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Climate warning as Siberia melts

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THE world's largest frozen peat bog is melting. An area stretching for a million square kilometres across the permafrost of western Siberia is turning into a mass of shallow lakes as the ground melts, according to Russian researchers just back from the region.

The sudden melting of a bog the size of France and Germany combined could unleash billions of tonnes of methane, a potent greenhouse gas, into the atmosphere.

The news of the dramatic transformation of one of the world's least visited landscapes comes from Sergei Kirpotin, a botanist at Tomsk State University, Russia, and Judith Marquand at the University of Oxford.

Kirpotin describes an "ecological landslide that is probably irreversible and is undoubtedly connected to climatic warming". He says that the entire western Siberian sub-Arctic region has begun to melt, and this "has all happened in the last three or four years".

What was until recently a featureless expanse of frozen peat is turning into a watery landscape of lakes, some more than a kilometre across. Kirpotin suspects that some unknown critical threshold has been crossed, triggering the melting.

Western Siberia has warmed faster than almost anywhere else on the planet, with an increase in average temperatures of some 3 °C in the last 40 years. The warming is believed to be a combination of man-made climate change, a cyclical change in atmospheric circulation known as the Arctic oscillation, plus feedbacks caused by melting ice, which exposes bare ground and ocean. These absorb more solar heat than white ice and snow.

Similar warming has also been taking place in Alaska: earlier this summer Jon Pelletier of the University of Arizona in Tucson reported a major expansion of lakes on the North Slope fringing the Arctic Ocean.

The findings from western Siberia follow a report two months ago that thousands of lakes in eastern Siberia have disappeared in the last 30 years, also because of climate change (New Scientist, 11 June, p 16). This apparent contradiction arises because the two events represent opposite end of the same process, known as thermokarst.

In this process, rising air temperatures first create "frost-heave", which turns the flat permafrost into a series of hollows and hummocks known as salsas. Then as the permafrost begins to melt, water collects on the surface, forming ponds that are prevented from draining away by the frozen bog beneath. The ponds coalesce into ever larger lakes until, finally, the last permafrost melts and the lakes drain away underground.

Siberia's peat bogs formed around 11,000 years ago at the end of the last ice age. Since then they have been generating methane, most of which has been trapped within the permafrost, and sometimes deeper in ice-like structures known as clathrates. Larry Smith of the University of California, Los Angeles, estimates that the west Siberian bog alone contains some 70 billion tonnes of methane, a quarter of all the methane stored on the land surface worldwide.

His colleague Karen Frey says if the bogs dry out as they warm, the methane will oxidise and escape into the air as carbon dioxide. But if the bogs remain wet, as is the case in western Siberia today, then the methane will be released straight into the atmosphere. Methane is 20 times as potent a greenhouse gas as carbon dioxide.

In May this year, Katey Walter of the University of Alaska Fairbanks told a meeting in Washington of the Arctic Research Consortium of the US that she had found methane hotspots in eastern Siberia, where the gas was bubbling from thawing permafrost so fast it was preventing the surface from freezing, even in the midst of winter.

An international research partnership known as the Global Carbon Project earlier this year identified melting permafrost as a major source of feedbacks that could accelerate climate change by releasing greenhouse gases into the atmosphere. "Several hundred billion tonnes of carbon could be released," said the project's chief scientist, Pep Canadell of the CSIRO Division of Marine and Atmospheric Research in Canberra, Australia.

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