

Typhoons Make Trees Grow Faster

An international scientific team, which included a researcher from Siberian Federal University, have studied the mechanisms of adaptation of Northeast Asian forests to more frequent tropical typhoons. It turned out that under global warming, typhoons have a severe impact on the reforestation process and will be of increasing importance in the future. The researchers elicited different strategies for coping with typhoon-induced disturbances in three key tree species which have a vast natural habitat in East Asia. It turned out that Mongolian oak (*Quercus mongolica*) and Korean pine (*Pinus koraiensis*) are the pioneers in disturbed areas, while Khingan fir (*Abies nephrolepis*) occupies new areas and enters the leaf canopy due to its ability to grow rapidly.



The scientists from Russia, the Czech Republic, and South Korea studied how natural disturbances caused, in particular, by typhoons, affect the restoration of the most valuable and highly productive forest ecosystems in East Asia. The experts were also interested in what strategies the key tree species common in vast territories from the Korean Peninsula to the Russian Far East use for survival.

“Tropical typhoons are typical for this region. Although they definitely are a negative factor for people and cause significant economic damage, for forests, on the other hand, it is a powerful driving force of the necessary dynamic processes. We used long-term radial growth models based on more than 800 trees and studied the influence of typhoons on tree life strategies. The study covered more than 300 years – the method of measuring the width of tree rings made it possible to look so far into the past,” said **Anna Vozmishcheva**, a researcher at the Laboratory for Complex Studies of Forest Dynamics in Eurasia, SibFU.



The expert explained that the models of radial increase were subdivided into two main groups depending on the mechanism of ecosystem restoration after the disturbances caused by a hurricane: the first group included trees that occupied significant gaps in the forest canopy after its severe destruction, and the second group was the trees freed from oppressing neighbours which reached the height of the forest canopy.

It is not by chance that the multi-species coniferous-deciduous forests of the temperate zone of Northeast Asia attracted the interest of the researchers. They are the most affected by hurricanes and typhoons that arise in the tropical Pacific Ocean and move to northern latitudes, gradually fading away.

“We found a significant change in the ratio of different strategies used by trees in proportion to the decrease in typhoon activity. Also, as a result of the study, it turned out that the life strategies of tree growth can be used as an important indicator of disturbances in the forest canopy in the distant past. How can we find out what happened to the forests 300 years ago, when the necessary tools and analysis methods were not available? What environmental, especially climatic shocks, diseases did they experience? By analyzing tree rings, we can figure out exactly how trees restore the forest canopy damaged after hurricanes. And then try to understand how these strategies change along the latitudinal gradient, that is, from the south, where the destructive activity of typhoons is maximum, to the north,” explained **Anna Vozmishcheva**.

The researchers emphasize that understanding how typhoon-induced disturbance affects tree regeneration will help predict the impact of a widespread, yearly decline of the forest area and define more accurately the rate of carbon accumulation and change in forest biodiversity.

“Our group managed to prove that the so-called gradient of typhoon activity (their weakening from south to north) was the main factor influencing the growth pattern of Mongolian oak and Korean pine in forests disturbed by hurricanes. In the south, these trees are more willing to fill wide gaps in the forest canopy. As for the Khingan fir, it often turns out to be in competitive suppression by taller and more disease-resistant tree species. But as soon as its neighbours are hit, it grows up to the upper level of the canopy, demonstrating a very high growth speed. Fir is more susceptible to various diseases, and its ability to grow rapidly compensates for its vulnerability. Actually, that is why the specimens of fir that we found were the youngest: it grows quickly, dies quickly and quickly restores,” concluded **Anna Vozmishcheva**.

In general, the researchers stressed that in the foreseeable future, catastrophic disturbances caused by typhoons would gradually shift to the north – this is one of the results of global warming. Typhoons will become more frequent and intense, and therefore the study of their impact on forest systems will become a promising topic for environmental research.

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