Spring cold snap helps with stream ecosystem research

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A rare April freeze in 2007 provided researchers at the Department of Energy's Oak Ridge National Laboratory with further evidence that climate change could have negative effects on stream and forest ecosystems.

As warm weather arrives sooner in many parts of the nation, forest plants and trees on the banks flourish, shading the stream from sunlight and causing an overall decrease in productivity in the late spring and summer. A research paper published in this month's issue of Global Change Biology titled "Unexpected effect of climate change: Stream ecosystem responses to the 2007 spring freeze" describes how a small change in canopy cover can dramatically impact a stream.

"The study implies that the algal productivity pulse in the stream that drives the ecosystem during the spring months could be shortened with climate change if leaf-out continues to occur earlier each year," said ORNL researcher Patrick Mulholland, author of the paper. "The stream no longer gets that period of peak productivity in spring because the leaves are shading the stream when the sun angle is relatively high."

For this particular study, an Arctic air mass sent temperatures to below 28 degrees Fahrenheit for several nights in succession, freezing many of the newly emerged leaves and leaving the stream exposed to higher than normal levels of sunlight over the next several months.

This early April freeze resulted in positive effects for a well-studied East

Tennessee stream and reiterated the importance of sunlight on the growth of algae, bacteria, snails and other organisms in forest streams.

Compared to typical conditions, the post-freeze conditions set in motion a chain reaction.

"Increased light levels caused a cascade of ecological effects in the stream, beginning with considerably higher growth rates during the late spring and summer months when normally low light levels severely limit stream production," said Mulholland, a member of the Environmental Sciences Division.

In this case, a freeze caused the Walker Branch stream to prosper, but an ecosystem cannot count on unexpected weather events to maintain productivity.

"The stream ecosystem cannot depend on an Arctic air mass moving in every year, killing the leaves and exposing the stream to sunlight, resulting in increased growth," Mulholland said. "It's an unpredictable weather occurrence. On the other hand, we see that early leaf emergence has become predictable and has negative effects on the stream ecosystem during the critical spring period when many stream organisms are dependent on algae for food."

Although canopy cover in the spring leads to decreased organism growth, in the autumn, bacteria and fungi decompose the leaves and grow from the nutrients, thus stimulating productivity.

Source: Oak Ridge National Laboratory (news : web)