Seeing the forest for the trees: What one oak tells us about climate change

April 17 2017, by Lynda V. Mapes, The Seattle Times

It is the time we wait for all winter, as spring's first green leaves unfurl. The joy we feel is the thrill of a new season, kicked off by the masterful work of trees.

Trees, it turns out, are up to far more marvelous things than we ordinarily think.

Mute, passive, unmoving, solitary? Actually, no. Trees talk. Move. Breathe. So numerous are their abilities, and so embedded in a continuum of thrumming life are trees, that to know even one well is to be dazzled.

I learned this from one tree, in particular: a big oak I got to know over the better part of two years, from the tossed sunlit glory of its airy crown, to the small skitter of busy lives in the soil at its roots.

It all started by working with a scientist and his research crew, probing deeply into the lives of trees at Harvard Forest, a 4,000-acre laboratory of mostly scrappy third-growth trees, on former pastures and farms west of Boston. I was interested as a journalist in looking for new and better ways to tell the story of our changing climate. It has been a yawner for too many - a distant debate about treaties, dueling science and doomsday scenarios. The stakes are high: the function of natural processes; the viability of habitats; even the survival of species, including our own. But the facts won't matter if we can't get anyone to pay attention.

What has been missing is the largely overlooked story of the delicate seasonal timing of the natural world, and how it is being disrupted. I was seeking the urgent testimony of living things to a world already changing around us.

People everywhere have always observed the seasonal procession of the year, and drawn meaning from familiar patterns in the lives of plants and animals. We have a deep sense, built from daily observation, of what in nature is supposed to happen, where, and when. And an undeniable sense, too, that something important is happening when seasonal timing is out of whack. Birders know this. Gardeners do, too.

Now scientists are beginning to explore this everyday evidence of climate change, to reveal from changing seasonal rhythms the effects on the landscape.

—-

At Harvard Forest, I wanted to take the back off the ticking seasonal clock to report, through the long-term, intimate observations by scientists in one place, and even the life of just one tree, what many intuitively sense: Our world is already changing.

To do it, I teamed with John O'Keefe and Professor Andrew Richardson at Harvard University, who was exploring data O'Keefe began gathering decades ago, walking a survey loop of the same 50 trees at Harvard Forest. With a clipboard, binoculars and pencil, O'Keefe documented every week in spring and fall the grand procession of bud break, leaf growth, color and drop.

"John, I need a tree," I wrote him early on, as I began joining his walks that first autumn in 2013. A tree that was a witness to our changing world.

And so we set off on his survey loop, auditioning trees. "Here," John said. "This might be a good one," he said, putting his hand on the big oak.

I tipped my head back to see its broad crown. It was big, that was for sure. Beautiful, no question. Now I just needed to know, was it old enough? I needed at least a century, a tree that reached back to the time when Model Ts were first off the assembly line, and our carbon love affair was revving up in earnest.

So we came back in spring 2014, with Dave Orwig, a master tree corer at the Forest, to bore deep into the oak.

The big oak talked back with a krrreck as Orwig drilled the bit nearly to the tree's heart. With a swift tug, he pulled out a long core of wood from the dark depths of the tree into the sunlight: a slim wand of time, looking into the past.

A quick field check later confirmed under a microscope that the tree was about a century old. That settled it: Like the trees used as markers by settlers to denote the metes and bounds of changing landscapes, the oak would be my witness tree.

—-

I moved to the Forest in the fall of 2014 to live with my tree for a year for what we called the Witness Tree Project, taking up residence just a short walk away from the oak in an old farmhouse. There was even a small troupe of cows for company in a pasture just outside the front door.

The big oak had sprouted by a stone wall as people left these woods for cities and factories, creating the emissions that are changing our world.

O'Keefe's field notes showed that by now, not only had average temperatures changed, but even the clockwork of the seasons themselves. Spring, on average, was earlier. Fall came later, and winter was squeezed on both ends.

On O'Keefe's weekly survey walks, we zoomed in the focus from the planetary to the very specific. He noticed everything: the mineral scent of the soil released in the first thaw, the first call of wood frogs and the arrival of ice on the puddles. What emerged was a vivid picture in Pointillist detail not only of the seasonal gyre of the year, but the interconnected timing of the forest with everything else, from the level of water in vernal pools to the first pollinators on the wing.

I began to understand the big oak in even closer focus, to see it not only as an individual, but a host to a web of life so interconnected as to make just one tree a forest unto itself. In its roots, a vast network of fungi lounged all through the soil, connecting the oak that seemed to stand so sedately alone to the other trees below ground. This fungal network greatly increased the tree's root area, and made available to it more nutrients and water than the tree could source on its own.

But the collaboration and communication engaged in by the tree went much further. In autumn, an army of jays and squirrels resolutely reported for work, gathering and distributing far beyond the tree's shady canopy the acorns that would start its next generation.

In spring, the tree spoke out a sharp warning to its grove of the insects chewing its leaves, using pheromones to call in an air force of predatory wasps to mount a fierce guerrilla defense. Neighboring trees eavesdropping on the warning geared up with changed leaf chemistry, to make their fresh lovely spring leaves less palatable to insect attack.

The big oak's command over its realm was impressive, active and

relentless. And oh, how it moved.

—-

Early in my experiments with the tree, I figured out that to know it at all, I would need to climb it. Which is where Melissa LeVangie and her twin sister, Bear, came in.

Melissa, the tree warden for Petersham, Mass., is charged with protecting the town's trees. She also happens to be a champion climber. So when it came time to get up in the tree, it was obvious whom I should call.

On the appointed day, Melissa and Bear arrived and rigged me up in a harness and ropes. I felt like a trussed turkey as the time came to give the rope that tethered me to the oak a pull. My feet lifted from the ground. In that moment, I was transported to the joy of my tree climbs as a girl, swaying atop a tall cedar in my tiny treetop girl nation of one.

My intended short visit turned into an obsession that eventually took me, with Melissa and Bear, into the oak's leafy crown some 80 feet up, picnicking in a hammock and even writing parts of the book that would come of all this, Witness Tree (Bloomsbury, 2017).

When I wasn't climbing the oak, I kept right on walking, alongside O'Keefe, and observing the explorations of the Richardson lab.

Richardson and other researchers were quick to see the value in O'Keefe's long, carefully kept records. And Richardson added a new twist: a bird's-eye view, with a bank of security cameras, of all things, mounted on towers in the Forest.

The tower by the big oak bristles with an array of instruments. Cameras

and sensors poke into the business of this grove, logging every act in the leaves' annual drama as they bud, unfurl, color and fall.

See it for yourself: Log on to the webcams at Harvard Forest to see the Witness Tree's patch of woods on Barn Tower and Barn Tower 2, or click on the Witness Tree camera to see the big oak. Watch it go through its day, in live images uploaded every half-hour in daylight hours. Through archives at the University of New Hampshire, you can watch the tree go through past years, if you'd like. Speed up the images, and watch the seasons fly.

Here is a way to see the proverbial forest for the trees, to get a sense at scale of how the Forest is responding to climate change. There has never been anything like it.

Combining O'Keefe's field observations with the forest-eye view from the cameras, and data from a bevy of gadgets, the Richardson lab and its collaborators are breaking new ground in understanding the impact of climate change on forests. They published research showing trees were packing away more carbon and growing faster than at any time in the past 20 years, and using less water to do so. With so much carbon dioxide in the air, trees such as the big oak open their stomata - the breathing pores in their leaves - less to take in the carbon dioxide that is their food. They lose less water in the bargain.

Here was climate change, visible not only in the calendar of the forest canopy, but deep within the mechanics of individual leaves, even within one tree.

—-

The story of climate change is not only one story, of course, even in one forest. While the big oak is thriving, hemlocks throughout New England

are dying because of woolly adelgid, a tiny, aphid-like pest native to Asia that is thriving in warmer winters and expanding its range.

Yet here in the Northwest, western hemlocks live with adelgid. Small white bags tied on hemlocks at Seattle's Washington Park Arboretum are the work of researchers trying to understand how.The bags exclude other insects - and the branches within are covered with adelgid, just as on eastern hemlocks. But outside the bags, where predatory wasps and flies can get at them, the branches are virtually adelgid-free. That could offer hope for eastern hemlock, perhaps by introducing the same predatory beetles and flies that feast on adelgid here, new research shows.

But while some of what scientists witness in the New England woods is defied by trees here, there also are troubles in Northwest forests too, as average temperatures creep up. More precipitation comes as rain. Snowmelt is earlier. Drought and fire and insect attack are killing trees from Seattle to the Cascade Crest and beyond.

Both global in its scope, and local in its effects, it is the insidiousness of climate change - in how we create it, with our everyday activities, and in the invasiveness of its footprint - that makes it a challenge unlike any we have ever faced.

The growing season is now so long in New England, it lasts longer than the leaves, the Richardson lab learned. Torn up, worn out, leaves shut down and fall off even as the weather remains fine. The timing of trees still is set to their earlier ancestors, not the supersized seasons these forests now endure.

The reason is that while changes in climate are nothing new to our adventuresome planet, change has never occurred at this pace, far faster than trees can adapt. Burning coal, oil and other fossil fuel has raised levels of carbon dioxide in the atmosphere to the highest levels in the

past 800,000 years, and that's happened just since the Industrial Revolution. Change at this scale usually takes place in 10,000-year cadences, not centennial. No human has ever breathed this atmosphere.

As all that carbon in the air acts like a thickening blanket swaddling the Earth, the surprises just keep coming. There are two seasons at work now: nature's calendar, and the seasons made by us.

At the end of my delicious, feral encounter with my tree, walking the woods in allhours and seasons and weather, climbing to the top of the oak, coring to its heart and digging into its roots, I had learned so much.

Of the urgent testimony of trees to the changes in our world. Of a moral compass in bad need of a reset, to include all the beings that not only share, but enable our world. But also of the importance of wonder, of days immersed doing "nothing" but observing the shapes of snowflakes; the arabesque of a leaf slowly twirling to the ground; the stoic expression of frogs; and the firm tread of tiny red salamanders, with their noble, Jurassic bearing. This was the nothing that is everything, that makes life worth living.

I had seen trees change scientists' understanding of the world. And the big oak had certainly changed me. I had learned many things, but most of all this: People and trees are meant to be together, and if we work at it, that's how we will stay. Right here, dwelling in our common home on this beautiful Earth, far into the future, amid the beauty and wonder of trees.

Citation: Seeing the forest for the trees: What one oak tells us about climate change (2017, April 17) retrieved 30 April 2024 from https://phys.org/news/2017-04-forest-trees-oak-climate.html