FALL/WINTER 2013-2014

SANCTUARY

THE JOURNAL OF THE MASSACHUSETTS AUDUBON SOCIETY

The Lives of Trees

What lives in and on and around trees

Lessons on the Links Between Species and Habitats

During the past twenty years, concurrent with my own work in conservation, there has been a significant shift in the way conservation scientists set about establishing goals for preserving biological diversity. At the beginning of my career, when I was the executive director of a small land trust in the Hudson River Valley, conservation biologists recommended that we protect land at what we might call the species scale. This meant that we would identify a rare species of flora or fauna found on a given property, map a tight circle around that species, and then work to protect the parcel that harbored the species. This method was relatively easy because it wasn't very difficult to raise the funds to buy a small piece of land, or negotiate a small conservation restriction, or secure the modest management cooperation of the affected landowner.

However, during the 1990s and 2000s, many of the scientists advising land conservation organizations reached different conclusions about biodiversity-driven strategies. Increasingly, they came to understand that it is not enough to limit the land trust's protection activities to the limited areas where a rare species is found. This is because drawing such tight boundaries does not take into account the variety of complex natural and human-made impacts that affect the species from outside the circle. These impacts are myriad and include things like fire, floods, invasive species, pests and pathogens, predators, air and water pollution, roads, and all manner of real estate development.

These realizations led conservation biologists to tell land trusts that they needed to change their approach to land and water protection from the species scale to the systems scale, establishing our conservation goals in a manner that took into account both natural and human-made systems that were having an impact on the rare species we were safeguarding.

Another logical outgrowth of this research was that land conservation organizations began to view not just species as their highest conservation goals but also entire ecosystems and larger wildlife habitats that provide harbors for rare species. We learned that if we set our goals at the right physical size and ecosystem scale, we would, almost uncannily, simultaneously capture a comprehensive suite of rare species within these landscapes. This has had a dramatic and, I believe, enormously positive impact on the effectiveness of Mass Audubon's conservation efforts.

So why are my comments relevant to this issue of *Sanctuary* magazine, which features articles about the immense importance and beauty of trees and forests, or to the release of one of Mass Audubon's most singularly important publications, *State of the Birds 2013* and *Breeding Bird Atlas 2*? They are relevant because the Atlas data proves, with unassailable clarity, that our most beloved bird species depend on healthy ecosystems and habitats.

With respect to several of our forest-breeding species, the news is relatively good. Forest birds are increasing their breeding footprint in the state more than species that breed in other habitats. Many of the species that have increased the most since 1979 are forest breeders, including the red-bellied woodpecker, Cooper's hawk, and warbling vireo. Five forest-breeding species are in urgent need of conservation. Two of these, long-eared owl and olive-sided flycatcher, are so rare that recovery seems unlikely. And three of these, purple finch, eastern whip-poor-will, and Canada warbler, are still common enough that we could reverse their trajectory. Fourteen species, including the Baltimore oriole, black-and-white warbler, and wood thrush (see page 23), are likely declining but still show a stable breeding footprint.

These species in decline, the "whispering birds," may be showing us the first signs of overall declines resulting from forest fragmentation. For example, the black-and-white warbler is known to need intact forest parcels, and fragmentation of forests due to development could be pushing them to the tipping point. Mass Audubon remains strongly committed to using the best science such as that attained by herculean undertakings that produce documents like *State of the Birds* and *Breeding Bird Atlas 2* to inform our conservation actions on the ground and in the water.

State of the Birds contains an extraordinary wealth of information and insight. It focuses on habitats and behaviors—and uses declining species in critical habitats to illustrate the challenges we face with recovering species.

Here are some of the habitat-behavior/species pairings.

- Agricultural landscapes—eastern meadowlark
- Shrublands and ground-nesting species—brown thrasher
- Agricultural landscape and aerial insectivores—cliff swallow
- Coastal-nesting species and sea-level rise—roseate tern, saltmarsh sparrow
- Suburban-nesting species and ground-nesting birds—killdeer
- Woods and forest ground-nesting species—wood thrush
- Freshwater marsh-nesting birds—American bittern

Henry Tepper, President

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Cover: Maxfield Parrish, 1952, *The Ancient Tree*

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Sanctuary is a journal about natural history and the environment that is published by Mass Audubon three times a year. Opinions expressed herein are those of the authors and not necessarily those of the Massachusetts Audubon Society. To respond to stories in this issue, email us at sancmag@massaudubon.org.

Sanctuary (ISSN 0272-8966), South Great Rd., Lincoln, MA 01773. Published three times a year. Memberships are $750 guardian; $500 patron; $250 sponsor; $150 protector; $100 contributor; $80 family plus; $70 supporter; $65 family; and $48 individual. Reprints of this issue are available. Write or call the publications office at Mass Audubon, Lincoln, MA 01773, 781-259-2167; or email *Sanctuary* at sancmag@massaudubon.org. Printed in the U.S.A.

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The Hickory Tree's Land

Two years ago as a result of a frek Hallowee snowstorm, a huge hickory on my land was knocked down by the weight of the snow on its still-green leaves. Some weeks later, in the process of cleaning up, I counted the rings on the stump and determined that the tree and I were the same age. This gave me pause. We had, perhaps needless to say, experienced very different lives.

© JOHN HANSON MITCHELL

The fall of the hickory

For whatever reason, when the tree and I were about 14, in contrast to the sedentary, stationary tree, I began to wander. I started by taking trains and getting off spontaneously in some unknown town, returning by dusk on another train. On other occasions, accompanied by my boring parents, I was taken off to various sections of the East Coast. After that I undertook the requisite American road trip to the West Coast with my older brother, traveling rough all along the way. Then I moved to Europe, went to school there for a few years, and then came back to this country and managed to land some writing assignments overseas.

In the meantime, the tree stayed put.

When the tree and I turned 30, as a result of the odd legal structure of American land use law, in exchange for money, I was informed that I owned the land on which the tree grew, and by extension, I owned, also, the hickory tree. To be frank, I never paid much attention to the tree. It was one of several hickories that grew along the western wall of the property on which I too lived. This was its native place. I was the indifferent alien invader. It was only after it fell that I began to think about its life.

Aside from growing and branching out, the tree did not change a great deal over the course of its existence. What changed radically was the land around the tree.

At the time of its birth, the land on which it grew was owned by a family named Hall, and was part of one of those small, diverse farm plots that used to characterize rural New England. There was an apple orchard just east of the tree. There was a large kitchen garden near the house and barn, a flock of hens, a pig, and, in its latter years, a white horse. Then old Levi Hall died and the land began to grow up to brush. The old horse died. The apple trees succumbed. White pines sprouted on the unmanaged lands.

The same thing happened to the land west of the hickory. White pines emerged in the unused fields, and by the time the hickory was 30 or 40 years old there was a dark forest growing where there had been hayfields and apples. Not long before the big storm hit, the same farm family undertook a timber cut and cleared out some of the pines, letting in more light. They also began restoring the fields, all of which was good for the hickory. What was not so good was what was happening to the land just beyond these two properties.

A major highway was rammed through the agricultural lands just east of the tree's land. A small farm abutting the property where the tree grew went out of business and sold the land, and a sterile housing development of massive trophy homes grew in the old hayfields and orchards. Five small industrial and research buildings were built on land to the south. Farther east the town permitted construction of a huge, out-of-scale, computer company headquarters in a productive pear orchard that had been growing just beyond the town center since the 1850s. More construction, more traffic, more noise, more suburban development. Only the land to the west of the tree remained intact.

Thanks to new interest in locally grown foods, two of the five farms in that section of the town began to reap economic benefits. With the increased light, the security of open space, and, of course, my own concern for trees, the hickory might have carried on for another hundred years. But that is not how things turned out.

The snows arrived early, the tree fell, and I alone survived to tell the tale. JHM

Tree Work

What Trees Do and How They Do It

by Teri Dunn Chace

Of the many enchanting creatures that inhabit J.R.R. Tolkien's Middle Earth, the ones that have always made a great impression on me are the Ents. These were treelike beings. They mostly inhabited the Old Forest and were very sturdy, with large, toed feet that gripped the forest floor, skin like bark, bushy hair and mossy beards, and "slow, solemn…very penetrating" eyes.

At times, when in heavy woods, I have paused and looked up and around, imagining the imposing presence of the Ents.

In the world we live in, we might well wish for Ents, for individuals intimate with the ways of the forest and the complexity of plant life, to defend or stand guard. Forests are so often under threat, not only from clearing, logging, storms, insects, and fires, but from the very air, water, and soil the trees depend on to grow and thrive, resources the activities of humans so often and so unfortunately taint.

© B.A. KING FROM *THE OAK BEHIND THE HOUSE*, 2007

Like all living plants, trees actively absorb water and nutrients from the soil and convey these necessities to their cells. It is a simple system since nourishment comes in and growth and expansion result. Bear in mind, however, that the process can get disrupted or ruined if, say, the water is polluted by something as seemingly harmless as road salt or as unexpected as contaminated floodwater.

Without getting overly technical, then, here's a more detailed description of how it works.

A tree's underground system—which can be as broad or expansive as its top growth—often has a long taproot that goes deep into the earth, while other roots develop laterally to support it. Very fine root hairs at the root ends take in water and dissolved minerals from the soil. The tree then converts this enriched moisture into a liquid called root sap. Root sap travels up the trunk via a network of tiny tubes called xylem in a layer of wood termed sapwood. It moves on through to branches and twigs to supply every leaf.

As you may recall from biology class, foliage is the "food factory" of a plant; each leaf is an individual photosynthesis unit. The leaves use moisture in concert with sunlight to remove carbon from carbon dioxide present in the air. Sugars are produced to nourish the tree, and oxygen is released as a byproduct. (Blocked sunlight and/or the presence of pollution, such as toxic fumes or a layer of ash on leaf surfaces, can inhibit the process of photosynthesis.)

But there's more. The activity on the cellular level inside these big plants is intensive. Sugars are conveyed through strings of cells out from the leaves—outward and downward, to be precise, thus feeding the entire tree. These cells form a layer beyond the xylem, just beneath the tree's outer bark; this layer is called phloem.

The xylem and the phloem are not actually back-to-back. A very thin layer of vascular tissue called the cambium, which runs from the leaves to the roots, separates them. Close study has revealed that the cambium is not merely a buffer or a protective layer. It generates more xylem cells on the inside and more phloem cells on the outside.

As growing season winds down in fall, the xylem and phloem layers cease functioning. Dead, thus chemically altered (and often discolored), xylem becomes "heartwood" inside the tree's trunk. Spent phloem, meanwhile, is incorporated into the tree's bark. New xylem, generated in the spring months, will become the new year's sapwood.

Have you ever seen a partially or completely hollow tree, still quite leafy and alive? This is possible because these "veins" are in the outermost layer of the tree, just

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under the protective "skin" of bark. Every year, going through the cycle of generating new xylem, cambium tissue, and phloem, a tree adds a ring. The interior rings, literally relics from the tree's sapling childhood, need not remain alive or intact for the overall plant to stand and survive. If they do, their role is supportive but not essential. The important sustaining activity is going on in the outermost layers.

When a tree's rings are intact, of course, you can count them to find out how old it is. Those who have studied them have been able to gather information about seasonal events and climatic changes based on the condition, thickness, and contours of the rings. One year, the ring is thin and drought or some other growth-inhibiting environmental stress is revealed; another year, there may have been a fire or lightning strike along one side that eventually healed over.

But back to the gas exchange. Plants absorb carbon dioxide from the air, and the oxygen they release purifies the atmosphere so that we can breathe. Humans and other creatures are thus in an important dependent relationship with trees: we release carbon dioxide when we breathe and they in turn release the oxygen we inhale. In the words of a forester, "This is why man can live a rich and happy life where there are trees. Where there are no trees life is as barren as the desert."

Reflecting on a treeless landscape, I am reminded of my first visit to Yorkshire, England. My travel companion reveled in the rolling rural hills and quaint villages, but I was dismayed to view environmental devastation and a reduced human population. Firewood was precious, shade was scarce, the land was badly eroded, and any resurgent tree seedlings were nibbled down by sheep and livestock.

Some scientists, more acutely so in this era of global warming, believe that the best way to cope with pollution, erosion, and other environmental stresses is to spare existing trees and plant more trees. Perhaps trees can alleviate or even reverse the effects of the burning of fossil fuels, overpopulation, and destroyed forests. In other words, more trees could counteract the damaging effects; trees could help save the world, help save us.

There are more benefits. On a physical level, trees offer cooling shade and shelter to our homes, streets, parks, and to many animals. Insects live in their bark, leaves, and branches, and birds come to feed on the insects and build nests in the branches or holes in the trunk. A large oak tree, just as an example, could be the whole world to a squirrel—food, shelter, exercise, society. Many trees, from apple to persimmon to walnut, provide food for us and other creatures. Wood makes its way into our fireplaces and wood stoves, our houses, decks, porches and fences, furniture, musical instruments, and much more. They are also a source of paper and related products. What other sort of plant can begin to offer this many useful resources?

Given trees' importance to other living things, planting even one in a suburban yard or local park or greenbelt is worth doing. You'll get to watch the small plant shoot upward and generate its first leaves and blossoms. Depending on the species, you may be able to harvest fruits or nuts, or watch local animals enjoy its shelter or bounty. What does it matter that you may not be around to see it grow into a stately specimen towering over the place where you planted it?

Tolkien's sense that trees are sensitive and worried about their survival or indignant at abuses doesn't seem so fanciful when you think about it. Although trees seem permanent and durable, they are vulnerable. We ought to be giving these grand complex beings the space and respect they need and deserve—for their survival as well as our own.

Teri Dunn Chace divides her time between Cape Ann and Upstate New York. She is the author of The Anxious Gardener's Book of Answers *(Timber Press).*

The World of Woodpeckers

Over 200 species of woodpeckers collectively occupy the globe; the variations in size, coloration, vocalizations, and habits of the different species are often spectacular.

by Wayne Petersen

There are few groups of birds with a greater affinity for trees than woodpeckers. Most woodpecker species forage principally in trees—both dead and living—and the majority of species also nest in tree cavities or roost in them at night. With woodpeckers' strong connection to trees, especially the woody trunks and limbs, natural selection through the millennia has forged a number of anatomical adaptations enabling them to efficiently exploit the variably smooth or rough outer bark of different tree species, along with the harder and more solid tissue that comprises much of the inner woody structure of a tree.

Although the woodpecker tribe clearly manifests a long-standing and intimate association with trees, so too do humans.

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Black-backed woodpecker

My personal affinity for woodpeckers enjoys a venerable genesis involving an elm tree. By the time I reached the seventh grade, I was already a dedicated birdwatcher, so during those seemingly interminable middle school days practically every spare moment was spent outdoors on the lookout for new birds to add to my list. One October day a birding buddy and I noticed an unfamiliar woodpecker working on a grand old and dying American elm situated along a roadside in our local birding patch. Carefully noting the woodpecker's markings, we were struck by the brilliant patch of yellow on its crown—a marking unique to only two North American woodpeckers. After brief consultation, my companion and I announced in unison that the woodpecker was a three-toed woodpecker, more specifically: *"The species on the left page!"* This joint proclamation specifically referred to the Louis Agassiz Fuertes color plate illustrating the Arctic three-toed woodpecker (today called the black-backed woodpecker) on plate 60 in T. Gilbert Pearson's *Birds of America* (1917). On the facing page was a depiction of the closely related American three-toed woodpecker—the species with which our discovery could most easily have been confused.

Little did I realize at the time that the woodpecker and that old dying elm tree would ultimately give me my "15 minutes of fame." A call to the Massachusetts Audubon Society eventually led to my name appearing in a Boston newspaper where Wayne Hanley, Mass Audubon's editor of publications at the time, printed the news of my discovery in an article titled, "Nature Sends Rare Northern Bird Here." In seventh grade, this is as good as it gets!

The real significance of my youthful encounter with a black-backed woodpecker was not my "15 minutes of fame," however; rather, it was the more subtle relationship existing between a tree and a bird. The magnificent American elm was for many decades an iconic and common tree species along rural roadways, in cities and townships, and in bottomland swamps throughout much of eastern North America. Its lofty height and vase-shaped growth form made it especially pleasing to the eye wherever a particularly large specimen stood apart from other forest trees.

But this is not the end of the story. Not unlike the blight that virtually wiped out the once-widespread and abundant American chestnut tree, a fungus called *Ophiostoma ulmi* that causes Dutch elm disease found its way from Europe to the United States during the 1930s. Transmitted by the elm bark beetle (*Scolytus multistriatus*), this pernicious fungus steadily began destroying a great majority of the American elm trees existing in our region. This is where the woodpecker enters the story.

Like many woodpecker species, the black-backed woodpecker has somewhat specialized food and fairly specific habitat preferences. Exclusively a species of the boreal forest, the black-backed woodpecker prefers areas

that have either been recently burned over or are heavily damaged by forest pests such as the spruce budworm. Such areas typically support large quantities of the larvae of bark beetles upon which the woodpeckers prefer to feed. Once an infested burn area has been properly exploited, the woodpeckers relocate to new food-rich areas. When these areas are overly scarce throughout large areas of the range of the black-backed woodpecker, the species periodically irrupts southward, much like a number of other northern forest birds when a food shortage exists. It happened that the black-backed woodpecker that I found in October many years ago actually represented the vanguard of just such a flight year—an event that was later well documented in the ornithological literature.

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American three-toed woodpecker

Thinking back, nearly as interesting as my boyhood encounter with the woodpecker was the fact that the bird was feeding on an American elm. I vividly recall how the bird aggressively flaked off long strips of elm bark until the ground beneath the tree became littered with debris. On the limbs where the bird had completely removed the tree's bark, they were conspicuously rusty-orange in color, and with my binoculars I was able to see the lattice of tunnels made by the elm bark beetle larvae as they gradually infected the grand old tree. At the time I failed to fully appreciate the connection between the woodpecker and the dying elm tree, but in retrospect practically every black-backed woodpecker I have ever seen in Massachusetts since has been on a dying American elm, clearly reflecting the woodpecker's preference for such infected trees on those rare occasions when this uncommon species wanders south to Massachusetts in search of food.

While the relationship between black-backed woodpeckers and insect-infected trees is not totally surprising, it should also not be surprising that other woodpecker species may also have equally strong affinities for different tree species. One of the rarer woodpecker species in the world resides in Cuba—the Fernandina's flicker. This species almost exclusively nests in the endemic royal palm, a tree that also regularly hosts many nests of the Cuban parrot in holes excavated by Fernandina's flickers.

This use of woodpecker holes by secondary cavity-nesting species is similarly seen in the Sonoran Deserts of the southwestern United States where Gila woodpeckers are the principal excavators of cavities of giant, tree-like saguaro cacti, and species such as the diminutive elf owl and flycatchers such as great crested and ash-throated are nearly obligate nesters in these woodpecker-created holes. And in the southeastern United States, the endangered red-cockaded woodpecker nests principally in longleaf pines and several other closely related pine species that grow in the flatwoods of the Deep South. Specifically, the nest holes of this species are invariably located in live pines infected with red heart fungus, a condition that creates a soft inner structure to an otherwise hard outer protective layer. These two characteristics of longleaf pines offer a perfect combination for the construction of safe and secure holes for the rare woodpecker to nest and roost in.

Equally interesting is the relationship between the acorn woodpecker and live oak trees. This species is particularly fond of pine-oak woodlands in western parts of the United States, Mexico, and Central America, mainly in areas where there is an abundance of fruiting live and other oak species. In such areas as many as 15 acorn woodpeckers may sometimes be found together in active and sociable groups where the woodpeckers systematically harvest and store acorns in holes specifically excavated for this purpose. As many as 40,000 to 50,000 holes have been counted in a single "woodpecker granary," and studies have revealed that some granaries may take many years to create. The strong reliance on live oaks by acorn woodpeckers may determine their survival, and the ultimate success of a group may depend on its ability to defend a granary.

The yellow-bellied sapsucker and its relatives have equally unusual associations with trees, especially those containing a rich supply of easily accessible sap such as poplar, willow, apple, maple, and a variety of coniferous tree species. In spring when sap is running up the trunk of many trees, sapsuckers excavate numerous small holes, both in vertical and horizontal rows that eventually begin to ooze sap. These holes are then revisited and sap along with small insects that are also attracted to the driblets are then consumed by the sapsuckers with great relish. Some of the holes may be routinely visited by other species as well as sapsuckers, including

a variety of insects and other small species of wildlife. While tree sap is not the exclusive source of food for the yellow-bellied sapsucker, it constitutes a principal and rather unique constituent throughout much of the year.

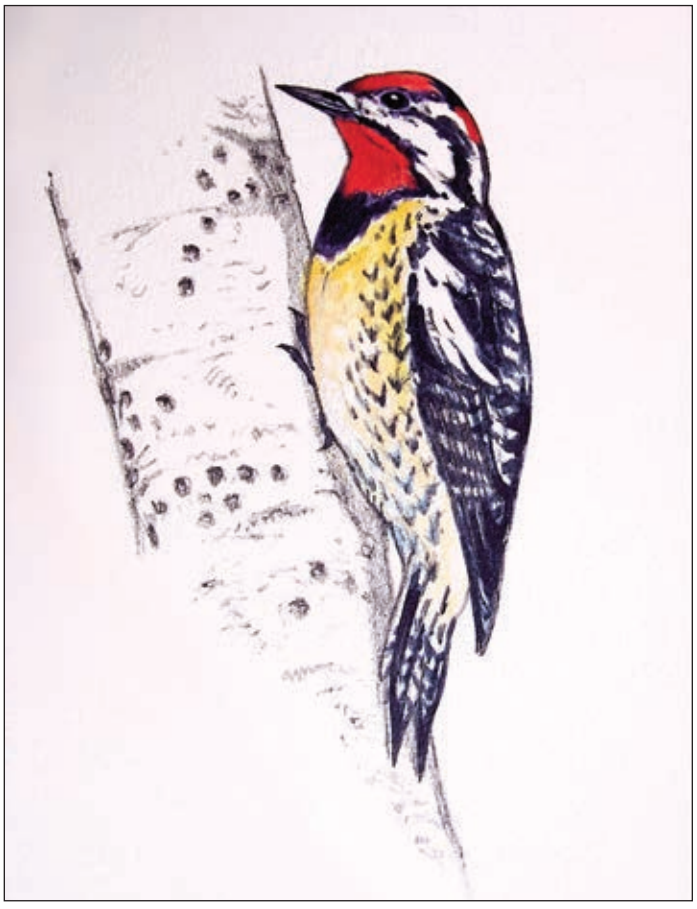
Although most woodpeckers utilize cavities excavated in either dead or living trees for nesting and roosting, not all species depend exclusively on trees for their food. The familiar northern flicker spends lots of time on the ground during warmer weather actively foraging for ants, readily using its long tongue for capturing the elusive insects much like tropical anteaters use their tongue to round up termites.

An even more specialized woodpecker foraging behavior is exhibited by the Lewis's woodpecker (namesake of explorer Meriwether Lewis who first described the species). This distinctive western woodpecker is largely reliant on flying insects for its food during the warmer weather. Though it nests in trees, even storing nuts and acorns like the acorn woodpecker, it spends much of its time fly catching, somewhat in the manner of true flycatchers. Lewis's woodpeckers spend considerable stretches watching for airborne prey from a conspicuous perch, followed by an active sally to capture the invertebrates on the wing.

In spite of these many variations, all woodpeckers have certain common anatomical features. To effectively cling to the woody trunks and limbs, woodpeckers have a different toe arrangement than many other bird groups. Basically, woodpeckers have two toes facing forward and two facing backwards or to one side, instead of three forward and one backward as in perching birds. This general arrangement is called *zygodactyly* and increases their gripping efficiency on tree trunks and limbs. Some woodpeckers even have feet that are *ectropodactyl*, meaning that they can practically move their toes into any position they want.

In addition to these unusual foot adaptations, the tails of most woodpeckers are also highly modified. A woodpecker's tail functions as a prop and is used in concert with its strong tree-grasping feet to hold onto the trunks and limbs of trees. To maximize their efficiency, the tail feathers of most woodpeckers, especially the two central feathers, are stiffened and modified into points that increase the support provided as a woodpecker hitches its way up a tree, or while it is pounding on a limb to access insects or grubs beneath the bark. The mechanical advantage and overall functionality of the modified feet and tails of woodpeckers operate much the way a lumberjack uses climbing spikes and a safety belt to cling to a tree trunk while using free hands to operate a saw.

Perhaps of all the remarkable adaptations exhibited by woodpeckers, none are more impressive than those associated with their skull structure. The inevitable question that observers of woodpeckers often ask is why woodpeckers don't get headaches! While a detailed explanation is complex, the essence of the answer lies in the mechanics of how a woodpecker physically pecks at wood, the relative size of its brain surface area compared to that of a human, the musculature structure of its neck, the hardness and shape of its bill, and the configuration of its tongue.



Yellow-bellied sapsucker

This last adaptation is especially unique in the way the tongue is withdrawn into the rear of the skull when it's not in use—much like a coiled watch spring—then extended far beyond the tip of the bill when the woodpecker is feeding. In addition to being exceedingly long, a woodpecker's tongue is tipped with backward-pointing spines or hooks, much like those on a porcupine quill or a whaling harpoon. These spines make it possible to stab or otherwise extricate insects and their larvae from beneath bark or deep from within the inner wood of a tree even when the prey is not visible to the foraging woodpecker.

While forest trees and all their glory offer tremendous visual pleasure and have diverse utilitarian value to humankind, they also have immense value as a dominant plant cover over vast reaches of our planet. And although there are countless associations between animal species and forest trees, in the avian world few are stronger than those with woodpeckers.

Wayne Petersen is director of the Important Bird Areas program for Mass Audubon.

The Life and Death of the Crocker Maple

The immense sugar maple at Wachusett Meadow Wildlife Sanctuary was more than just a tree.

by Joe Choiniere

On a Monday morning, November 18, 2002—one of those cold, clear, and windy dawns with a frontal passage following an overnight ice storm—two staff members at Wachusett Meadow Wildlife Sanctuary heard what for a moment they thought had to be a plane crash. Within seconds, however, they knew what had happened: an ancient giant, the Crocker Maple, had fallen.

This grand tree—once 85 feet tall, 186 inches in circumference, with massive limbs spreading 120 feet—had snapped off about 5 feet from the ground and fallen—all at once—imbalanced by the weight of ice on its asymmetrical branches and further pressured by a mashing northwest wind. The scene was overwhelmingly sad. The jagged stump, almost 6 feet through, supported and buttressed by protruding roots above the underlying granite ledges, stood alone, silent.

© JOE CHOINIERE

Jonah Choiniere (left), age 2, and Ethan Choiniere, age 5, under the Crocker Maple in 1984.

This tree was already a celebrity when C.T. Crocker III donated the core of Wachusett Meadow Wildlife Sanctuary in Princeton to Mass Audubon in 1956. Named in honor of the sanctuary's donor, the Crocker Maple drew hundreds of visitors to sit under its sprawling limbs. One of these limbs, larger in diameter than any average tree, curved downward almost to the ground before arching upward again, creating the so-called "pony branch," a tree horse that children could climb onto and ride. Other branches arched similarly in all directions—so heavy were these limbs under the weight of summer's leaves that they were cabled by an arborist and supported by the anchor points high in the center branches of the tree.

The value of the tree to visitors, volunteers, and staff was something I well understood but underestimated. After the tree fell, the outpouring of sentiment and comments overwhelmed me. Trees have an almost universal appeal, and old large trees even more so. Those outstretched gracefully arching branches, wider than the tree was tall, took on a human likeness, seeming to hold up the sky while the huge roots appeared to anchor to the bedrock of earth—all in all evoking a comforting feeling for those sitting on the lichen-covered bench beneath the tree.

I am often affected by the notion that trees connect sky and earth, acting as a conduit between two worlds and serving as a living space for so many organisms. Among the sentiments recorded in Wachusett Meadow files are those of Terri Klingler, a sanctuary trail guide and preschool teacher who noted that she "would especially miss sharing the tree with countless groups of schoolchildren" whom she read to "under the tree's calming boughs." She wrote that the tree was often hugged and many, many children were touched by the maple.

Donna Choiniere wrote, "Every person should belong to a tree—this tree belonged to everyone. The Crocker Maple was a family tree—a few tears from my own little ones watered the tree's abundant roots at times."

Long before these and other poignant elegies for the tree were composed, others were inspired, including arborists of the Davey Tree company, hired as early as 1935 to perform work on the giant maple over the years to maintain its stature. In a letter to then-sanctuary director Mel Thomason, in 1965, the Davey Tree regional foreman expounded about "filling a basal cavity in… the largest sugar maple I have ever seen."

He also gave Thomason some advice. "Avoid tapping this tree for maple sugar since most of the decay I observed appears to have originated from maple sap tube installations. Place wood chips around the base of the tree so its many visitors cannot harm the exposed roots." Mass Audubon never tapped the tree for sugar, but we did set pails under dripping twigs and branches broken from winter damage, collecting amounts of sap often exceeding that from our tapped trees.

In a *Worcester Evening Gazette* article from 1960, another Davey Tree spokesperson explained that the company had cared for the tree for over 25 years, and installed the steel cables to support the massive limbs. The tree was called the "largest sugar maple in New England" in a newspaper article in 1965, although subsequent measurements placed it as the third largest in Massachusetts. Estimates of age were 250 to 300 years.

We had the opportunity to investigate its age right after it fell. An interesting result of the oblique angle of the trunk's breakage allowed staff to see the tree rings in side view across the large expanse of the stump, from outside to center, clearly enough to in effect age the tree. Although the tree's annual growth rings appear as circles in cross section, the rings appear as lines or ellipses in long section. The outer six inches were of a solid live wood, slow grown but increasing every year. It was still a lively tree, in others words. This dense live wood had to be sanded to be seen well enough to actually age the tree. We determined that the tree was 240 years old in 2002.

That means that the Crocker Maple was already twenty years old when the nearby Goodnow House, now the sanctuary visitor center, was built in the 1780s. The maple and others scattered up the hillside were likely left standing and encouraged by the first settlers of the area to provide sap for making maple sugar—a sugarbush of sorts. These other maples, including one visible from the stump of the Crocker Maple, are giants but not as large. The Crocker Maple had the benefit of open growth with little competition, and a year-round spring and stream to supply water and nutrients.

Nationally, champion trees are measured and compared via a formula that sums the height in feet, the circumference in inches, and one-quarter of the branch spread in feet. Trees with scores of 300 or so are usually champions or close. The Crocker Maple's best score based on unofficial measurements was 311. Massachusetts' champion sugar maple grows in Charlemont and is well over 100 feet tall, achieving 368 points! Measurements didn't matter anymore anyway—the sheer breadth of the Crocker Maple's dripline, over 100 feet, was only exaggerated by its now shorter stature, and its ancient unmeasurable qualities had become more magnified. It was truly a giant in everyone's eyes.

When the remainder of the tree's central leader, a full 35 feet of the two-foot-in-diameter stem, fell in 1988, it brought the support cables, now 40 years old, down with it; the giant limbs visibly sagged; and the pony branch actually touched the ground. There was now no longer any attachment point for cables for the large limbs, and they began to fall as well, as storms began to disassemble the tree limb by limb. First the beloved pony branch, then another, and another. These branches alone were larger than any of the big trees around the area.

Interestingly, each insult to the tree resulted in a heavier crop of leaves the following year on the remaining branches, which only exacerbated the effects of weight. As the tree declined, we considered various possibilities for keeping the tree alive. Without a central leader to support the heavy limbs, we would need to install pillar supports, two for each limb, with a saddle between for support. Our arborists thought it virtually impossible to save the tree given its age and condition. The tree was certainly destined to come apart, and staff and volunteers felt it best to let it live out its life as best it could. What finally fell in 2002, about two-thirds of the original tree, was in some ways a fitting tribute, one last giant statement in a lifetime full of superlatives. The local sentiment was strong to leave the tree in position where it had fallen, to return to the earth in the place of its heyday.

The tree stump, mass of boles, limbs, branches, and the bench all still sit on the granite ledges where the tree first rooted. It's a different feel to sit by the silent stump rather than beneath the singing branches that once sheltered this spot.

Local trees can live at least triple the life span of humans—their presence and permanence on the landscape spanning generations and giving them a unique position among natural objects: a standing of sorts, which the presence of the huge tree stump only seems to magnify. Despite its demise, here fallen and returning to the ground, the Crocker Maple has such standing.

Joe Choiniere is property manager at Wachusett Meadow and Broad Meadow Brook wildlife sanctuaries.

The Ghosts in the Woods

Stories told by ancient trees

by Gayle Goddard-Taylor

In central Mexico, near the church of Santa María de la Asunción, stands a behemoth of a tree, a Montezuma cypress (*Taxodium mucronatum*). The tree measures 120 feet in circumference, and, too huge to be tested to determine its age, it is estimated to be several centuries old.

The Arbol del Tule, as the tree is called, was a sapling when Ghenghis Khan dreamed of world conquest, a youngster when the Black Death plagued Europe, and an adult centuries before the Spanish first set foot on the land of the Aztecs. Despite its girth, it is not the oldest tree of its kind, and we know this because those who can determine a tree's age—dendrochronologists—have found older specimens.

Tree-ring study is a relatively young science. Astronomer A.E. Douglass, on a trip to Arizona in the early 1900s, first noticed the ring patterns in a field of recently cut trees and realized they could be cross-dated by matching patterns of small and large rings.

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Centenarian birches

"It should be noted that da Vinci also surmised that precipitation was controlling the patterns of tree rings," says dendrochronologist Neil Pederson of the Lamont-Doherty Earth Observatory at Columbia University.

Tree rings have far more to tell us than how old a tree is, however. Reconstructed from living as well as dead trees, ring chronologies give visual evidence of extreme droughts and floods, untimely frosts, and volcanic eruptions. They warn of the need for water management, an application that Pederson is pursuing, and of the dangers of excessive timber harvesting. The secrets trees harbor have helped resolve historical mysteries and, perhaps most importantly, are being used to map the earth's ancient climate in hopes of informing the future of our warming planet.

One of the most important revelations, according to University of Arkansas dendrochronologist David Stahle, has been the recording of strong signals in tree-ring data from Mexico and the US of the El Niño/Southern Oscillation (ENSO) phenomenon of air circulation above the equatorial Pacific Ocean.

"This was a major climatological breakthrough," says Stahle. "It has improved long-range climate predictability, at least statistically, for some areas of the world." It is one of the reasons that dendrochronologists like Stahle want to assemble tree-ring data from other areas of the world affected by ENSO.

Reading rings is considerably more complicated than simply drilling into your backyard beech, however. Not all tree species are equally valuable for embedded climate history. "We ask which trees have remarkable longevity and which species record climate history accurately," says Stahle. "There are many that do both, but there are also many that are unsuitable." Among the top contenders in the eastern US are oak, hemlock, and various pines. In Mexico, the Douglas fir also ranks high.

Beyond the question of species is another critical con-

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White pine at the Moss Steps, Boylston

cern—where to find undisturbed forests of these trees. "If a forest has been heavily timbered, it will present quite a different history than if it were undisturbed," says Stahle. "If our goal is to study climate history in an unmolested way, we want virgin forest."

Within such a forest, researchers may sample 40 to 100 trees, typically extracting two cores of 5 millimeters and boring as close to the center of the tree as possible. The fragile cores are placed in straws, sealed, and annotated. The collection date is paramount because it marks the start of the ring chronology.

At the lab, the cores are dried, mounted, and polished to a high luster. Chronologies are created by cross-matching patterns in the cores, looking for redundant patterns among multiple trees. From this, a "master" dating chronology that represents the history of growth in that region emerges. Long strips of graph paper represent sequences of counted rings—ring width is gauged on a scale from 1 to 10, with 10 being the narrowest.

Analysis can now begin. Typically, a single tree ring represents one year of growth and is a couplet of light and dark bands. The light band ("early wood") shows the growth the tree makes in the spring fueled by snowmelt and spring rains. The dark band ("late wood") marks when the tree's growth shuts down for the year. Generally, large rings record wet years and small rings dry years. But there's more to it than that.

"There are two different seasons, the winter precipitation season and the summer precipitation season," explains dendrochronologist Matthew Therrell of the University of Alabama. "So instead of just saying it was a wet year or a dry year, you can actually determine whether that year had a wet winter and a dry summer."

In the desert Southwest and in Mexico, late wood can show intriguing variations. A wet winter and spring may be followed by a dry summer, shutting down growth and triggering the late-wood band. But perhaps two weeks later, soaking rains return for a couple of weeks, causing early-wood growth to restart. When the rains end, the true late-wood band resumes. The ring for that year will show four bands—light, dark, light, and finally dark wood. The dark band caused by the heavy summer rains is called a false ring.

A severe early or late frost will also leave its mark in the rings, showing up in the large vessels that resemble a cross section of soda straws. "In a frost ring, those vessels will be damaged because they've gotten ice in them," says Therrell. "The tissue gets crushed or collapses. In some cases, it will become crescent-moon shaped."

A critical step forward in tree-ring research was begun in 1999 when centuries of tree ring data were compared with the Palmer Drought Severity Index (PDSI) for North America, a data set of soil moisture and temperatures recorded instrumentally since the 1880s and used by meteorologists. This proved that tree rings were an accurate tool for delving even farther back in time than the PDSI could—in some regions the ring chronologies extended as far back as 2,000 years. Since then, additional drought indices have been developed for other regions of the world.

Therrell was one of a team of researchers led by Stahle who examined a network of 800-year-old bald cypress

(*Taxodium distichum*) ring chronologies that helped resolve one of the most enduring riddles in our country's history—the fate of the "Lost Colony of Roanoke" in the 1580s and the Jamestown colony in the early 1600s. Tree-ring data coupled with historical accounts confirmed that both groups could not have picked a worse time to establish themselves in the New World. "At that time there was a really severe drought underway," says Therrell. "It's what David Stahle termed the 'Megadrought.'"

In fact, much of the country was enveloped by this 22-year drought. Dependent on their Native American neighbors, who were also struggling to survive, colonists suffered the consequences of bad timing. Tree-ring records show that during the three years from 1587 to 1589, when Roanoke settlers were in residence, the region had the worst drought in 800 years. When relief arrived in 1590, the settlers had vanished. Colonists arriving at Jamestown in 1607 encountered the driest seven-year-period in 770 years. Malnutrition coupled with unfit drinking water decimated their numbers. Severe drought was also a significant factor in a massive population collapse in 16th-century Mexico—and may have helped usher out what historians call the Terminal Classic Period of Mayan culture (AD 750-950).

Spruce Forest, Wachusett Mountain

Although Spanish conquest in the 1500s brought with it a smallpox epidemic that claimed 8 million native people, modern-day Mexican doctor Rodolfo Acuña-Soto was puzzled when historical records referred to a fever called "Cocolitzli" in epidemics in 1545 and again in 1576. The symptoms, as described in Aztec codices, did not match those of smallpox.

Beyond illuminating historical events, tree-ring data is helping to effect environmental management in today's world. In Zimbabwe, for instance, Stahle and his colleagues studied the rings of the bleedwood tree (*Pterocarpus angolensis*), an important commercial species of Africa that can live 200 years. Studying a forest at the edge of the Kalahari Desert, the group discovered that timber companies were cutting trees based on an overly optimistic growth rate. "They were cutting too frequently and as a result probably reducing the productivity of the forest," says Stahle.

Columbia's Neil Pederson is pursuing another practical application, the management of dwindling drinking water resources. Tree-ring data showed that in 1922 when the Colorado River Compact—a formula for allotting states water from the Colorado River—was signed, the region was undergoing the wettest 30-year period in 500 years. "Essentially, the compact overpromised water to these states," he says.

Pederson has been initiating discussions with water managers in New York as well as in Georgia, which is among the southeastern states undergoing drought. Tree-ring data from living trees as well as timbers from old homes indicate that the Northeast is experiencing one of the wettest periods in 500 years. That, of course, does not mean that droughts won't return.

"We should be learning from the lessons of the past and adapting to these changes," says Pederson.

Gayle Goddard-Taylor is a field editor for Sanctuary *magazine.*

The Maple on the Common

Last vestiges of a lost town

by Thomas Conuel

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On the western edge of the abandoned town of Dana, an ancient gnarled sugar maple stands sentinel, one of several trees of its kind that, along with an impressive red maple, tower over this grassy triangular plateau that was once a vibrant town common with churches, stores, and family homes. Back in 1938, the town was demolished, its people and livestock sent elsewhere to make way for the massive Quabbin Reservoir. The place is now an evocative empty ruin that is on the National Register of Historic Places.

The old maple is now near the end of its reign on Dana Common, though it has outlasted the buildings that once defined this place: the town store and post office; the former Baptist meetinghouse; the Eagle Hotel, a local landmark built in 1820; the nearby Vaughn home, remarkable now for its cellar hole and stone foundation built of small rounded stones from the nearby Swift River; and the Congregational church, which was shared by several different religious congregations. All are gone now, moved or torn down to make way for Quabbin Reservoir.

Dana Common, on the East Branch of the Swift River, sits on a high slab of forest and field that was above the reservoir's rising water line and so escaped inundation, as did the big maples.

Dana, carved out of land from the nearby towns of Greenwich, Petersham, and Hardwick in the northeast area of the Swift River Valley, was named after Judge Francis Dana of the Massachusetts Supreme Court. Dana was a flat, mostly elevated, area, with good soil, working farms, and several fine ponds that are now part of the reservoir. The sugar maple, as with all the big trees here, probably started out as a sapling planted by industrious, civic-minded residents of the town around

1840 to 1855 when most of the buildings on the town common were constructed and the town's population was heading for its peak of 876 residents in 1860.

The town cemetery was nearby, now a large open field to the right of Dana Common. Work crews moved the graves in 1938 when Quabbin Reservoir obliterated Dana on the map of Massachusetts, but they left the sugar maple and its companions on the denuded town common.

Were there such a thing as an insurance actuarial table for trees, it would tell us that the life span of a sugar maple in New England is around 150 to 175 years, putting this maple on Dana Common firmly in the column of advanced age and probable demise sometime in the next decade or two. Its branches, on close inspection, confirm this—several are clearly dead, or spindly and unhealthy with clumps of dried brown leaves curling against the deeply furrowed grayish brown bark.

The moist warm climate of recent years has not helped this sugar maple. Indeed it is accelerating the aging process by encouraging stem canker, stem decay, and canker-rot fungi, which invade the tree and flourish in its roots and leaves. A cooler drier climate would be most beneficial for the old sugar maple at this point, but the tree has no say. The seasons go round and round for sugar maples as well as humans.

This sugar maple presided here during the glory days in the mid-19th century when Dana was a growing farming community and the common was the cultural, religious, and community center for the town. On summer days, residents lounged under the maple's spreading branches. There were picnics and town gatherings here through the latter part of the 19th century, and right up to the summer of 1938 when the town officially closed and faded from existence.

Shortly after, the devastating Hurricane of '38 swept the area, knocking down church steeples, blowing roofs off barns, and uprooting many of the big trees in the Swift River Valley, leaving them in twisted heaps. The sugar maple and its companion big trees on the town common survived the hundred-mile-per-hour winds, probably because the somewhat thin alluvial soil of the common forced the sugar maple, over many years, to spread its roots wide and deep in search of nutrients, likely saving the sugar maple from the worst fury of the hurricane.

This maple has seen a lot of history and changing landscapes. It's an enormous tree, as are its notable companion trees on the town common—still impressive, easily 80 feet high, 16 to 18 feet in circumference, with long spreading branches reaching out in all directions.

By the time this maple took up its post on the common in the mid-19th century, the nearby landscape had already undergone profound change. The Indian tribes, mainly the Nipmucks who once called this land home, were pretty much gone. Though we have no written record, it is probable that parts of the landscape we call Dana Common were open land created by the Native American tribes in the area. They likely followed the common practices of many New England tribes and cut and burned the forest to create fields where they cultivated corn, beans, squash, and tobacco while removing dense stands of trees that interfered with hunting, tracking, and killing game. Later, burning the woods to clear land for farming became a common practice of the English settlers, and so widely used that by 1743 a Massachusetts Bay General Law regulated the burning to conserve woodlands.

The town of Dana supported over time a typical southern New England mix of oak, maple, chestnut, basswood, birch, ash, and pines. Where the soil was not as rich, black and white oaks and hickory sprouted. Open land and farms were plentiful, and the landscape was dotted with fields, pastures, and orchards. The big sugar maple was part of this landscape, but as the woods of Dana gave way to farms and open land in the early to mid-19th century, it stood protected from cutting by its location.

After completion of the reservoir, the old sugar maple stood out in this barren landscape. Red pine, a nonnative species with a heavy dark crown, was planted extensively to cover the scars of construction throughout the reservoir, including around Dana town common. That was a mistake. Underneath the dark canopy of red pine and the heavy carpet of pine needles little else grows on the forest floor. Years later, the now-retired Quabbin forester, Bruce Spencer, cut and cleared the red pine, returning the land to open fields. The old sugar maple fits right in with this landscape, representing a bit of a reversal from the usual progression—the land here has gone from developed to sparsely populated to near wild.

The Dana Common Historic and Archaeological District was listed on the National Register in 2013 with a citation noting that, though all the buildings are gone, the landscape "with its foundations, cellar holes, stone walls, fence posts, and open spaces, continues to reflect the town's history." A celebration was held on a July day to commemorate the common's listing on the National Register. Gate 40 of Quabbin Reservoir was open—only for the day—to allow vehicles access to the town common, which is nearly two miles in from the highway. The Petersham brass band played; people of all ages came with picnic baskets to sit in the shade of the big trees. An antique fire truck from the Swift River Valley Historical Society parked near the old sugar maple drew appreciative comments. Old friends with family connections to the discontinued towns, often called the Quabbin survivors, met and talked.

The old sugar maple had no citations, but along with the other big trees on the common it easily dominated the landscape. A mother with two boys rested under its shady limbs. The day was hot. One of her boys—he looked to be about 8 or so—lay back and put his hands behind his head and gazed up at the highest branches of the old sugar maple. He began counting aloud the branches of the ancient sugar maple tree.

Thomas Conuel is a field editor for Sanctuary *magazine.*

The Oak Tree's World

There is more than meets the eye in the life of a tree.

by Michael J. Caduto

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Back in the mid-1970s, I conducted a botanical study of the hybridization between red and black oaks in at the George B. Parker Woodland owned by the Audubon Society of Rhode Island. During one springtime field trip, when the oaks were in full bloom, I stopped to eat lunch in a mixed stand of white pines and oaks that stood 60 to 70 feet tall. Since I wanted to see the oak flowers firsthand, I found a pine with low-hanging branches and began to climb.

After some long minutes during which I wriggled through the thick uneven limbs, my head rose up into another world. The crowns of pine and oak intermingled and were gently dancing in a moderate breeze. As it turned out, the topmost leader of the pine I climbed had been broken off some decades ago and the wound was healed over entirely with a smooth layer of bark sporting a small depression shaped like a saddle. I climbed into the bark seat and rode the top of the swaying pine, like a sailor in the crow's nest of a schooner, amongst a waving sea of green tree flowers.

I was reminded of the kinship between the sound of a breeze through the branches and waves gently breaking on shore.

Another sound was in the air; thousands of insects buzzed from flower to flower amid the oaks, gathering an early harvest of spring pollen including many small wasps, some parasitic tachinid flies, and hundreds of honeybees. What would the world in the treetops look like through the multifaceted eyes of a wasp or bee and interpreted by the ganglia (clusters of neurons that process information) of an insect?

That wing-born symphony of six-leggeds hummed the notes of an epiphany. From nature walks to natural history books to botany classes, I had been taught that our early tree flowers—including those of oaks, maples, birches, and hickories—are wind pollinated. And while wind may be their chief means of pollination, insects obviously play a vital role.

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Plum galls

In the treetops riding the wind, I imagined a wise oak and wondered what it would have say to me if I understood the language of the Ents (J.R.R. Tolkien's beings resembling trees). I suppose something along these lines: "You have seen me there, a spire spanning the plane between soil and sky. Over the years, you have come to know me—swinging from my branches into a swimming hole, climbing to a tree fort, or watching squirrels gather acorns scattered at my roots."

The oak might have gone on to elaborate—pointing out that like all trees it is the suture that ties mineral to air, water, and, on deadly occasions, fire. The tree might say that it has seen all, heard all, as only one who has been rooted in place for a century can, unmoving as the earth turned through time.

In fact, this idea of interconnection with earth and air and the cycle of life is spot on. Some of the acorns that speckle the ground each autumn—insurance for the next generation of oaks and food for a multitude of squirrels and mice—owe their existence to the wind and the ravenous vernal appetites of airborne insects. But there are many other insects and organisms that employ oak trees for shelter, food supplies, and even nurseries.

While it is not as celebrated as the sugar maple or flowering dogwood, the red oak is one New England's most abundant and stalwart trees. Mature individuals rise on graceful arching trunks, sheathed in bark sporting long ridges that intertwine like ski trails running down a mountain slope. In springtime, each individual tree is festooned with dangling male catkins whose pollen fertilizes minute female flowers that take two years to mature into large, classic, glossy acorns with shallow cups—a favorite food of everything from squirrels, chipmunks, and white-footed mice to raccoons, white-tailed deer, and black bears. On hot summer days, the red oak's broad, thick, bristle-tipped leaves cast a deep cool shadow. When autumn arrives, the leaves turn a rich crimson or golden yellow.

The leaves and twigs of red oak often appear to produce another crop of misshapen fruit—odd swellings on stems and leaves. These are the ubiquitous oak galls: rounded growths caused by insects, fungi, and bacteria. Some are spherical, others are woolly pom-poms, and one even resembles a tiny peach. They include the oak saucer gall, hedgehog gall, and spangle gall.

There are more than 800 species of insects and mites that form galls on oaks. Each springtime, adult insects lay eggs in the tissues of leaves or twigs while also injecting substances that cause the surrounding plant tissue to grow in a particular manner and at an accelerated pace. Galls form in locations where plants grow the most—twigs, leaves, shoots, seeds, and fruit. Each gall takes on the exaggerated character of its host cells. The hard-coated oak bullet gall forms from stiff twig tissue while the soft, fuzzy, woolly oak gall results from the rampant growth of the tiny hairs on leaves, a kind of pubescence gone wild.

Galls protect and feed the insect larvae developing inside. As gall insects grow, they exude substances in their saliva that mimic the plant's growth hormones and cause the gall to increase in size even more. Because most gall tissue forms in the plant's phloem, which carries sugars and other carbohydrates from the leaves to the rest of the plant, gall tissue contains more sustenance than the surrounding plant tissue.

Most galls, especially leaf galls, are merely cosmetic and harmless to the tree unless they form in great numbers. These galls are an example of commensalism—a symbiotic relationship in which one species benefits while the other is unharmed. However, galls

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Oak gall

that form on twigs and branches can hurt the tree by impeding the flow of sap. Red oak twigs are frequently infected by the gouty oak gall formed by the activity of another wasp, *Callirhytis quercuspunctata*, disfiguring the twigs as they complete their two-year life cycle.

The common oak apple gall can be caused by two species of parasitic wasp: *Biorhiza pallida* and *Loxaulus maculipennis*. As these galls grow, they transform the tissue of the leaf midrib or leaf stem into a round swelling with a crisp, brown, shell-like covering that surrounds an interior of delicate fibrous threads that radiate out from the center. The larva lives in a small hard capsule in the heart of the gall.

While not as common, my favorite galls are the whitish, woolly twig gall and the wool sower gall (white oak), both of which appear like oak-borne cotton balls that are complete with dark spots that look like seeds. These round white tufts are caused by the gall wasps *Andricus furnessae* and *Callirhytis seminator*, respectively.

The gall insects that hijack a tree's growth process in order to survive will often, in turn, serve as a source of food for other wildlife including other insects and birds. Woodpeckers and other birds peck tapered holes down into hard gall tissues and consume the gall insects in the center.

Another avian treat on red oaks is the ready supply of soldier beetles *(Chauliognathus pennsylvanicus),* or leatherwings, that hunker down in the cracks and crevices of bark and under the leaves. Growing to about one-half inch, their wings are yellow to red with blackish tips. Both the adults and larvae prey on numerous harmful insects including aphids and caterpillars.

Perhaps the red oak's best ally is the tachinid fly, *Compsilura concinnata*, whose larvae digest gypsy moth caterpillars from the inside out. The adult tachinids, whose hirsute, dark gray bodies have four longitudinal black stripes on the thorax, were introduced from Europe in 1906 to control gypsy moths and other forest defoliators. When gypsy moth caterpillars hatch in springtime, the female tachinid fly approaches a larva and deposits young maggots directly into the hapless host. Each female tachinid fly attacks numerous gypsy moth caterpillars, and each growing tachinid larva consumes the inside of the gypsy moth caterpillar, crawls out of its host, and pupates in the soil, in a bark crevice, or even in the webbing of the gypsy moth itself. Ten days later, the adult fly hatches out.

Gypsy moths were imported to an area near Boston in 1869 in an attempt to establish a source of silk, but the caterpillars escaped into the wild. Nearly 50 of its foes were also brought into this country to control these ravenous caterpillars. Another gypsy moth foe is a fungus, *Entomophaga maimaiga*, which was brought here from Japan in 1910. After overwintering in the soil until spring arrives, this fungus releases infectious spores that attack gypsy moth larvae. Spores produce an enzyme that enables them to penetrate the caterpillar's skin. Within a week to ten days, the infected caterpillars shrivel, ruck, and die.

Other beneficial fungi live in the soil, unseen, where roughly half the biomass of each red oak resides as roots. Some plant roots can even discern whether fungi are hurtful or helpful. Detrimental fungi are attacked as soon as they invade root tissues. But when the root senses a beneficial mycorrhizal fungus, the plant suppresses its counterattack and allows the fungal threads to penetrate and absorb carbohydrates from the tree. One mycorrhizal fungus—whose growing soil strands, or hyphae, intermingle with the roots of oak trees—produces the small reddish brown mushroom *Lactarius camphorates* that smells like maple syrup.

The reciprocal aspect of this relationship occurs as the strands of the mycorrhizal fungus expand the roots' ability to absorb water and mineral nutrients from the soil. A tree whose roots are associated with mycorrhizal fungi is more vigorous; it can better withstand the vicissitudes of drought and disease.

In a mature forest ecosystem, oaks and other kinds of trees are joined underground by a woody web of roots that become grafted together as they grow in contact with one another. This intertwining system of roots weaves together with another vast network—the symbiotic strands of mycorrhizal fungi. In this way, a forest evolves into one giant organism.

Michael J. Caduto is the author and coauthor of 18 books. He offers tree programs for all ages through his website: www.p-e-a-c-e.net

Forest Insect Pests

Not all tree-associated insects are beneficial; below is a list of the most destructive.

by John Burk

Emerald Ash Borer (EAB): In its ability to rapidly decimate an entire species, EAB, which affects all ash species, is regarded in the same vein as chestnut blight and Dutch elm disease. Detected first in Michigan in 2002 and spreading throughout 19 states, EAB was first confirmed present in Massachusetts in September 2012 when one was discovered in Berkshire County. Human transport of infested ash wood and hardwood firewood are the primary means of dispersal. Larvae bore into host trees to feed on inner bark during the warm months, excavate holes to overwinter, then emerge as adults through *D*-shaped exit holes in late spring. Symptoms include dieback, split bark, abnormal sprouting, and high woodpecker activity. Without any known treatments officials hope to slow the spread by restricting movement of potentially infested wood.

Asian Longhorned Beetle (ALB): The discovery of this brightly colored beetle in Worcester in 2008 generated national media attention. This beetle, which is native to China, Japan, and Korea, is especially insidious because it affects a variety of species of hardwoods such as maple, birch, and ash. Named for its antennae that are longer than its body, ALB has larvae that cause mortality by boring into the host tree and girdling stems and branches. Evidence of their presence includes dime-sized circular exit holes and oval egg pits. Unfortunately, the only way to control ALB is to destroy infested or potential host trees. Nearly 35,000 trees in Worcester have been removed since 2008. Early detection and public outreach are crucial to mitigating infestations.

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Hemlock Woolly Adelgid (HWA): This hemipteran, or true bug, which reached New England during the mid-1980s after being introduced from Asia, causes mortality to affected hemlocks within 5 to 15 years. Though the diminutive insects are nearly impossible to see, their white wool-like egg cases are a prominent sign of infestation from winter through midsummer. Because HWA is susceptible to subzero winter temperatures, its effects in Massachusetts were initially greatest in mild lowlands such as the coastal plain and Connecticut River Valley; however, it has become increasingly widespread statewide as a result of recent mild winters.

Elongate Hemlock Scale: Hemlocks are stressed by these tiny armored insects, which were introduced to the United States from Japan in 1908. They feed on the needles of hemlocks and other conifers, causing nutrient loss, premature needle drop, and crown thinning. Scale is often present in conjunction with HWA but rarely causes mortality on its own. The waxy secretions of adults are often mistaken for HWA.

Winter Moth: Massachusetts has the dubious distinction of being the first state to host populations of these late-season fliers, which arrived in the latter 1990s after being introduced to Canada from Europe in the mid-20th century. Caterpillars emerge around mid-April during cyclical outbreak years, causing varying amounts of bud damage to a variety of host species including oaks, maples, birches, and fruit trees. (Blueberry growers have suffered extensive losses in some years.) The logically named moths emerge around Thanksgiving and are on the wing into December after the flight season for other insects.

Eastern Tent Caterpillar: Easily identified and named for the conspicuous silk tents that they weave on tree branch crotches and forks, eastern tent caterpillars are not a significant forest pest because they generally favor fruit trees in urban and suburban settings. However, they occasionally affect deciduous forest species such as maple, oak, birch, and ash. Individual trees may suffer significant but temporary defoliation during outbreak years, which occur at 8- to 10-year intervals.

Forest Tent Caterpillar: These native moths are misnamed because the caterpillars actually weave sheets on which they congregate. Their host species include oaks, maples (but not red maple), birches, poplars, and ashes. Though outbreaks, which occur at roughly 10-year intervals, can cause temporary defoliation, populations are usually not large enough to cause significant injury.

Gypsy Moth: Gypsy moth caterpillars have caused widespread defoliation throughout the Northeast since being introduced to Massachusetts in 1869. Larvae favor oaks but have also affected other species including birches and basswood. Population cycles are highly irregular; the last significant outbreak was during the early 1980s.

Red Pine Scale: Hundreds of acres of non-native red pine plantations in Massachusetts, including those at Quabbin Reservoir and town and state forests, have recently been decimated by these microscopic brown insects, which have spread north from New Jersey since the 1960s.

Nantucket Pine Tip Moth: Though also not regarded as a true Massachusetts forest pest, this moth can cause damage to pine plantations and seedlings in open areas. In New England, they have affected pitch pines and non-native Scotch pines.

John Burk is an outdoor writer, photographer, and historian. He has published a number of books, guides, and articles related to New England.

The Political Landscape

Ancient Sentinels: Protecting Our Old-Growth Forests

by Karen Heymann and E. Heidi Ricci

Old-growth forests stand as cathedrals untouched by the rapid expansion of European settlement into the industrial age when almost every last tree in Massachusetts was felled for food, fuel, or fiber. An ancient grove of trees literally breathes: the ecological processes that support life have intensified over time; organisms have inhabited the nooks and hollows of fallen branches; populations of lichens, colorful wildflowers, and ferns have filled voids; and decaying organic litter has slowly blanketed vast fungal networks living in perfect symbiosis with the tree's root system, or rhizosphere.

An old-growth tree has witnessed centuries of change on the adjoining landscape it overlooks from its perch on a mountain slope. The surrounding land was cleared and farmed and gave way to new young forests interspersed with roads, homes, and industry. Storms came and went—its top has been shattered more than once but it put out new branches while clinging to its rocky perch. Birds have nested in its branches; mammals have homes in its hollows. The forest floor under it grows deeper and thicker each year with accumulating, decaying leaves, supporting the herb layer, salamanders, innumerable insects, and mushrooms. New young trees grow nearby where a great branch fell during an ice storm a few years ago, taking smaller trees with it and creating an opening in the canopy. A few years ago, this ancient sentinel had a rare encounter with humans who scrambled across steep rocks, measured it with tape, and peered at it with strange scopes pointing at its highest tip.

Old-growth forests contain very old trees, undisturbed by human actions during the last 200 years or longer and shaped entirely by natural forces. These unique stands are exceedingly rare; small areas are mostly scattered across remote locations on state-owned lands in western Massachusetts, adding up to about 1,000 acres in total. The tallest tree in New England, a second-growth white pine, towers 170 feet above the footpaths of the Mohawk Trail State Forest, which is also home to some of the last remaining old-growth forests in Massachusetts. It is hard to believe that such tall pines once graced much of our landscape, lush green giants thousands of years in the making, until they were cleared, cut for masts, farming, grazing, and settlements, all within a few hundred years.

Until recently, old-growth forests were not believed to exist in intensively settled states such as Massachusetts; however, over the past few decades scientists and enthusiasts have discovered and documented numerous sites. Today, old growth is one of the rarest habitats in our region, constituting less than one-tenth of one percent (<0.1 percent) of our forests.

We have only just begun to document the tremendous diversity of life that resides in this rich habitat. Old-growth forests are home to a great variety of plants and animals, and teach us about the characteristics of mature natural forests. Studies have documented certain species of birds such as the Blackburnian warbler to be more abundant in old growth than in secondary forest. A greater abundance of bryophytes (mosses and similar species) has been documented in old-growth

What is Old Growth?

Old-growth forest is more than just a collection of big old trees. An area with this designation contains trees of all ages and has a complex multilayered structure that supports many plants and animals. Standing snags, fallen trees, live trees with cavities, and ground covered in centuries of decayed leaves are rich and varied habitat features.

The following qualify a forest to be classified as old growth.

- Covers at least 10 acres, or otherwise is large enough to function as a forest unit and regenerate over time.
- Contains trees that are more than 50 percent of the maximum age possible for the species.
- Have no evidence of significant human alteration (this can be met looking at soils and historic information).

Places to See Old Growth

- The southwestern town of Mount Washington, home to a 200-year-old pitch pine stand close to the 2,624-foot summit of Mount Everett.
- The narrow Ice Glen in Stockbridge, with 300- and 400-year-old trees in the boulder field.
- High along Todd Mountain in western Franklin County within the Mohawk Trail State Forest, where 400-year-old eastern hemlocks are found.
- An area surrounding the Mount Wachusett summit, home to a section of gnarled trees overlooked until the 1990s because they are not remarkably large but are nevertheless as old as 350.

forests in western Massachusetts compared with nearby secondary forest, and certain wildflowers are also associated with old forests. Preserving old growth as living laboratories for research and education will improve our understanding of how forests function, and will also provide a way to measure the effects of pollution, climate change, and human activity on the environment.

How we manage our forests may have a tremendous influence on the value of the services that the forest can provide, such as maintaining clean drinking water, storing carbon, and increasing biological diversity. New England is among the nation's most densely forested regions, but most of what we see today is relatively young secondary forests on sites that have been logged and are still early in the centuries-long process of recovery. Old-growth forests cannot be recreated, but, by preserving the remaining sites and allowing surrounding younger forests to mature, we can protect our natural heritage and learn much about how to sustain the health of our forests and forest economy.

The majority of currently documented old-growth forest in Massachusetts is located on public lands managed by the Department of Conservation and Recreation. Although Mass Audubon helped secure administrative protection of these areas through state old-growth policy and landscape designations, no permanent protection exists for old-growth reserves in the Commonwealth. To make these protections permanent and to establish surrounding forest buffers, we are supporting legislation that would provide permanent protection for old growth.

You can make your voice heard by contacting your state senator and representative and telling them that you support legislation to permanently protect old growth forests and that you want them to support it too.

For more information, contact Karen Heymann, director of Legislative Affairs, at kheymann@massaudubon.org

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Karen Heymann is Mass Audubon's legislative director. E. Heidi Ricci is Mass Audubon's senior policy analyst.

The Case against Trees

by Chris Leahy

"If you've seen one redwood, you've seen them all." – Ronald Reagan

What the Gipper actually said during his first gubernatorial campaign in California in 1966 was: "…if you've looked at a hundred thousand acres or so of trees—you know, a tree is a tree, how many more do you need to look at?"

At issue was whether the last of California's redwood stands were to fall to the lumber industry's chain saws or be preserved in a national park, as a majority of Californians preferred. Despite the fact that he was mocked for his callous remark, he reiterated his indifference to arboreal magnificence a year later after a visit to one of California's most spectacular redwood groves: "I saw them. There is nothing beautiful about them, just that they are a little higher than the others."

For card-carrying tree huggers, Reagan's comments register on a continuum somewhere between the ridiculous and the blasphemous. But from a broader perspective, the human relationship with trees is at best ambivalent. On the one hand, there is no other plant form that is granted so much respect, even reverence, as an individual tree. One may be deeply moved by a melancholy moorland as night falls or the sweep of a rolling prairie vista, but no one (well, perhaps a few botanists) stands in awe of a lone shrub or a single grass inflorescence. In part, our awe of trees doubtless arises simply from their stature—they are bigger than we are, often way bigger, sometimes awesomely bigger.

The tallest living thing in the world is a California redwood that tops out at a meticulously measured 379 feet 4 inches; it is currently thriving at an undisclosed location in Redwood National Park, the park Mr. Reagan was speaking against in 1966 (and that Jimmy Carter signed off on as President in 1978).

Another factor in our arborophilia is respect for age. Noah's grandfather, Methuselah, departed the earthly realm at age 969 years and 7 days. But he was just a pup compared to a European olive in Lebanon that lives on at 6,000 or perhaps 6,800 years. Trees are also often seen as having a humanoid form. We both have "trunks" and "limbs," and the trees in Joyce Kilmer's famous poem are allotted a mouth, eyes, hair, and a bosom. Trees that talk and even "walk" abound in myth and fantasy from Aesop's chatty oaks, firs, and walnuts to Tolkien's Ents, and we have all seen trees that, due mainly to deformities of age, appear to have human faces.

Finally, of course, we honor trees for their utility as

Ent, a treelike being

shade givers, food bearers, and building material. It was this last dendroid virtue that Mr. Reagan was "honoring" when he pandered to the lumber barons.

But for all the praise and preservative passion that people (mainly from highly developed cultures) have accorded trees, there is arguably a more extensive tradition in which these bigger, older, sometimes creepily anthropomorphic life-forms threaten us from the dark side. In early agricultural societies, e.g., in Europe and Mesoamerica, where ancient dense forests once dominated the landscape, trees, in the form of deep forests, were seen as providing refuge for ferocious animals and other hazards—think of Hansel and Gretel and other tales of Perrault and the Grimm brothers in which the forest, co-villain with witches and wolves, is a dark brooding place of disorientation and menace.

Agrarian cultures were also disposed to regard trees as cluttering land that might be put to better use for grain fields and temple complexes. In some cultures, a distaste for trees progressed to abhorrence. A friend who worked as a forester in Guatemala for a couple of years told me that, among the Highland Maya, there was a widespread belief that when you plant a tree, somebody dies—not a promising climate for the refor-

estation project my friend was there to promote.

In case you're tempted to regard this as an aberration within a bizarre culture, compare the superstition, long prevalent in England, that bringing flowering hawthorn branches into a house was likely to result in someone's illness or demise. (It turns out there was a whiff of reason in this belief: Hawthorn flowers at room temperature produce a gaseous form of the organic compound trimethylamine, which is also given off by rotting animal flesh; the smell reminded people of the stench of death in London during the plague years.)

When the Spanish arrived in the New World, they introduced a more mercantile approach to eliminating pesky trees. To this day some Latin American countries have laws on the books imposing a tax on so-called "lazy land," i.e., forest land that has not been cleared for crops or cattle grazing. While some of the more valuable forest trees such as mahogany might be hauled out and sold, much of the timber, including many forest giants, were simply burned where they fell, briefly enriching the thin, nutrient-poor, tropical soils. In these former forests one now often sees a single giant ceiba or other towering species left in the pasture to appease any tree god who might be considering revenge.

The tallest living thing in the world is a California redwood that tops out at a meticulously measured 379 feet 4 inches...

In our present sophisticated age, we have found a new trick to play on Mother Nature by in effect enlisting bad trees in a war against good trees to serve our various voracious appetites. The "bad" trees, notably oil palm and species of eucalyptus, are not evil in themselves, of course, and were thriving harmoniously within their native ecosystems in West Africa and Australasia respectively before we put them to work for us. Oil palm is a fast-growing, high-yield crop with pulp and nuts that are used mainly in the production of highly saturated inexpensive cooking oil and biofuel for which global demand continues to grow.

Due to its popularity and relative ease of production, vast areas of Malaysia and Indonesia that until recently supported tropical rain forest have been converted to oil palm plantations, and the deforestation has slowed only slightly in response to howls of protest from conservationists. The oil palm monocultures are biological deserts except for the numerous crop pests that need to be "treated" by sundry means, and they replace some of the most species-rich habitat on the planet, containing orangutans and other critically endangered species. Development of the palm plantations also releases large quantities of methane, a major warming agent in our planetary greenhouse.

Eucalypts are the dominant forest trees of Australia and native almost exclusively to the Australasian region. In their native lands, more than 700 species of eucalypts nurture a famously unique biota, including the world's richest variety of marsupial mammals and over 800 bird species. A eucalypt's virtue as a tree useful to humanity, however, is its ability to grow tall fast. As such, it has been used in tropical regions worldwide to quickly replace forest cover eliminated by the several tactics described previously.

From the human perspective the species of eucalyptus that have been introduced throughout the tropics can be granted a measure of utility, for example, in erosion control, as a source of charcoal for cooking and heating in the developing world, as a nearly inexhaustible supply of cheap wood pulp, and by partially replacing the carbon sequestration contributed by the original native forest. But like oil palm, eucalyptus away from home is a poor host to the plants and animals of its adoptive lands. It makes for a sterile forest more frightening in its way than the gloomy woods of the fairy tales; far more than hawthorn in an English parlor, it is a harbinger of death.

Further evidence in the case against trees is on view right now across the lushly forested plains and modest hills of our fair Commonwealth. In Thoreau's day, much of the Massachusetts landscape was more like the one we now associate with the Midwest—farmsteads with hayfields and pastures and trees limited to scattered windbreaks and woodlots. During these preindustrial times and even for decades after the farmers departed for the more forgiving soils to the West and into the factories, the "early-successional" habitats, grasslands, and shrublands harbored many birds and other species evolved to thrive in such landscapes. Upland sandpipers, American kestrels, brown thrashers, prairie warblers, vesper and grasshopper sparrows, and eastern meadowlarks were familiar birds of the countryside in this pastoral period, and Thoreau and his contemporaries would likely have dismissed as ravings the suggestion that these species would ever become rare and local in distribution.

But such is now the case. In precolonial times, successional habitats would have been less extensive, but present nonetheless as a result of wildfires, floods, and blowdowns. Today however we have neither farms nor uncontrolled wildfires, and the trees are back, gradually encroaching on the last remaining, undramatic scrubby tangles and weed-choked fields that barely register with us but represent paradise to unique communities of birds and butterflies.

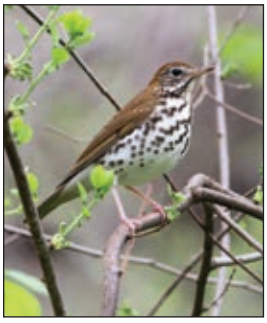
To cast trees as "the enemy" is just a cheeky conceit to get your attention of course. The return of our forests has restored much wildlife—including such charismatic megafauna as bears, moose, beavers, bald eagles, pileated woodpeckers, and many other species that were either extirpated during what might be called the Exploitation Period or required big old trees to make a living. We can rejoice in the knowledge that Massachusetts has one of the highest percentages of fully protected forest lands in the nation. But the loss of grasslands and shrublands and their dependent species is one of the greatest ecological challenges we face going forward, one that must largely be met by aggressive landscape management. Perhaps we need a new poem that does for grass and bushes what Joyce Kilmer's did for trees.

Chris Leahy holds the Gerard A. Bertrand Chair of Natural History and Field Ornithology at Mass Audubon.

Breeding Birds Across the Commonwealth

by Chris Leahy

Published by Mass Audubon in September, *State of the Birds 2013* contains information on the status of breeding birds in Massachusetts and recommendations that are gleaned from changes in the species' populations. Findings in the publication are based on two significant Mass Audubon initiatives, *State of the Birds 2011* and the Massachusetts *Breeding Bird Atlas 2*.



Wood thrush

The following is an excerpt on the status of woodland birds in general and more specifically on the wood thrush.

Forest birds in Massachusetts, on the whole, are doing well. Ovenbirds are holding their own, Great Horned Owls seem to be on the rise, and current populations of Cooper's Hawks, Pileated Woodpeckers, Warbling Vireos, and others are breaking records. This will come as no surprise to anyone who has driven across the Commonwealth recently: from Cape Ann to the Berkshire Hills, the forests are back. From the colonial period up until the industrial revolution, we cleared the land with abandon, creating a prairie-like landscape where Upland Sandpipers, Vesper Sparrows, and other farmland birds prospered and multiplied. But we live where the climate and most of the soils, left to their own devices, will grow trees, and when the farmers left and the felling and mowing and grazing ceased, the forest returned….

Early colonists called the Wood Thrush the Swamp Angel. Our first State Ornithologist, Edward Howe Forbush, thought its song "…seems like a vocal expression of the mystery of the universe, clothed in a melody so pure and ethereal that the soul still bound to its earthly tenement can neither imitate nor describe it." It is a bird of the deep, moist, shady forest, though it will often nest in a shady patch of the woods in the corner of a park or suburban garden. Its nest is a variable combination of forest products, bark fibers, mosses, often with a strong component of damp leaves from the forest floor, and is usually placed in a shrub or small tree at an average height of 7 to 8 feet from the ground. While nesting, adults and young subsist mainly on worms, snails, and other soil invertebrates. All of these traits imply that the ideal Wood Thrush forest is one with a full canopy, a subcanopy and shrub layer, and moist soil with a layer of leaf litter and some shade-tolerant herbs. This applies to the tropical forests where the birds winter as well as their breeding habitat in eastern North America.

The decline of Wood Thrushes has been very well documented since the 1970s. The proposed causes of the problem include many of the familiar suspects: pesticides, acid rain, collisions with windows and towers, parasitism by Brown-headed Cowbirds, and especially, habitat loss, fragmentation, and degradation. *See* State of the Birds 2013 *to learn more.*

Breeding Bird Atlas 2 **as well as** ***State of the Birds 2013*** **are obtainable online.**

Go to www.massaudubon.org for more information.

Birding the Sanctuaries through Four Seasons

by Ann Prince

BLOG EXCERPTS

by Chris Leuchtenburg

Arcadia Easthampton & Northampton
A red-bellied woodpecker called from the other side of the pond...

Ashumet Holly East Falmouth

Catbirds, red-wings, and a common yellowthroat surrounded the grassy pond.

Broad Meadow Brook Worcester

I have to say I saw a lot of birds…a scarlet tanager, eastern wood-pewee, red-eyed vireos, and ovenbirds in the woods.

Canoe Meadows Pittsfield
…the kettle of 14 vultures circled gracefully overhead for several minutes. Such a sense of elegant freedom.

Cook's Canyon Barre
I added a black-throated green warbler to my list and had a most pleasant walk.

Daniel Webster Marshfield
...this is one of the best places in the state to see purple martins, of which I counted 20.

Eastern Point Gloucester
Three species of swallow swooped overhead, an oriole called, then a warbling vireo.

In spring 2013 birder/blogger Chris Leuchtenburg of Newton retired from his position with the Massachusetts Division of Ecological Restoration and set out to find birds at Mass Audubon sanctuaries statewide. Birding all 54 of our Mass Audubon sanctuaries in a single year is ambitious, and timing retirement to coincide with spring migration to start such a venture shows dedication. As might be expected, Chris' resolve has paid off—not only in birds sighted but in days spent at some of the most beautiful places in the state.

Birder/blogger Chris Leuchtenburg by a holly tree at Ashumet Holly Wildlife Sanctuary

When my son, Noel (15), and I caught up with Chris on April 18 at Allens Pond Wildlife Sanctuary in South Dartmouth, he'd already visited 11 sanctuaries spanning from western to eastern Massachusetts. At Drumlin Farm in Lincoln he saw wild turkeys at the feeder and wood ducks in the pond, at Pleasant Valley in the Berkshires he tracked down a singing fox sparrow and a drumming yellow-bellied sapsucker, and at Moose Hill in Sharon he met with a flurry of birds including a phoebe, kinglets, and chickadees.

At 10 a.m. on this perfect spring morning, our birder companion for the day had already spent several hours at Allens Pond. He had spotted a first for him, a winter wren, darting about in the bushes.

The intrepid birdwatcher expounded on his aspirations. Chris says that the reason he chose Mass Audubon sanctuaries as his destinations through four seasons is he appreciates our approach that balances protecting nature with reinforcing a healthy relationship between people and the environment.

"Getting to sanctuaries all over the state is challenging," he says, "but manageable. And you can cover a lot of ground. I love Allens Pond—for the birding and because it's such a beautiful location on the shore. The Bayside restaurant across the road doesn't hurt either."

We joined Chris on the trails, first along the coastline and then through the marsh. Two common eiders graced the bay, and an osprey flew over then landed on the beach. In the wetland black ducks floated and dipped, a wading great egret stood out in brilliant white, and lots of red-winged blackbirds were conspicuously perched along the edge, calling. Melodious song sparrows and mimicking mockingbirds ornamented the tops of stunted cedars broadcasting their avian narrations.

After a great meal across the street at the Bayside, we agreed that we'd catch up midsummer to check on Chris' progress.

Chris and I reconnected at Ashumet Holly Wildlife Sanctuary in mid-July. By then Chris had been to 36 sanctuaries, some more than once. He's found it rewarding to press on, sweeping the trails looking and listening for songsters at sanctuaries such as Broadmoor in Natick, Wellfleet Bay in South Wellfleet, and Ipswich River in Topsfield. "I have had wonderful experiences at some of the smaller sanctuaries too," he said. "I think about the irresistible bench by the pond at Pierpont Meadow [Dudley], the great blue heron rookery and porcupine den at Rocky Hill [Groton], and the beaver dams at Waseeka [Hopkinton]."

At Ashumet in East Falmouth, the inexhaustible birder was already watching and photographing the barn swallow colony there. "Although there is no education building here for people," he says, "there is a barn for the eponymous swallows." We looped around, passing lots of holly trees of different varieties with ripening berries and encountering cheery slate-colored gray catbirds, some of them meowing. Following Chris as he watches birds is pleasant because he truly has an appreciation for each and every bird species and why it is special in its own way.

When we parted that day, Chris said that next he'd embark on a kayak excursion to Sampsons Island, just a few hundred yards from mainland Cotuit. According to his blog, he was greeted there by dive-bombing willets. "They took turns swooping down," he wrote, "almost touching me and screaming epithets." Other birds for Sampsons Island were osprey, piping plover, least tern, common tern, and American crow. By mid-August, Chris' tally had reached 133 bird species at 40 sanctuaries, and summer wasn't over yet. He would round out the month taking to the trails at Lynes Woods in Westhampton, Road's End in Worthington, and Graves Farm in Williamsburg; and then bird a handful of sanctuaries in September.

Our all-weather Mass Audubon sanctuary visitor has more birding adventures to come as the cold weather sets in. "I have held off going to Felix Neck on Martha's Vineyard to see the barn owl there in the fall, and I've scheduled North Hill Marsh in Duxbury for November when the ducks should be numerous," he says. "I'm planning to stretch this out till the end of the year. I'll visit Eagle Lake [Holden] in December, hoping to see redpolls."

No doubt by winter solstice Chris' itinerary will be complete, his blog will have lots more reports and anecdotes, and his master bird list for Mass Audubon sanctuaries will reach more than 150 species, and whatever the number, in his words, he's just "enjoying the journey."

For a full chronicle go to Chris Leuchtenburg's blogsite: rivergis.wordpress.com

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Ann Prince is associate editor of Sanctuary.

Great Neck Wareham
Peppered across the cove were a couple dozen buffleheads and a great blue heron stalked in the marsh.

Ipswich River Topsfield
Hearing and briefly seeing the black-billed cuckoo was a real treat. It serenaded me...

Lincoln Woods Leominster
I did enjoy hearing and eventually seeing a pair of pine warblers.

Long Pasture Barnstable

Chickadees always put me in a good mood and helped me enjoy the blue, blue sky.

Marblehead Neck Marblehead
A house wren sang loudly as it tended its nest in a tree hole.

Nashoba Brook Westford
I got an unusually good look at an ovenbird. On these woodland paths, it isn't unusual for me to hear five or ten for every one that I manage to see.

North River Marshfield
I managed to identify a couple of red-eyed vireos, a red-bellied woodpecker, a northern flicker, and at least two wood thrushes.

Rocky Hill Groton

Someone noticed a brown creeper carrying nesting material to the crevice underneath the peeling bark.

Skunknett River Barnstable
An osprey carried a fish back to its nest by the pond.

Stony Brook Norfolk
Sure enough I quickly found the warbling vireo, and three least sandpipers were happily feeding on the exposed mud...

Wellfleet Bay South Wellfleet
In addition to the 28 black-bellied plovers and 146 sanderlings, there was a dunlin and a group of 9 ruddy turnstones.

Family Programs

BERKSHIRE SANCTUARIES
Lenox, 413-637-0320
Bird Banding Demonstrations
December 14 and January 1—10 a.m.-noon.

BOSTON NATURE CENTER
Mattapan, 617-983-8500
Wonderful Winter Trees
January 12 —2-3:30 p.m.

BROAD MEADOW BROOK
Worcester, 508-753-6087
Owl Prowl
January 18—6:30-8:30 p.m.
Holiday Nature Crafts
December 14—1-4 p.m.

BROADMOOR
South Natick, 508-655-2296
Owl Prowls for Adults and Families
Most Saturday evenings—November-March

CONNECTICUT RIVER VALLEY
Easthampton, 413-584-3009
Boreal Forest Ecology and Cellar Hole Hike
November 23—10 a.m.-1 p.m.
Panpipes: Create a Craft from Nature
December 8—10 a.m.-noon

DRUMLIN FARM
Lincoln, 781-259-2206
Winter Hike for Teens
December 7—10 a.m.-3 p.m.
Winter Botany and Tree ID for Adults
January 18—1-3:30 p.m.
Exploring the Woods on Skis for Teens
January 18— noon-4 p.m.
Bringing the Forest Home
January 28—10 a.m.-1 p.m.

FELIX NECK
Edgartown, 508-627-4850
22nd Annual Felix Neck Fall Festival
November 23—11 a.m.-3 p.m.
Rain date: *November 30—11 a.m.-3 p.m.*

IPSWICH RIVER
Topsfield, 978-887-9264
Big Woods Hike
November 17—departs every 15 minutes from noon-1:30 p.m.
Winter Solstice Lantern Walks
December 14 and 15—4-6 p.m.
Vacation Week Family Fun Days
December 27-29—1-2:30 p.m.
Wingmasters Presents: North American Birds of Prey
January 26—1-2:30 p.m.
Groundhog Day Extravaganza
February 2—1-4 p.m.

OAK KNOLL
Attleboro, 508-223-3060
Family Owl Prowl
December 27—6-8 p.m.

WACHUSETT MEADOW
Princeton, 978-464-2712
Winter Open House
January 25—1-4 p.m.

Birding Programs

BERKSHIRE SANCTUARIES
Lenox, 413-637-0320
Exploring the Rhode Island Coast: Sachuest Point
December 7—8 a.m.-6 p.m.

BOSTON NATURE CENTER
Mattapan, 617-983-8500
Wings of Winter
December 14 —10:30 a.m.-noon

BROAD MEADOW BROOK
Worcester, 508-753-6087
Friday Morning Birds
December 6, January 3, February 1, March 1—7-9 a.m.
Saturday Morning Bird Walk for Adults
December 7, January 4, February 7, March 7—7-9:30 a.m.

BROADMOOR
South Natick, 508-655-2296
Live Owl Program and Owl Prowl
February 1—3 p.m.

CONNECTICUT RIVER VALLEY
Easthampton, 413-584-3009
Eagles at Quabbin Reservoir
February 1—10 a.m.-1 p.m.
Winter Crows
February 9—2-6 p.m.

DRUMLIN FARM
Lincoln, 781-259-2206
Several Birds with One Stone
December 15—8 a.m.-5 p.m.
Eagles and Owls
February 15—9 a.m.-4 p.m.

IPSWICH RIVER
Topsfield, 978-887-9264
Birdwatchers' Getaway for the Day
January through May—Once a month on Fridays
Eagles and Owls
January 19 and February 2—8 a.m.-noon

JOPPA FLATS
Newburyport, 978-462-9998
Wednesday-Morning Birding
Every Wednesday—9:30 a.m.-12:30 p.m.

WACHUSETT MEADOW
Princeton, 978-464-2712
Owl Prowl
February 15—5-7 p.m.

WELLFLEET BAY
South Wellfleet, 508-349-2615
Birding Cape Cod
Every Friday through mid-May—9 a.m.-noon

SCHOOL VACATION WEEK PROGRAMS

BOSTON NATURE CENTER
Mattapan, 617-983-8500
February Vacation Week
February 17-21—8:30 a.m.-5:30 p.m.

BROAD MEADOW BROOK
Worcester, 508-753-6087
February Vacation Week
February 17-21—9 a.m.-3 p.m.
For children ages 6-11

BROADMOOR
South Natick, 508-655-2296
February Vacation Week
February 18-21—8:30 a.m.-4:30 p.m.

CONNECTICUT RIVER VALLEY
Easthampton, 413-584-3009
February Vacation Week
February 17-20—9 a.m.-3 p.m.
For children ages 6-12

DRUMLIN FARM
Lincoln, 781-259-2206
February Vacation Week
February 17-21
March Vacation Weeks
March 18-27

HABITAT
Belmont, 617-489-5050
February Vacation Week
February 18-21—9 a.m.-3:30 p.m.
For grades K-6

March Exploration Week
March 17-21—9:00 a.m.-3:30 p.m.
For grades K-6

IPSWICH RIVER
Topsfield, 978-887-9264
February Vacation Week Adventure Days
February 18-21

JOPPA FLATS
Newburyport, 978-462-9998
December Vacation Week
Flyby at Joppa Flats
Winter Backyard Birds:
December 30—10 a.m. to 3 p.m.
Raptors: *December 31—10 a.m. to 3 p.m.*

MOOSE HILL
Sharon, 781-784-5691
Animal Adaptations
December 23, 24, 26, 27, 30, and 31
Australia, the Land Down Under
February 17-21

WACHUSETT MEADOW
Princeton, 978-464-2712
February Vacation Week
February 18-21—9 a.m.-3 p.m.

WELLFLEET BAY
South Wellfleet, 508-349-2615
December Vacation Week Adventures
December 27 and 30—9 a.m.-2:30 p.m.
February Vacation Week Adventures
February 17–21—9 a.m.-2:30 p.m.

MAPLE SUGARING PROGRAMS

DRUMLIN FARM
Lincoln, 781-259-2206
Backyard Sugaring
February 1—1-3:30 p.m.
Sip Some Sap
February 26—1-2:30 p.m.
Maple Moo
February 28—3:30-5 p.m.
Maple Magic
March 7—3:30-5 p.m.
Sap-to-Syrup Farmer's Breakfast
March 15, 16—9 a.m.-1 p.m.

IPSWICH RIVER
Topsfield, 978-887-9264
February Flapjack Fling and Sugaring Tour
February 22
Breakfast Times:
8:15, 9, 10:15, and 11:15 a.m.
Tour Times:
9, 10, 11 a.m., and noon
Please visit our website for more information

Maple Sugaring Weekend Tours
March 1, 2, 8, 9, 15, and 16—Tours at 10 a.m., 12:30, and 2:30 p.m.
Maple Sugaring School & Scout Group Tours
February 11-14
February 25-March 7

MOOSE HILL
Sharon, 781-784-5691
Maple Sugar Festival
March 9, 15, and 16—11 a.m.-3 p.m.
Preregistration recommended

Call the individual sanctuaries for more information, fees, and to register.

For a full listing of Mass Audubon programs and events, visit our online catalog at www.massaudubon.org/programs.

The Ring-Standard Calendar
The perfect holiday gift

This year's Ring-Standard calendar design was originally designed by Mary Shakespeare for the 1951 edition. The desktop calendar measures 4¼ × 3¼ inches, is printed on recycled paper, and, as always, is presented in a gold gift box.

Available at the Audubon Shop At Drumlin Farm Wildlife Sanctuary
781-259-2214
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For a gift that's off the beaten path…

A gift membership brings a year of wildlife and wonders to explore at our statewide network of wildlife sanctuaries.

Or consider a donation in honor or in memory of a special person. It's a wonderful way to celebrate this season of giving.

Visit us online at www.massaudubon.org to order gift memberships or donate today!

Mass Audubon
Protecting the Nature of Massachusetts

If You Feed Birds— Mass Audubon Needs Your Help

During the weekend of February 1 and 2, 2014, we invite you to note the number and diversity of birds visiting your bird feeder. Fun for novice and experienced birders alike, Focus on Feeders helps to raise awareness of birds and enhances Mass Audubon's efforts to protect wildlife habitat across Massachusetts. Ask others to join in because the value of this information increases with the number of reports.

Report forms are available on our website at www.massaudubon.org/focus and at many of our wildlife sanctuaries statewide, or request a form by email at focusonfeeders@massaudubon.org.

Eastern Bluebirds at Feeder © Chris Steel

Please report your observations to Mass Audubon by February 28, 2014.

Travel with Mass Audubon Naturalists

Join Mass Audubon Staff Naturalists and Ornithologists on International Birding and Natural History Tours

© CLASSIC ESCAPES

Keel-billed toucan

INTERNATIONAL TOURS

Birding and Beyond in Burma: January 18-31, with Chris Leahy

Birding the Eastern Andes, Colombia: January 29-February 7, with Elissa Landre

Birding the Central Andes, Columbia: February 7-18, with Elissa Landre

Belize Birding: February 1-10, with David Sibley and Joan Walsh

Eastern Caribbean Cruise, Lesser Antilles: February 16-24

Birding in the Darien, Panama: February 21-March 2, with Sue MacCallum

Birding Off the Beaten Path, Jamaica: February 23-March 4, with Bill Gette

Kenya Birding and Big Game Safari: February 26-March 12, with Dave Larson

Kenya Birding and Big Game Safari Tanzania extension: March 11-19, with Dave Larson

Costa Rica Birding: March 26-April 4, with Bob Speare

Exploring Crete: April 5-15, 2014, with Elissa Landre

Georgia and the Caucasus Mountains: April 26-May 10, with Chris Leahy

Iceland: June 14-23, 2014, with Bill Gette

Spitsbergen Cruise: July 10-20, 2014, with Wayne Petersen

US TOURS

Bosque del Apache and the Rio Grande Corridor, New Mexico: January 7-13, 2014, with Bill Gette and Alison O'Hare
For more information, contact Joppa Flats, 978-462-9998

Gay Head to Chappaquiddick — A Martha's Vineyard Weekend: January 10-12, with Scott Santino and Strickland Wheelock
For more information, contact Ipswich River Wildlife Sanctuary, 978-887-9264
Cosponsored with Drumlin Farm

Hiking and Birding in Arizona: January 25-February 2, with Bob Speare

Birds and Blooms of Southern California: March 4-12, with René Laubach and Doug Williams
For more information, contact Berkshire Sanctuaries, 413-637-0320

New Mexico—Rio Grande Lowlands to Rocky Mountain Highlands: April 22-30, with René Laubach and Bob Speare
For more information, contact Berkshire Sanctuaries, 413-637-0320

Birding the Southern Peninsula and Keys, Florida: April 11-18, with Carol Decker and Scott Santino
For more information, contact Ipswich River Wildlife Sanctuary, 978-887-9264

Sketching and Naturalizing on Monhegan Island: June 12-14
For more information, contact Ipswich River Wildlife Sanctuary, 978-887-9264

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Curious Naturalist

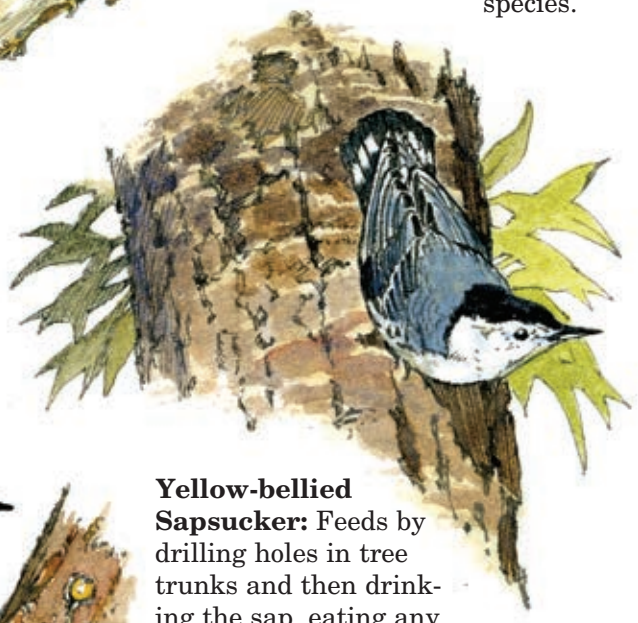
Bark Birds

Illustrated by Gordon Morrison

Apart from woodpeckers, there are a number of species of birds that depend on tree trunks for both nesting and food supply. Some of these species are avid predators on destructive tree-dwelling insects such as gypsy moths.

Brown Creeper: An obscure brown-striped bird with a stiff woodpeckerlike tail that it uses as a prop. Feeds on adult insects and insect eggs, and begins hunting at the base of a tree and works its way upward, circling, then flying over to the next tree and repeating its performance. The high-pitched call is a good test of hearing.

Red-breasted Nuthatch: This relatively tame bird generally favors evergreens. It feeds mainly on insects but will also eat the seeds of spruce and balsam and appears at local bird feeders in certain years. Generally, it is a more northerly nuthatch and is smaller than the white-breasted species.



White-breasted Nuthatch: A common feeder bird in winter. In summer it is a voracious eater of local insects, including the caterpillars of destructive species. Often feeds head down on trunks and was once known as the "upside-down bird."

Yellow-bellied Sapsucker: Feeds by drilling holes in tree trunks and then drinking the sap, eating any insects that get caught in the sticky liquid. If you can find one, it's easy to observe since individuals tend to hang out on a single tree while they feed. Other species often use their "sapwells," hummingbirds in particular. Sapsuckers seem to have favorite trees that they return to often to bore new holes.

Black-and-white Warbler: Easily recognized by its zebralike markings. It circles trunks searching for plant lice and scale insects, and also the caterpillars of gypsy moths and brown-tail moths. Its song in spring sounds like a squeaky old wagon wheel.

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Outdoor Almanac Autumn/Winter 2013-2014

November 2013

November 15 Late-migrating raptors such as rough-legged and red-tailed hawks are migrating.

November 17 Full moon. The Sassafras Moon (Choctaw).

November 19 Field crickets move into country houses.

November 23 Watch for dragonflies over sunny meadows on warm days.

November 26 Late-fruiting mushrooms such as the oyster mushroom are still evident in the woods.

November 28 Oaks hold their leaves.

November 30 Watch for robins in wild cherries, dogwood, sumac, and viburnum.

December 2013

December 6 First snows around this date.

December 9 Witch hazel blooms, the last flowering shrub to blossom.

December 15 Watch for the tunnels of boring beetles beneath loose bark.

December 17 Full moon. The Oak Moon (English medieval).

December 19 The buds of spring are set. Look for the variation of shapes and colors.

December 21 Winter solstice. Longest night of the year.

December 25 Look for evergreen Christmas ferns in the snowy woods.

January 2014

January 1 Begin the New Year with a winter walk.

January 4 Watch for pine grosbeaks and redpolls in evergreens and birches.

January 8 Look for the bright stems of red osier dogwood along stone walls and roadsides.

January 12 January thaw. Around this date a warming trend often occurs. Watch for flights of bees and other insects.

January 14 Stoneflies bask on exposed rocks near running water.

January 15 Full moon. The Quiet Moon (Celtic).

January 18 Watch for fox and bobcat tracks.

January 30 Great horned owls begin to nest about this time.

February 2014

February 2 Groundhog Day. According to legend, woodchucks predict an early spring if they don't see shadow; a longer winter if they do.

February 10 If there's a snowmelt, look for traces of tunnels dug by voles and shrews.

February 14 Skunks emerge to mate about this time of year. Listen for their squabbles late at night.

February 15 Full moon. The Moon When Trees Pop (Dakota Sioux).

February 17 Starlings begin their whistling about this time. Listen also for the spring songs of chickadees and titmice.

February 20 On warm sunny days, look for signs of snowfleas at the bases of tree trunks, like a sprinkling of pepper on the snow.

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