

The Temperate Times

Newsletter of the Northeast Temperate Network

Volume 9, Issue 1 - Winter 2016

Red Alert for Red Pines

A recently released report authored by current and former NETN forest health crew members explores the deleterious effects that the Red pine scale (*Matsucoccus matsumurae*) could have on Acadia National Park's and other regional red pine trees. Red pine scale is an invasive insect from Japan that can kill red pine trees, a native pine of the northeastern U.S. The scales likely came to this country on exotic pines from Asia planted at the New York World's Fair in 1939. The first sign of problems was when red pines began dying in Connecticut in the 1940's, though it wasn't until as recently as the past few years that the insects have emerged as a problem for the rest of the Northeast. It was discovered in NH in 2012, Maine in 2014, and in Vermont in 2015. The scale was confirmed on Maine's Mount Desert Island (MDI) in September of 2014. The reasons for this recent rapid spread are unknown, though milder winters from climate change are likely playing a role. As with most complex natural ecosystem dynamics - there are likely many things influencing the sudden acceleration of the insect-caused mortality.

Red Pines, cont. page 2.

Bird, Pollinator, & Wildlife Habitat Not Just for National Parks Anymore.

Among the many reasons NETN monitors landbird populations is that they are an important component of a park's natural resource community and can be sensitive to sudden or rapid ecosystem changes. On the other side of the coin, they can also be indicators of healthy and diverse ecosystems. Management activities aimed at preserving and enhancing habitat for migratory birds can have the added benefit of preserving entire ecosystems and their associated ecosystem services (CO₂ sinks, erosion control, oxygen providers, run-off control, etc). Most national parks are limited as to what they can do with regards to direct forest management, but one of NETN's member parks - Marsh-Billings-Rockefeller NHP in central Vermont has a little more leeway with regards to how its forests are managed. Home to one of the oldest continually managed forests in the country, the park was founded with a mandate to continue the history of hands-on forest management of its roughly 550 acre forest.

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Winter takes hold in
Acadia National Park.
Amy Meredith photo.



Red pine die off on Acadia's Norumbega Mountain. NPS photo.

The tiny, reddish brown insects are thought to spread by bird nest building activity, on the backs of squirrels, or by the insects crawling along branches that reach the limbs of other close by red pines.

Red pines inhabit MDI in patchy stands of varying densities, sizes, and age classes throughout Acadia National Park as well as non-federal lands. Two areas of symptomatic or dead trees were believed to be the epicenters of the infestation, while stands in other parts of the park show little if any symptoms of red pine scale. The goals of the recent study were to determine the distribution of both red pine and the red pine scale infestation, and establish permanent plots that can be used in the future to track the health and changes in red pine stands within the park over time. Study authors assessed red pine presence and condition from 132 observation points in October 2014, and established and sampled 63 permanent variable-radius plots. Field work was conducted in the winter when the scale is dormant to reduce risk of spreading it. Red pine scale was detected on 30 of 52 twig samples collected from permanent monitoring plots and individual trees along roads and trails. Findings showed that the scale is more widely distributed across MDI than originally thought - up to 7 miles from the epicenters of the infestation. Signs and symptoms of red pine scale were seen on all age and size classes of red pine, and even some trees that had no visible symptoms were even infested. Dead red pine trees have a very low level of decay, and with scattered trails and roads throughout the infested areas report authors predict that few trees will become hazards in the

next 3 to 5 years. However, repeat surveys are needed in the next few years to accurately assess the rate of decay and hazard potential of standing dead red pines. A baseline of regeneration in red pine stands has been collected to enable managers to track changes in forest dynamics, although deep snow affected researcher's ability to fully quantify the understory. Long-term monitoring of the red pine plots established for this study can be used to document the spread of red pine scale across the landscape as well as subsequent changes in forest composition as a result of widespread red pine mortality. Additional work is needed to analyze tree cores that were collected to determine if the timing of the infestation and red pine health decline are reflected within them.

In recent years, park managers have received many questions from neighbors and the visiting public regarding dead and dying red pine trees, especially those trees on the park's Norumbega Mountain. For some, dead and dying trees detract from the perceived beauty of a landscape. Many of Acadia National Park's red pine stands are very visible from boats off-shore and along highways, carriage roads, lake shores, or on exposed mountainsides. One response to stand mortality that was used in the past, exemplified by actions taken in Acadia after the widespread fire of 1947, would be to remove dead trees and present a manicured appearance to park visitors. The best available science, however, shows that this practice removes nutrients and potential habitat from the ecosystem and would not meet current NPS management policies. Hazard trees are still of concern however and are one of the most pressing logistical problems that will result from widespread red pine die-off. Hazard trees are trees that are both structurally weak and located in areas where people (or property) could be injured should the trees fall unexpectedly. There are currently dead red pines in the Norumbega Mountain area, as well as across the Somes Sound near St. Sauveur and Acadia Mountains that could fall on power lines or roads. Fortunately, so far very little sign of structural decay has been found in standing dead red pines. However, almost a quarter of dead red pines did show signs of woodpecker damage, a sure sign that insect recyclers have begun breaking down the tree snags. It will be helpful to track the rate of decay in future years to better be able to predict when a stand may begin to experience tree-fall, and to plan for future hazard tree management related to red pine scale infestations. Preliminary data suggests that dead red pines might remain sound for several years before falling. This conclusion is supported by the fact that red pines usually have a well-developed root system that is both spreading and moderately deep, making them firm against wind and unlikely to be blown down, especially in stands that have a solid makeup of healthy trees in the canopy. There are little data specific to the rate of red pine decay, but similar species such as lodgepole pines killed by mountain pine beetles did not experience significant decay for 15-20 years in dry sites. However, basal decay developed between 4 - 7 years after death, after which the tree was more likely to fall. These numbers indicate the likelihood that red pines that have succumbed to red pine scale recently should not pose an

Red Pines, cont. page 3.



Top to bottom: red pine with discolored needles; adult emergence from intermediate stage; male cocoons and female ovisacs. Maine Forest Service photos.

immediate threat, giving park managers several years to develop a response plan. Due to limited staff time, much of the data collected during the 2014 winter field season has yet to be analyzed. Important questions about red pine stands in the park remain. How does canopy closure differ between healthy stands and symptomatic stands? Is the timing of the initial infestation reflected in tree rings? Is there a relationship between red pine density and type and amount of regeneration? Will this insect pest cause high density red pine stands to experience a different succession than mixed stands following red pine mortality? Many of the most interesting lines of inquiry appertain to the ecological response of the forest to red pine scale and subsequent consequences. This makes the continuing long-term study of affected and currently unaffected stands of the utmost importance. A baseline has been established and subsequent surveys can track the spread of the scale and monitor forest response.

While this study has provided data on a variety of metrics related to forest health, not all areas of interest could be addressed and included in the protocol. Fire danger related to an increase in fuel load is an area deserving further investigation. The potential impacts that red pine mortality will have on wildlife are also unknown. Many birds and mammals that feed on red pine cones may have to find alternative food sources, while wildlife that finds food in snags or rotting logs may have more feeding opportunities as dead pines decay. It is hoped that this data will provide a foundation of information upon which

to build in the future, both by NPS staff and other researchers interested in the effects of red pine scale on the forests of the park and coastal Maine.

Natural resource agencies throughout the Northeast are looking for help from people who may encounter red pines when in the outdoors. Learning and looking for signs of red pine scale could help slow the spread of this invasive insect. It's still limited to a handful of counties in VT, NH, and ME and concerned citizens who spot suspicious trees should contact their local natural resource agency. The main symptoms to look for are brick red needles starting on the inner parts of the tree and spreading to the tips resulting in tufts of green at the ends of branches. For more information, check out <http://vitalsignsme.org/mission-red-pine-scale>. ^{TT}

Wildlife Tracking Program Expands to Two NETN Parks This Winter.

NETN's Science Communication Specialist Ed Sharron will be leading public wildlife tracking programs at two of NETN's parks this winter. Both Marsh-Billings-Rockefeller NHP and Saint-Gaudens NHS will host 2 to 4-hr tracking programs from January through March.

Both parks offer ample and diverse habitat to be explored that provide homes for many different kinds of animals. Sign encountered on past treks include mink, fisher, bobcat, fox, coyote, porcupine, otter, turkey, mice, deer, owls, and several other critters of the forest.

Tracking involves being aware of all the signs that animals leave behind (not just tracks) for you to follow and learn from. Tracking offers that rare glimpse into the life of a wild animal. A skilled tracker can tell many things about an animal from its sign, including the kind of travelling it was doing (walking, running, stalking, trotting, etc.), what its mood may have been, and what it recently had to eat if scat (droppings) are found.

Tracking is also a scientifically viable way to monitor wildlife populations in parks and other natural areas. The



All tracks tell a story. Here, a lucky mink emerges through a hole in the ice of a frozen brook with a meal, perhaps a frog it dug out of the mud, hanging from the left side of its mouth. Ed Sharron photo.



The group examines a beautiful set of red fox tracks at Marsh-Billings-Rockefeller NHP during a 2015 tracking program. NPS photo.

Appalachian National Scenic Trail used tracking to get a better grip on Canada Lynx populations in the northern reaches of the trail in Maine, and deer-pellet surveys are another tool in the tool bag of some park managers to better understand deer populations.

The program begins with an indoor presentation on tracking basics, with videos and sound recordings, and then the group heads out into the park to find some tracks and sign.

Check in on park websites or follow NETN on Facebook for exact times and locations of this year's programs. ^{TT}

Big Changes in NETN Staffing

There has been a major shake-up of NETN staff over the last several months. The biggest change for the network is the moving on of long-time Program Manager Brian Mitchell. One region's loss is another one's gain, as Brian recently



Brian at work in Acadia's intertidal. NPS image.

accepted the Regional Program Manager for I&M's Southeast Region.

Brian helped to guide NETN through most of its protocols coming on-line over the past decade. His strong leadership, amazing organizational skills, and "snarky" (his words) sense of humor have shaped the Network into the robust monitoring program that is today. His legendary bike-commuting through Nor'easters and in 20 below-zero weather will live in the annals of NETN history forever.

Another goodbye the Network had to make recently is the departure of the forest health crew leader Jesse Wheeler. Jesse started with the forest crew in 2010. He came to the Network from Antioch where he studied plant ecology in salt marshes. He is now the exotic plant management program lead in Acadia NP. His strong and laid-back leadership will be missed, but it is good to still have him stationed at one of NETN's parks!

The water quality crew also has seen some changes over the recent past. First, Karla Burnley has joined the team this past monitoring season as the new Hydrologic Technician. Karla had a long and



Liza helps to install some water quality monitoring equipment in Pogue Brook. NPS image.

impressive career with the USGS doing water monitoring work and NETN has certainly already benefitted from her considerable knowledge and skills about running a water-tight water-quality monitoring program. We also had to say goodbye to water-quality monitoring tech Liza McElroy.

Liza did a fantastic job to help keep the water-quality monitoring ship afloat during a period of transition. Liza is also an amazing artist and helped the network and Marsh-Billings-Rockefeller NHP with some beautiful projects during her time here. She will be moving back to Alaska soon and we all wish her the best of luck in all her future endeavors. TT

Lessons Learned from a Decade of Forest Health Monitoring in NETN

Co-written with NETN Ecologist Kate Miller

As NETN's Plant Ecologist, I have spent that past 10 years monitoring forest health in national parks across the eastern U.S. With a solid decade of monitoring under our belts, we have a good understanding of the health of, and threats to, forests in NETN parks. Forest conditions for Network parks vary from site to site, but a general rule of thumb is that more northerly parks tend to be in better condition and suffer less from regional stressors. The overall good news for all parks is that they preserve areas of older forest habitat that are of regional significance, consistently housing more coarse woody debris, higher densities of large trees, and higher proportions of late successional forest than surrounding forest lands. That said, our Ecological Integrity Scorecard indicates that many of the parks in NETN have lower levels of coarse woody debris and snags (standing dead trees) than needed to support the full range of wildlife dependent on these features. As park forests continue to develop under natural disturbance regimes, we expect them to become even more important sites of older forest habitat.

The bad news is that forests in NETN parks are threatened or already under attack by a number of serious stressors, including invasive plant species, deer overabundance, exotic forest pests, atmospheric deposition, and climate change. Issues of deer overabundance and invasive species, which tend to go hand-in-hand, are most extreme in New Jersey's Morristown NHP. As indicated by lack of seedlings, saplings, and even small trees (<8" diameter at breast height), tree regeneration has failed to reach the canopy for many years - possibly decades - in park forests. When natural canopy disturbances do occur (blow downs, etc.), there aren't enough subcanopy trees to fill in the gaps, and the canopy may become sparser over time. On a positive note, we observed a slight recovery in tree regeneration during the 2015 survey in Morristown due to several natural events that lowered deer densities, although this recovery will need to be sustained for many years to successfully regenerate the next cohort of trees into the canopy. While less extreme than in Morristown, we also see considerable impacts from high deer levels in New York's Roosevelt-Vanderbilt NHS and Saratoga NHP, as well as Connecticut's Weir Farm NHS.



A canopy gap in the forest of Morristown NHP quickly fills in with invasive Japanese Barberry shrubs. NPS image.

Forests, cont. page 5.

Not coincidentally, invasive species are also abundant at these parks. Exotic shrub thickets, which thrive both in high deer densities and in disturbed soils (e.g., historically plowed fields), are causing problems throughout NETN parks, including in Morristown NHP, Minute-Man NHP (Massachusetts), and Saratoga NHP. Invasive species and deer are less abundant in NETN's more northern parks, including Acadia NP (Maine), Marsh-Billings-Rockefeller NHP (Vermont), and Saint-Gaudens NHS (New Hampshire), and we encourage managers to try their best keep it that way!

Two primary concerns relative to atmospheric deposition and forest health are Nitrogen (N) saturation and soil acidification. Excess N, which typically is a limiting nutrient in land-based ecosystems, can lead to leaching of soil nutrients and further impacts as N is exported into lakes and streams. Acidification, which is the process where soils become more acidic, is of most concern on poorly buffered soils. In addition to lowering soil pH, acidification can alter soil chemical properties such as increasing availability of Aluminum, which is toxic to plants. Both N saturation and acidification can weaken trees, making them more susceptible to other stresses like drought. We haven't monitored forests for long enough to know how forest soils and vegetation in NETN are responding to lowered deposition rates as a result of the Clean Air Act. However, we do know which parks are most vulnerable to N saturation and acidification, and a lot of it has to do with carbon content of the soils. In Acadia NP, where soils are poorly buffered and very carbon-rich, forests are most susceptible to acidification, and robust to N saturation. In contrast, soils in Saratoga NHP are well-buffered against acidification, but their low Carbon (C) content makes them highly vulnerable to N saturation. In general, soils that are low in C, including the historically plowed soils common in many NETN parks, are vulnerable to N saturation. Most other NETN parks tend to be intermediately vulnerable to acidification.

While we are unsure exactly how climate change will impact forests in NETN parks, we are certain that impacts will happen, if they are not already happening. In the short-term (years to decades), reducing non-climate stressors in parks, such as invasive plant species and exotic forest pests, is one of the best management actions park managers can take to ensure that forests are resilient for responding and adapting to a changing climate. In the long-term, climate change adaptation will be necessary, and managers should be starting the process of planning for climate change adaptation now. Beyond reduction of non-climate stressors, my primary recommendation to park managers in the short-term is to take a largely hands-off approach to forest management. In other words, park managers should allow forests to develop under natural processes, such as succession and natural disturbance, and should only intervene when natural processes are disrupted by a stressor, such as overabundance of deer. In Marsh-Billings-Rockefeller NHP, where sustainable timber harvesting is embedded in park management objectives, we recommend managers find ways to maintain or increase tree species diversity and complex forest structure through their forestry operations. Given that selective

forestry can reduce tree species diversity and forest structure, managing forests to counteract this trend could be a challenge for the park.

I encourage land managers, from small private landowners to land management agencies, to take a similar hands-off approach, particularly if their land is not managed for timber production. Over the years, I have observed many a well-intentioned landowner who, through trying to be a good land steward, takes actions that impair rather than improve ecosystem health. Many of these mistakes relate to the misconception that forests need to be "cleaned up" to be healthy. My main objective in writing this article is to dispel this myth, and to proclaim that healthy forests are messy! I also offer the following guidelines that I abide by on my own property, and that I hope are useful for others.

- **Dead wood is good wood.** While they may look messy to an untrained eye, dead and dying trees are important features of a healthy forest. As stated by Franklin et al. (1987), "At the time a tree dies, it has only partially fulfilled its potential ecological function". Dead standing (snags) and down wood provide crucial habitat for many species of birds, small mammals, amphibians, insects, mosses, and fungi. Down wood also provides important habitat for tree seedlings to germinate. The tip-up mounds created by downed trees provide additional regeneration sites for tree seedlings, and are important habitat for small mammals and ground-nesting birds. In fact, the Winter Wren, whose exuberant and melodious trills are one of the first songs of spring, is a species that specializes in nesting in the root-wads of downed trees. Where possible, leave dying trees and dead wood to persist in the forest.

- **Encourage native species.** Invasive species are a major threat to the health of our northern forests. Refraining from planting non-native species, and removing invasive species that are already present are some of the best ways to ensure a healthy forest. Personally, I have been battling a stand of oriental bittersweet for the last 5 years on my property. There are a number of excellent websites that provide useful information on how to identify and



The diminutive and boisterous Winter Wren often builds its nest in the tipped-up root wads of trees. Kelly Colgan Azar photo. Inset image: Kyle Jones.

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manage invasive plants, including the Invasive Plant Atlas of New England (<https://www.eddmaps.org/ipane/>), the New York Invasive Species Information (<http://www.nyis.info/>), and the New Jersey Invasive Species Strike Team (<http://www.njisst.org/>).

• **Keep the good bugs happy and the bad bugs away.** Insect pollinators are critical to a functioning ecosystem, vital to farmers, and are extremely vulnerable to pesticides. Following organic gardening practices and planting a diversity of native flowering plants is a good and proven way to keeping pollinators happy. More information on pollinator conservation can be found here: <http://www.xerces.org/pollinators-northeast-region/>.

Exotic forest pests, which pose a big threat to several very common species in the northeast, are primarily spread by the movement of firewood. For more information about specific forest pests and how to slow their spread, check out the U.S. Forest Service Northern Research Station's Invasive Species website (http://www.nrs.fs.fed.us/disturbance/invasive_species/). Many states also have informative websites specific to pests in their state.

• **Protect the soil.** Healthy soils are important for ensuring healthy forests. Earthworms, which are not native to the northeastern US, may be good for the garden, but are not good for northern forests. Leaf litter, which supplies nutrients to



Exotic forest pests, such as the emerald ash borer, are often accidentally spread by people transporting firewood from state to state. USDA image.

plants and buffers the underlying soil from desiccation, can be quickly consumed by earthworms. Many beloved understory plants, including trout lily and

trilliums, are dependent on a thick layer of leaf litter, and can quickly decline after earthworm introduction. Seedlings of common tree species, including sugar maple and northern red oak, are also sensitive to earthworms. Earthworms are often used as fishing bait, and may also come in compost, mulching, or other nursery material. To avoid further spread of earthworms in the northeast, unused bait should go in the trash, not in the woods. Also avoid dumping excess mulching or compost containing worms in the forest. For more information, check out the Great Lakes Worm Watch program's website (<http://www.nrri.umn.edu/worms/>).

• **Maintain forest buffers.** Forests can slow the movement and improve the quality of water flowing into streams, ponds and wetlands. Forested buffers also provide shade for streams, which improves habitat for cold-water fish species like brook trout. Forest buffers are important for many species of amphibians that breed in aquatic habitats, but spend most of the year in upland habitats. Maintaining forest buffers adjacent to streams, ponds and wetlands can go a long way in protecting aquatic ecosystems and the species dependent on these habitats.

• **Above all else, just let it be.** Doing nothing is a perfectly acceptable approach to managing forests where timber production is not the primary objective, and where stressors are not impeding natural processes. Nature typically does not require human intervention to be a healthy functioning ecosystem. Allowing natural processes, such as disturbances and dying trees, to occur without human interference is good practice for northeastern forests.

Following the above guidelines will promote forest health across the northeast, and I encourage interested readers to check out the links provided to learn more about sound land stewardship. For more information on the Network park forests, visit NETN's website (go.nps.gov/netn), which houses numerous 2-page resource briefs, annual technical reports, and detailed monitoring protocols for the programs we are currently implementing. We also have a Facebook page where we post updates from field crews and announce public events. TT

Record El Niño Brings Warm Winter Weather and Challenges to the Northeast

As most readers will remember, the winter of 2014-2015 brought with it long stretches of below average cold and above average snowfall to the northeastern United States. February of 2015 went down in the record books as the second-coldest February on record for both the region and for eight individual states, including Pennsylvania, New York and all six New England states. Boston had it's snowiest winter ever getting buried under 112 inches of the white stuff. Due to a record-tying El Niño event and other climatological factors, the winter of 2015-2016 has so far been about as far from those conditions as possible, but changes could be headed our way before we see those first spring wildflowers. El Niño is associated with a warming of sea surface temperatures in the tropical regions of the Pacific Ocean, primarily to the west of South America. When ocean water

temperatures in this region are warmer than normal, it impacts weather patterns around the world, especially during the late fall and winter. For reasons still not well understood this natural phenomenon happens somewhere between every 2 to 7 years when prevailing trade winds, which drive the direction and force of ocean currents, slow down. As a result, cold water from the depths doesn't get mixed with surface water, the ocean's surface temperature rises, and global weather patterns are affected. The current El Niño has tied the strongest previous El Niño on record in 1997-1998 (record keeping began in 1950), and appears to have peaked according to recently released NOAA data. El Niño's aren't the only climate-related force that influences the Northeast's weather though, and a stronger polar

El Niño cont. page 7.



Many amphibians spend the winters hibernating under Marsh-Billings-Rockefeller NHP's Pogue. NPS image.

vortex has so far also been keeping us warmer this year. The polar vortex is a ring of cold winds that flow around the North Pole. Low pressure forces these winds — and their arctic air — to stay near the pole. High pressure in the Arctic can push the winds away from the region and down to the mid-latitude regions of the planet. Those fluctuations make up what's known as the Arctic Oscillation (AO).

When pressure at the Arctic is exceptionally high, the AO is “negative,” when pressure is low, it is “positive.” The cold weather in the early months of 2014 was largely attributed to the shifting of the polar vortex away from the Arctic and toward the equator — a negative AO. The AO has been exceptionally positive for the early part of the winter, resulting in a stronger than average polar vortex and keeping the coldest air pinned up in the Arctic. Recent weather has already shown that this pattern could shift and the rest of the winter could be very different for December's record warmth. Predicting weather is always challenging, and throwing El Niño, Arctic Oscillation, and long-term climate change into the mix makes it even more so, but there exists a good possibility for this winter's weather pattern to turn colder and snowier as the season progresses into February and early March.

The record-breaking warmth of early winter came on the heels of the warmest November globally and capped a year in which every state in the Lower 48 was warmer than average. December 2015 was also both the warmest and wettest December on record in the contiguous United States

according to NOAA. Almost 12,000 daily warm records were tied or broken with hundreds of cities from the Plains to the East Coast smashing their previous records.

Warm winter temps such as these can have big impacts on wildlife in the Northeast if they persist, both positive and negative. White-tailed deer often thrive in years with little snow and warm temperatures leading to a bigger herd the following summer. But their larger cousins, moose, suffer from an extended warmer winter since winter ticks, a significant factor in moose mortality, proliferate under such conditions. Climate change is likely the biggest factor causing shorter, warmer winters that are helping winter ticks decimate northeastern moose populations. A single moose can play host to 75,000 ticks which can drain blood and energy reserves and lead to death, with calves being most likely to perish.

Many other animals may also suffer during warmer winters. Toads and bees that winter beneath the frost line will have less snow to insulate the soil above leading to a higher risk of freezing when temps do drop. Warm winters can also lead to early springs and accelerated blooming times of pollen producing food sources for bumble bees and other pollinators. If insects emergence from hibernation is out-of-sync, much of their food supplies may have already passed by. Some insects can use up their energy reserves when alternating periods of warm and freezing temps accelerates their metabolisms as they repeatedly come out of winter diapause - a hibernation-like, dormant state that allows insects to otherwise withstand freezing temperatures.

One troublesome insect that does benefit from warm winters is the invasive winter moth. On the watch-list of several NETN parks, this European species is usually active from November into January, laying low during deep freezes. A mild winter however means an extended mating season and come spring there are more moths to consume the leaves of maple, oak, and fruit trees. On the plus side, many native pond-bottom hibernators (green frogs, painted turtles, pickerel frogs, etc.), many of which inhabit NETN waterbodies, also benefit from a mild winter since ponds are less likely to freeze decreasing the risk of hypoxia (oxygen deprivation).

Time will tell what the remainder of the 2015-2016 winter will bring. No matter whether it is cold and snowy or warm and rainy, some species will make out better than others.^{TT}

Habitat from page 1.

Like many forests in the northeast, the park's woodlands are relatively young and lack much of the complex and dynamic features that would be found in typical forests of much greater age. Using data provided by two of NETN's long-term monitoring programs (forest health and breeding landbirds) the park is taking direct action in managing the forest to improve overall ecosystem function, encourage healthy tree stands, and enhance bird habitat availability.

You don't need to be a national park manager, however, to help improve bird and wildlife habitat. In point of fact many scientists are concerned our natural areas — parks, preserves, and national parks — aren't enough to sustainably support

natural ecosystems long-term. Every landowner has the opportunity to contribute to a healthier and more complete ecosystem by making changes to the ways they take care of their properties - whether they be several hundred acres or several hundred square feet. For larger landowners engaged in forest management, several Audubon groups in the northeast including Vermont Audubon and Mass Audubon work with area foresters to help landowners integrate the practice of timber management with songbird habitat improvement. Landowners with relatively small pieces of land can also create better bird habitat in their yards as scientists are finding out

Habitat, cont. page 8.



The typical view a migratory songbird has when looking for a suitable place to raise their young when flying over much of the suburban landscape in America: a predominance of manicured lawns, smatterings of trees, and a low diversity of native plants or shrubbery. Google Earth image.

more and more that even habitat improvements to small yards can have a meaningful impact on wildlife. Birds, butterflies, and other insects help control pests and seed and pollinate the food we eat - but human actions have seriously impacted their numbers. According to the National Audubon Society, the 20 birds on the Common Birds in Decline list have lost at least half of their populations in the past 40 years due to residential and industrial development, and Monarch Watch estimates that 6,000 acres of potential monarch/pollinator habitat a day are lost in the U.S. to development (2.2 million acres per year) with a total of about 147 million acres being lost since the program began in 1992 – an area 4 times the size of Illinois. As development pressures continue to increase along bird migration corridors and impinge upon pollinator and wildlife habitat, scientists, conservation groups, and gardening clubs are encouraging people to forsake much of their relatively lifeless lawns and to plant native shrubs and plants that have many benefits to landowner and the environment alike.

Ironically, maintaining a meticulous, weed-less lawn is one of the least “green” things you can do in your yard. Reducing the size of manicured lawns means less water needed to irrigate it as well as less equipment and fossil fuels (gas for the mowers, weed-whackers, and leaf blowers, fertilizers, pesticides, seed spreaders, lawn aerators, sprinklers, hoses, etc.) needed to maintain it. A Yale University study estimated that the U.S. uses more than 600 million gallons of gas to mow and trim lawns each year. The amount of natural gas required to make approximately 200 bags of lawn fertilizer would heat your home for a year. Each 40-pound bag contains the fossil fuel equivalent of about 2.5-3 gallons of gasoline. Transporting these bags of fertilizer from the factory to the store and to your home requires additional fuel.

In the U.S. over 45 million acres—more than 950 times the size of Acadia National Park—are carpeted with lawns, and

about 500 square miles of turfgrass are added every year. Lawn maintenance can be a huge undertaking of both time and money as the average U.S. homeowner spends about 40 hours a year mowing grass and collectively spends over \$40 billion on lawn care. The U.S. Environmental Protection Agency estimates that 80 million households spread about 90 million pounds of herbicides and pesticides on lawns in a year (more than 10X used for farming), which can seep or be washed into local aquifers, ponds and streams impacting human health and damaging wildlife food sources. Lawns are also water intensive.

According to The Handbook of Water Use and Conservation, roughly 2 trillion gallons of water are used on lawns annually - half of which isn't even taken up by the grass as it is evaporated or runs-off due to over-watering.

Replacing some lawn with a variety of native plants, shrubs, and trees of differing size classes is a great way to increase the health and utility of your property to native birds, insects, and wildlife. When you take a tour of your yard and look at the leaves of some of the nonnative ornamentals you may have planted, you'll likely notice that they show little to no signs of insects feeding on them - unlike the neighboring indigenous maples, oaks, cherries, willows, etc. While this may be a bit more aesthetically pleasing, if these are all your yard has to offer it can be a virtual food desert for native birds - birds that have often flown thousands of miles to feast on what once was an incredible bounty of insects that lived in relative balance with native plants. Healthy bird communities coincide directly with healthy insect populations. More than 9 out of every 10 terrestrial North American birds raise their young on insects, mostly caterpillars which are rich in fats and proteins. As one example, the Carolina Chickadee requires a stunning 390 to 570 caterpillars *per day* to feed its clutch of 4 to 6 chicks in the 16 day time-span from when they hatch to when they fledge. This totals about 9,000 caterpillars just to raise one batch of Chickadees. And almost all the foraging for those caterpillars happens within 50 meters of the nest, demonstrating why having a lot of caterpillars in your yard would benefit these and many other birds. And it's not just birds that need insect biomass, many species of spiders, frogs, toads, bats, rodents, foxes and even bears all need insects and the larval host plants that support them to survive. If you enjoy trees and are looking to get the biggest ‘bang for the buck’ to help your local birds and wildlife, keep or plant more oak trees, which lead the list of top 20 trees species that support the most caterpillars (534 species of the wrigglers). Cherries and willows are also highly valuable for birds and wildlife. Selecting plants that host the insects birds eat is only one piece of a healthy bird habitat

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A Song Sparrow prepares to bring a mouthful of caterpillars and other insects to its nestlings. Ed Sharron photo.

mosaic however. Plants that provide fruits and seeds give birds much needed energy during migration, making them equally essential. Plants that provide shelter during extreme weather, nesting structure, and safety from predators are also ideal. You can find plants that are native to your area by going to: <http://findnativeplants.com/>.

Property owners have always affected, both in positive and negative ways, the health of the ecosystem that makes-up and surrounds their yards. About 85 percent of all invasive woody plants that are spreading through wild areas originally escaped from home gardens. Some nonnative invasive species do indeed provide birds with food but they also harm the surrounding ecosystem. Porcelainberry (or Amur Peppervine - *Ampelopsis brevipedunculata*) is a species on many of NETN's park invasive species early detection lists because of the way it can take over woodlands and smother native plants. Many birds, unfortunately, devour the berries of these and other invasives helping to spread destructive plants far away from the source. Porcelainberries and other nonnative berries don't pack the nutrient punch that native fruits do either. A study in Rochester, NY revealed the highest fat content and energy densities in fruits that migrant birds ate came from native shrubs.

Another study compared two types of landscapes in southeastern Pennsylvania. One property in each of six pairs had a higher proportion of native plants and the other was more typical with an indigenous tree canopy that shaded lawns rimmed by alien ornamentals and ground covers predominately from Asia. Unsurprisingly, a greater diversity and abundance

of birds and caterpillars was found in the yards containing naturally occurring plants. What did surprise researchers was just how dependent birds of conservation concern were on native-dominated yards. Wood thrushes, Eastern Towhees, Veeries, and Scarlet Tanagers were eight times more abundant and significantly more diverse on those parcels.

There are several fun and interesting citizen science projects and groups that can help to increase landowner understanding about the roles they play in an ecosystem and guide them to improving their own properties. One particular program that helps people out with this rewarding endeavor is the Cornell Labs Yardmap (<http://content.yardmap.org/>) project that lets landowners use satellite imagery of their properties to view and share habitat improvements that they and others have made and to get pointers on how to create better habitat in their yards. It's also connected to eBird (a very popular online birding checklist program) so people can keep track of the birds they see on their properties as well.

Another program, called Hummingbirds at Home (<http://www.hummingbirdsathome.org/>), joins Audubon's citizen science programs like the Christmas Bird Count and the Great Backyard Bird Count by enlisting people to log observations of hummingbirds on flowers and note blooming patterns. Several recent studies indicate that the arrival of hummingbirds on their foraging grounds is getting out of sync with food availability and flower pollination. The goal of the Hummingbirds at Home program is to help scientists better understand what's going on, and to find ways everyday citizens can help.

Evidence continues to mount that any landowner can and indeed must play a role in preserving bird habitats. People wanting to make a difference need not completely tear up their entire lawns this spring as a measurable difference can be achieved almost immediately by planting even a single native plant, tree, or shrub in your yard. Many eco-minded landscapists recommend starting slowly and making a plan - a perfect winter activity. There are many books available that give helpful advice on how to reduce your lawns with pointers on the kinds of plants, shrubs, and trees to plant for your part of the country and by habitat type.

With ever-increasing pressures on native birds, insects, and animals - property owners have become important players in the management of our nation's wildlife. The actions of many individuals can make a big difference by enhancing biodiversity of native plants and animals of North America and the ecosystems that sustain them.^{TT}



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