

# Deadly Haze over Forests in the Arctic

SibFU researchers [have reconstructed](#) the impact of industrial emissions in the north of Siberia on Siberian forests, a significant part of which is associated with the activities of large industrial facilities in Eurasia and North America, located thousands of kilometers away. Key findings of the researchers are published in [Ecology Letters](#).



*'Having been studying boreal forests in the Arctic regions of Siberia for 30 years, the researchers have found increasing desensitization of trees in the Arctic zone to external climatic factors, in particular, temperature. At first glance, we are dealing with an amazing paradox: the average annual temperature, including in the Arctic zone of Russia, increases, and it would seem that trees should grow better, and forests should spread. However, we see something completely different. Since the 1970s, 24,000 km<sup>2</sup> of boreal forests have died in the Arctic. If we compare the Siberian forests and jungles of the Amazon with the lungs of the planet, our forests are experiencing severe pneumonia. A possible reason is a peculiar arctic haze saturated with various pollutants, the elements industrial emissions are saturated with. This aerosol suspension in the air hinders the normal life, especially, the photosynthesis of plants,'* said **Vladimir Shishov**, head of the Department of Mathematical Methods and Information Technologies of Siberian Federal University.



There are several hypotheses why the Arctic forests, including the Siberian ones, are experiencing this growth depression.

'We used mathematical modelling and proved that the depression of wood growth is primarily affected by the lowering amount of incoming solar radiation from 1960 to 2000, which affects plant photosynthesis. This global phenomenon is called the dimming effect. It was recorded almost throughout the Northern Hemisphere and especially in the Arctic regions,' continued Vladimir Shishov.

Knowing this trend, the researchers discovered a collateral source of information that correlates with the amount of incoming solar radiation – the diurnal temperature range. Having linked these two factors, the scholars modified the Vaganov-Shashkin model and, using calculations on a supercomputer, showed a clear correlation of the depression of the growth of woody plants in a vast area from the mouth of the Ob to the mouth of the Khatanga River and the effects of illumination of the territory.

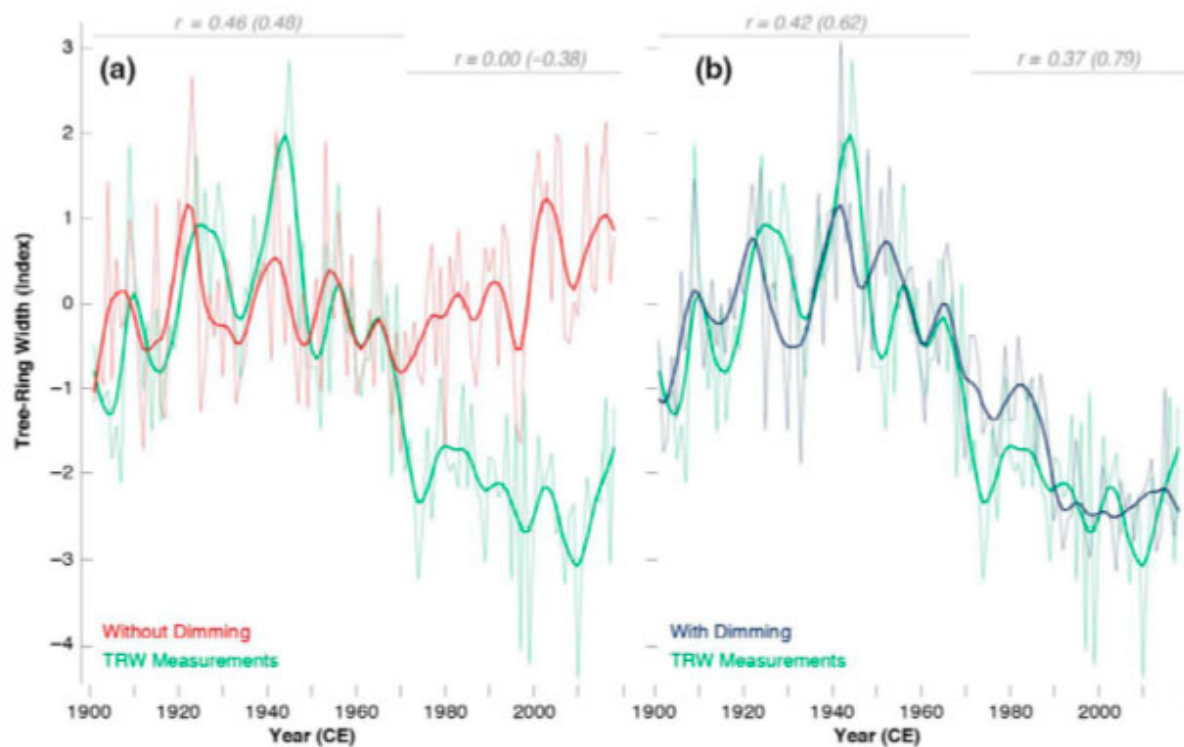


Figure. Simulation of tree growth without dimming effect (a) and with it (b) (Kirdyanov et al., 2020)

*'Once again, the versatility of the Vaganov-Shashkin model developed by our Krasnoyarsk school of modelling has been proven. The factor of diminishing solar radiation was perfectly integrated into the base model. It is obvious that the Siberian Arctic forests are in a depression on a vast territory, and this is especially noticeable in the vicinity of the city of Norilsk. The fatal role is played by the "Arctic" fog which is formed due to a large amount of emissions from large industrial enterprises, and the patterns of the circulation of air masses in the Arctic,' the scientist summed up.*

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