

How fires are changing the tundra's face

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Climate change takes a heavy toll on the tundra, increasing the probability of extreme droughts. As a result, the frequency of fires in forests, bogs and even wetlands continues to rise. In addition, the northern areas of the tundra have also become more accessible and negatively impacted by human activities in recent years.

Two young ecologists from the University of Münster are studying the

serious consequences fires can have for vegetation, soils and some endangered bird species. Even decades after the last fire event, impacts on plant communities are clearly visible. They will present their results at the ['Ecology Across Borders'](#) conference in Ghent, Belgium this week.

PhD student Ramona Heim from Professor Norbert Hölzel's working group at the Institute of Landscape Ecology, University of Münster, compared two study sites in northeastern Russia, where the last fires occurred 11 and more than 30 years ago. At the younger site, [soil temperature](#) and permafrost depth were significantly higher and lichen cover was much reduced. In contrast, moss, grass and herb species were more abundant compared to control sites nearby.

"Soil temperature at our older study site is no longer impacted by the fire, but even 30-odd years after the fire event, lichens have not completely recovered", says Ramona Heim. "The dense cover of shrubs was a surprise. Usually, fires prevent the formation of dense shrub layers, but these results suggest that [tundra fires](#) could promote it instead", she adds.

The change in vegetation structure has important long-term consequences for plant communities, microclimates and animals depending on certain plants or structures. For instance, reindeer need specific lichens in their diet, which have been found to be considerably less abundant even decades after a fire.

The surveys were conducted in cooperation with Andrey Yurtaev of the University of Tyumen and nine students from Russia and Germany.

Wieland Heim, another member of Prof. Hölzel's working group, investigated the effects of the ever-increasing fires on breeding birds and plant communities in wetlands at Russia's Muravioka Park. The diversity of birds and plants was recorded along 22 transects on areas that had

burned last year.

While many plant species benefitted from the fires and the resulting niches and nutrients available, the diversity of [bird species](#) declined significantly. Birds, such as ground and reed breeders that rely on special microhabitats were among the losers.

"Since fires usually break out in spring during the breeding season and many birds do not produce a second brood, the expanding and more frequent fires can have serious consequences for their reproduction", reports Wieland Heim.

The yellow-breasted bunting (*Emberiza aureola*) is one of particularly affected species. Historically known to cover habitats across northern Eurasia, their populations have plummeted by 90% in recent years. It was the first songbird species with a large range to be listed as 'critically endangered to extinction' in the IUCN Red List. The main reason for this massive decline in numbers is illegal bird-hunting in China. However, more frequent and more severe fires in its breeding habitat will put this species under additional pressure.

As a result of [climate change](#) and increasing development in the tundra, permafrost thaws earlier and deeper and organic layers dry out faster. This biomass can then ignite easily. After a [fire](#), the insulating effect of the then burnt organic material is missing and consequently the albedo changes, i. e. the proportion of light reflected from the ground. Darker soils heat up more, causing their surface to dry out and permafrost to thaw even more, releasing further flammable organic material and leaking stored methane into the atmosphere.

Ramona and Wieland Heim are married and support each other's research. Ramona Heim is mapping and determining [plant communities](#). Wieland Heim is a passionate ornithologist and has been working in

Muraviovka Park since 2011. Together, they have set themselves the task of investigating the causes and effects of fires in this sensitive permafrost region.

Both will present their work on Tuesday 12 December 2017 at the 'Ecology Across Borders' conference.

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