

Why do autumn leaves bother to turn red?

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Soils may dictate the array of fall colors as much as the trees rooted in them, according to a forest survey out of North Carolina.

By taking careful stock and laboratory analyses of the autumn foliage of sweetgum and red maple trees along transects from floodplains to ridge-tops in a nature preserve in Charlotte, N.C., former University of North Carolina at Charlotte graduate student Emily M. Habinck found that in places where the soil was relatively low in nitrogen and other essential elements, trees produced more red pigments known as anthocyanins.

Habinck's discovery supports a 2003 hypothesis put forward to explain why trees bother to make red pigments, by plant physiologist William Hoch of Montana State University, Bozeman. Hoch found that if he genetically blocked anthocyanin production in red-leafed plants, their leaves were unusually vulnerable to fall sunlight, and so sent less nutrients to the plant roots for winter storage.

For trees living in nutrient-poor soils, then, it makes sense to produce more anthocyanins, which protect the leaves longer, so as much nutrient as possible can be recovered from leaves before winter sets in. It is, after all, the process of recovering of nutrients from leaves which turns leaves from green to yellow, orange and sometimes anthocyanin-red.

The trees Habinck studied appear to be acting in accordance with Hoch's hypothesis. "It makes sense that anthocyanin production would have a function, because it requires energy expenditure," said Habinck. Put in economic terms, anthocyanins are an investment made by stressed trees

in situations where they stand to gain from the extra recovery of nutrients from leaves. It's not about the showy color, but about survival.

"The rainbow of color we see in the fall is not just for our personal human enjoyment -- rather, it is the trees going on about their lives and trying to survive," said Habinck's advisor, Martha C. Eppes, a soil scientist and assistant professor of Earth sciences at the University of North Carolina at Charlotte. Eppes will present the research at the Geological Society of America Annual Meeting, Monday, 29 October, in Denver, CO.

The reason the soil-leaf color connection wasn't made long ago is partly because Hoch's hypothesis was needed to put it into perspective. It also might be that many plant researchers were missing the forest for the trees.

"I think that most of the work has been done by biologists looking at production of anthocyanins in trees themselves," said Eppes. They hadn't stepped back and looked at patterns of tree color.

Eppes wants to follow up Habinck's study with a wider analysis of satellite data showing tree color which can be compared to geological maps of the types of soils over large portions of land.

Source: Geological Society of America

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