will increase the carbon dioxide emissions from soil more than previously estimated. This is a mechanism that will significantly accelerate the climate change. Already now the carbon dioxide emissions from soil are ten times higher than the emissions of fossil carbon. A Finnish research group has proved that the present standard measurements underestimate the effect of climate warming on emissions from the soil.

The error is serious enough to require revisions in climate change estimates. In all climate models, the estimates of emissions from [soil](#) are based on measurements made using this erroneous method. Climate models must be revised so that the largest carbon storage of the land ecosystems will be estimated correctly. The sensitivity of the soil carbon storage to climatic warming will endanger the carbon sink capacity of forests in the future.

Research on the effect of climate change on the [carbon dioxide](#) release from soil is seriously studied by many research groups around the world. It is known that emissions from soil have a significant influence on the carbon dioxide concentration in the atmosphere and thereby on the future climate. However, these studies are usually based on short-term measurements of the carbon dioxide production of soil. According to the results of the Finnish research group, such a method gives systematically biased estimates on the effects of climate change on the emissions.

The carbon dioxide measured in short-term experiments comes from carbon compounds that are decomposed quickly, but such compounds are not abundant in the soil. Based on radiocarbon measurements, the Finnish research group showed that the more slowly decomposing compounds are much more sensitive to the rise of temperature and that such compounds are abundant in the soil.

The studies in boreal forests showed that [carbon dioxide emissions](#) from the soil will be up to 50 percent higher than those suggested by the present mainstream method, if the mean temperature will rise as it is estimated, that is, by 5 centigrades before the end of this century, and if the carbon flow to the soil will not increase. An increase of the growth of forest biomass by 100-200 % would compensate the increasing releases from the soil. According to the previous erroneous estimates, a 70-80 % increase of growth would be enough. The difference is significant. Even according to the highest estimates, the growth of forests will only increase by 60 % if the mean temperatures will rise by 5 centigrades.

According to the results, the climatic warming will inevitably lead to smaller carbon storage in soil and to higher carbon dioxide emissions from forests. These emissions will further warm up the climate, and as a consequence the emissions will again increase. This interaction between the carbon dioxide emissions from soil and the warming of climate will accelerate the climate change.

The present [climate models](#) underestimate the increase of carbon dioxide emissions from soil in a warmer climate. Thereby they also underestimate the accelerating impact of the largest carbon storage in forests on the climate change. This result is also essential with respect to the climate policy measures concerning forests. The carbon storage of forests is, more than previously assumed, sensitive to climatic warming, and the carbon sink capacity of forests is endangered. To maintain the

[carbon storage](#), the accumulation of organic material in forests should increase. However, this is not compatible with the present bioenergy goals for forests and with the more and more intensive harvesting of biomass in forests.

The research was carried out as cooperation between the Finnish Environment Institute, the Finnish [Forest](#) Research Institute and the Dating Laboratory of the Finnish Museum of Natural History at the University of Helsinki. The research was funded by the Academy of Finland and the Maj and Tor Nessling Foundation.

**More information:** Karhu, K., Fritze, H., Hämäläinen, K., Vanhala, P., Jungner, H., Oinonen, M., Sonninen, E., Tuomi, M., Spetz, P. & Liski, J. 2010. Temperature sensitivity of soil carbon fractions in boreal forest soil. *Ecology* 91(2): 370-376.

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