

Western forests have suffered from drought and mountain beetle infestations—evident in stands of deadwood on the public lands shown in the background of this scene outside Bozeman, Montana. Gallatin Valley Land Trust holds an easement on the lands in the foreground.

GALLATIN VALLEY LAND TRUST AND LOUISE JOHNS

Unwelcome Arrivals:

Facing Climate-Driven Stewardship Challenges

BY MARINA SCHAUFFLER

Along the Chesapeake Bay's low-lying shores, rising waters have begun reclaiming farmland. One conservation easement landowner there says that on old aerial photographs of his property, "You can see former cornfields that are now marsh." In one spot alone he's seen marsh reclaim more than 20 feet of land.

"Owners of easement lands are starting to have issues with erosion," says Kate Patton, executive director of the accredited Lower Shore Land Trust in Maryland. "We're on the cusp of further stewardship issues and we are now planning for those."

As climate change reshapes ecosystems, land trust staff and volunteers around the country are attempting constructive responses and trying to help landowners adapt. Many challenges require the help of scientists as land managers confront problems that are new to their regions

or occurring on an unprecedented scale. Increasingly, they're forced to ask—in one's words—"How do we put back the resiliency in the landscape?"

More Salt, Less Soil

Rising waters are causing increased erosion and saltwater intrusion along the Chesapeake Bay. In a single Maryland county (Somerset), researchers estimate that 860 acres of farmland were inundated in the past decade. According to NASA Earth Observatory, the bay's water level is projected to keep rising at least one half-inch per year, a vertical increase that could amount to roughly 50 horizontal inches on flat land.

Continued inundation complicates the work of drafting and monitoring conservation easements, and increases the need to ground them in scientific data. Conservation easements prepared by the Maryland Department of Natural



After a series of hot dry days, salt from saltwater intrusion has moved up through the soil profile and precipitated as a crust on the surface of this Maryland farm field near the Chesapeake Bay.

DANI WEISSMAN/UNIVERSITY OF MARYLAND (2018)

Resources (DNR) consider whether “a candidate for conservation will be inundated, whether the proposed easement terms can help wildlife habitat to migrate inland and whether the easement will foster community resiliency to climate change impacts,” notes Stacy Schaefer, who works in land acquisition for the Maryland DNR.

At the accredited Virginia Eastern Shore Land Trust, Executive Director Hali Plourde-Rogers has begun sending more conservation landowners to the state’s Shoreline Erosion Advisory Service, in which staff members visit sites and outline options for living shorelines (see “Enhancing Natural Protections against Rising Waters,” *Saving Land*, Winter 2019).

Some landowners are finding elevated salt levels in their soils, Patton says. Bay water can enter farm fields or the surrounding drainage ditches due to storm surge or “king tides,” astronomically high tides that occur several times each year.

Brackish water can percolate up through soil, forcing air out of soil pores and changing its chemical composition—killing off plants and agricultural crops. This process can also release nitrogen and phosphorus into waterways, raising the risk of algal blooms.

Nearly a tenth of the U.S. coastline is vulnerable to saltwater intrusion, according to a 2016 study published in the journal *Science* (<https://science.sciencemag.org/content/353/6300/705>). On the Delmarva Peninsula, notes Dani Weissman, a doctoral researcher at the University of Maryland’s Agroecology Lab, the problem is “incredibly widespread”—visible even on Google Earth imagery.

Asked what people can do, Weissman says, “There’s not a lot; that’s the problem.” Researchers are experimenting to see if farmers could grow salt-tolerant crops like sorghum, switchgrass and salt marsh hay. The latter species might help fields transition to tidal marshes, researchers theorize, helping retain nutrients and sediment before full inundation.



MATT CHAMPLIN

New York’s Finger Lakes Land Trust is working to combat harmful algal blooms like these in Owasco Lake.

The Agroecology Lab is just now getting enough data on which to start basing recommendations, and has begun sharing its findings with the public. “The science hasn’t made it into specific management guidance for farmers or landowners just yet,” Weissman says, “but that needs to happen soon.”

“Plumbing Projects”

Given the new challenges that climate change presents for water quality and quantity, the accredited Finger Lakes Land Trust in upstate New York is “paying more attention than ever to projects driven by water quality,” says Executive Director Andrew Zepp. “Trends indicate that the region is experiencing higher surface water temperatures and more intense rain events that wash nutrients from farmland and residential properties into the lakes,” he notes.

Phosphorus, which remains inactive in cold waters, can in warmer waters fuel blooms of cyanobacteria, commonly called blue-green algae, which causes skin, eye

and throat irritation and nausea in humans and other mammals. With climate change warming lake waters, harmful algal blooms have occurred recently in all of the Finger Lakes, either as localized outbreaks or lake-wide events—posing a threat to tourism, wildlife and drinking water (the lakes are a water source for roughly a million people).

“We’re getting involved in landscape-scale plumbing projects,” Zepp notes, to combat runoff of phosphorus and nitrogen. FLLT is working “to put kinks back into streams, create stormwater detention basins and restore wetlands and vernal pools,” slowing and filtering nutrient runoff before it reaches the lakes.

FLLT has strengthened its relationships with lake associations and county soil and water conservation districts, engaging their expertise to help area municipalities in building the capacity needed to complete local runoff mitigation projects.

New York state created a source water protection fund that is helping land trusts

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acquire more acreage in vulnerable watersheds, but funding work to implement and monitor local mitigation remains difficult. And each new measure must be designed “to withstand storm events that are getting more extreme,” Zepp says. “This is really challenging stuff.”

“Like Medicine for the Landscape”

In drought-stricken parts of the West, the scarcity of water and risks of fire are reshaping approaches to land management. Increasingly, conservation groups are working to educate landowners about how to reduce the risk of damaging megafires that endanger human communities, produce excessive carbon emissions, hasten erosion and damage water quality.

For roughly a century in California there’s been an emphasis on avoiding fire, leading to overstocked forests with dense understory growth, explains Autumn Gronborg, forest restoration project manager with American River Conservancy. In the Sierra Nevada, forests typically have 900 to 1,300 trees per acre now compared to a historical density of between 40 and 100 trees per acre.

To reduce what Gronborg calls that “heavy fuel load in a fire-driven ecosystem,” conservation landowners are starting to use a

combination of ecological forestry techniques (such as thinning the understory and smaller or mid-size trees, leaving the larger trees) and prescribed burns.

There are many “different flavors of fire,” says Edward Smith, a forest ecologist with The Nature Conservancy (accredited) in California. “Safe levels of intensity can be managed...when prescribing the right conditions—in terms of weather, vegetation, people and equipment.” Prescribed burns can act “like medicine for the landscape,” says Gronborg, and they typically release fewer carbon emissions than megafires. Smith adds, “Reintroducing low- to moderate-intensity fire helps forests realign with the changing climatic regime.”

The Conservancy has teamed up with federal agencies to create a Fire Learning Network (see resources box) and prescribed fire training exchanges, Smith says, “that are giving people a world of exposure to what’s involved in planning for and managing fire.”

Marian Vernon, Sierra meadows adaptation leader with the nonprofit Point Blue Conservation Science, sees “a lot more collaboration within the land trust community and with other natural resource agencies, involving more information-sharing, idea generation and sharing of findings.” But

she’d like to see even more cooperative field research. She says there’s a great need right now “to experiment and monitor the results.”

“The pace and scale at which ecological forestry can be done” is still limited, Gronborg says, by workforce limitations and lack of markets for the thinner-diameter wood products generated. And while contractors hired to manage the burns typically assume liability, many land trusts still have concerns about conducting prescribed burns at the wildland-urban interface.

Gallatin Valley Land Trust (accredited) in Montana is situated where new development intersects with fire-prone ecosystems. Stewardship Director Peter Brown would like to see more conservation easements used there to minimize potential loss of homes and threats to firefighters in future wildfires.

GVLT has shifted from easements that emphasize forest preservation to ones that encompass forest management, he says, “recognizing that’s critical to mediate fire risk and insect infestation.” Brown acknowledges that it’s a “tricky decision-making time for land trusts and landowners” as they seek to maintain their lands’ wildlife and scenic values in the face of “major impacts from drought, insects and disease.” New easement language cites “current allowable tools,” he says, to provide more flexibility for management approaches “tied to ecological processes.”

Many Bugs, Few Solutions

At some land trust preserves around the country, insect invasions are upending ecological processes. Last spring in Robinson Woods, the flagship preserve of the accredited Cape Elizabeth Land Trust (CELT) in Maine, “It was raining caterpillars,” recalls Executive Director Cynthia Krum. Visitors could emerge dripping with the caterpillars of winter moth, an invasive European native without effective natural controls in the U.S. Northeast.

The moths arrived in the forested suburb of Portland nearly a decade ago, on the heels of an infestation around Boston that Russ Hopping, ecology program director with The Trustees of Reservations



Prescribed burning at The Nature Conservancy’s Independence Lake Preserve near Lake Tahoe in October 2018.

EDWARD SMITH/THE NATURE CONSERVANCY



Students from Point Blue's Students and Teachers Restoring A Watershed (STRAW) program help restore creekside habitat on a private ranch. Point Blue is currently testing climate-smart planting palettes in hopes of providing wildlife habitat and food in the face of climate change.

(accredited) in Massachusetts, calls “an absolute horror show.”

Winter moth caterpillars feed primarily off oak and maple leaves, emerging from pupae underground in early December. The females crawl up trunks to lay their eggs in the canopy, where caterpillars hatch in spring to feed on new leaf growth. “Winter moth can’t emerge when ice covers the ground, so there’s a high rate of failure,” says Maine state entomologist Allison Kanoti. But the warmer winter temperatures associated with climate change appear to be supporting the moth’s spread.

Resources

Northern Institute of Applied Climate Science *Adaptation Workbook*: <https://forestadaptation.org/adapt/adaptation-workbook>

Point Blue Conservation Science’s climate-smart restoration resources: www.pointblue.org/tools-and-guidance/management

Fire Learning Network: www.conservationsgateway.org/ConservationPractices/FireLandscapes/FireLearningNetwork/Pages/fire-learning-network.aspx

The Coastal Resilience Network: <https://coastalresilience.org/resources>

As trees around Cape Elizabeth became defoliated, and some began dying off, residents mobilized to band individual trees—wrapping trunks with materials to trap the caterpillars on their upward climb.

Christopher Tullmann, co-chair of CELT’s stewardship committee, says the trust recognized the importance of the “entire town doing something together” and helped coordinate and fund banding efforts.

In 2014 the Maine Forest Service began releases of a biological control, a parasitoid fly that feeds specifically on the winter moth. The flies now are established at the first Cape Elizabeth sites and appear to be killing off some of the moths.

Land trusts are often valuable cooperators in control projects, Kanoti notes. Local conservation groups can reach the public in ways that agencies can’t, she says, spreading key messages through their “caring, engaged visitors and volunteers.”

Parasitoid fly releases in Massachusetts eventually knocked back the winter moth population there, but Kanoti cautions that biological controls can take a decade or more. “It won’t necessarily save the mature trees on the landscape; it’s more likely to be effective in the aftermath forest.” She advises landowners that “active management can help to maintain forest health,” and recommends that thinning occur before anticipated insect infestations so it’s not a concurrent stressor.

As spring arrives, the Cape Elizabeth community is waiting to see what this season will hold. Meanwhile, Hopping has turned his attention to three new insects now invading Massachusetts: the emerald ash borer, southern pine beetle and spotted lantern fly. “I keep trying to find the hope and the solution in all this.”

Planning for Systems

Faced with complex and interconnected climate challenges, land trusts are planning for the effects of climate change on systems and developing strategies to address impacts. “Land trusts are beginning to do vulnerability assessments to determine the threats/impacts of climate change and using tools such as the Northern Institute of Applied Climate Science’s *Adaptation Workbook* to lay out actions to take to address those impacts,” says Kelly Watkinson, Land and Climate Program manager at the Land Trust Alliance. “This helps them both manage their own land and help landowners/communities think through actions.”

While it is impossible to predict all of the potential future impacts of climate change, these tools will help land trusts assess climate-related stewardship threats and help them respond more systematically and effectively to increase the land’s resilience. 🌱

MARINA SCHAUFFLER IS A FREQUENT CONTRIBUTOR TO SAVING LAND.