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## Scientists seek to document later fall colors

Associated Press

PORTLAND, Maine — Clocks may not be the only thing falling back: That signature autumn change in leaf colors may be drifting further down the calendar.

Scientists don't quite know if global warming is changing the signs of fall like it already has with an earlier-arriving spring. They're turning their attention to fall foliage in hopes of determining whether climate change is leading to a later arrival of autumn's golden, orange and red hues.

Studies in Europe and in Japan already indicate leaves are changing color and dropping later, so it stands to reason that it's happening here as well, said Richard Primack, professor of biology at Boston University.

"The fall foliage is going to get pushed back," Primack warned.

Down the road, scientists say there could be implications not just for ecology but for the economy if duller or delayed colors discourage leaf-peeping tourists.

Phenology is the study of timing in nature, whether it's crocuses emerging in the spring, leaves falling from trees, or Canada geese heading south for the winter.

And it's tricky business for fall foliage.

The budding of plants each spring is tied almost exclusively to warming temperatures, while fall's changing colors are linked to cooling temperatures, decreasing sunlight and soil moisture.

The brilliant colors associated with fall happen when production of chlorophyll, the green pigment in plants that's crucial to photosynthesis, slows down as the days get shorter and the nights grow longer. That exposes leaves' yellow, red and orange pigments that are normally hidden from view.

How and when that happens depends on temperatures and moisture levels. In some years, the colors are more vibrant than others. Further complicating matters: A tree that's stressed may simply drop its leaves, with no color change, or brown leaves.

"Fall is still an enigma," said Jake Weltzin, executive director of the National Phenology Network in Arizona and an ecologist with the U.S. Geological Survey.

Scientists caution that heavy rain, drought-like conditions or temperature extremes can cause dramatic year-to-

year fluctuations that don't establish a long-term trend. For example, heavy rainfall in New England this spring, followed by a deluge caused by Irene, is causing fungal growth that's causing some trees' leaves to turn brown and drop earlier than normal.

William Ostrofsky, forest pathologist with the Maine Forest Service, is skeptical about whether there's a proven link between fall foliage and climate change.

"I just don't know that there's any evidence to indicate there's a trend one way or the other," said Ostrofsky, who points out that year-to-year fluctuations make it difficult to discern long-term trends. "I really don't think we've seen any long-term trend, as far as I can tell."

While there's no definitive study in the U.S., some data points toward later leaf drop:

— Researchers at the NASA Goddard Space Flight Center and at Seoul National University in South Korea used satellites to show the end of the growing season was delayed by 6 1/2 days from 1982 to 2008 in the Northern Hemisphere.

— In Massachusetts, the leaves are changing about three days later than they were two decades ago at the Harvard Forest 65 miles west of Boston, according to data collected by John O'Keefe, a retired Harvard professor and museum coordinator who's continuing to collect data.

— In New Hampshire, data collected at the federal Hubbard Brook Experimental Forest in Woodstock suggests sugar maples are going dormant two to five days later than they were two decades ago.

— In Vermont, state foresters studying sugar maples at the Proctor Maple Research Center in Underhill found that the growing season ended later than the statistical average in seven out of the last 10 years.

And then there are regular folks like 83-year-old Nancy Aldrich at Polly's Pancake Parlor in New Hampshire, who has been keeping her own records since 1975. Her numbers show that color change is a moving target, and she's not willing to go out on a limb in terms of making any declarations.

"I'm know I'm vague about it, but so is nature," Aldrich said from the restaurant in Sugar Hill, in New Hampshire's White Mountains.

Scientists are getting serious, and in Maine they're enlisting gardeners, 4-H programs, teachers, students and families in their efforts to collect data.

"There are signs everywhere that things are changing — how is the question. Some species are being affected while others are not," said Esperanza Stancioff of the University of Maine cooperative extension and Maine Sea Grant, who has trained 195 citizen scientists to enter data online in her "Signs of the Season" phenology project.

To assist both backyard observers and researchers alike, the National Phenology Network has spent the last four years coming up with standards to be used by observers in reporting foliage color changes. Final tweaks on the uniform reporting standards should be completed in a few weeks, Weltzin said.

Another part of the effort to study climate change through the lens of fall foliage is being conducted from space by the U.S. Geological Survey utilizing satellites from NASA and the National Oceanic and Atmospheric Administration.

Right now, the effort is focused on Shenandoah National Park in Virginia, where scientists are attempting to understand the factors that go into the metrics to ensure proper analysis of the photos taken from above, said

John W. Jones, a research geographer with the USGS outside of Washington, D.C.

For now, there's no reason to fear drastic changes.

In the short term, people may have to adjust the timing of their foliage-viewing vacations, and long-term implications for climate change could alter the schedule altogether, Primack said.

Foliage aficionados insist there's been nothing — not even felled trees or record August rainfall caused by Irene — this year to prevent the nation's leaf peepers from getting their full-colored fix this fall. "Tourists are coming, regardless of the weather. Many of our properties are filled to capacity," said David West, vice president of marketing for the Pocono Mountains Visitors Bureau in Stroudsburg, Pa.

The bigger concern is whether tourists can afford to get out and enjoy the sights. "The economy, I think, has a bigger impact on what people do and their travel plans," said Lisa Marshall of the Wisconsin Department of Tourism.

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Associated Press reporters Genaro Armas in State College, Pa., and Carrie Antlfinger in Milwaukee contributed to this story.

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