How Did the Bobcat Cross the Road?

State and local projects are reconnecting a broken landscape.

BY SUSAN SHEA

Bobcats crossing road in New York

GORDON ELLMERS TNC

On a cold winter morning, Jens Hilke trudged through a foot of snow toward the Little River in Waterbury, Vermont. Hilke, a conservation planning biologist with Vermont Fish and Wildlife Department, was followed by his colleague, James Brady, a biologist with Vermont Agency of Transportation (VTrans), who wore a neon-yellow jacket. They stopped at the crest of a steep slope. This was no secluded mountaintop. To their left, cars and trucks rumbled over two tall bridges on Interstate 89's north– and southbound lanes. To their right, traffic whizzed by on Route 2 over another bridge. Spread out below was the Little River and its confluence with the larger Winooski.

These major roads are known barriers to wildlife movement between the Mount Mansfield and Camel's Hump State Forests, as evidenced by the regular presence of dead animals on the highways and by game camera photos. In 2013, as part of a repaving project on Route 2, VTrans worked with Fish and Wildlife to make changes to the underpasses to allow wildlife to cross safely beneath the three bridges.

In this visit to the project, Hilke pointed out a flat area halfway down the slope that was designed specifically for wildlife travel, especially large mammals. To create this passage, and to make it attractive to animals, an excavator had added dirt to fill in and smooth the holes between the loose stone riprap that extends from the bridge abutment to the riverbank. Hooved animals avoid jagged, uneven terrain. The excavator also added soil and formed a flat area that resembles a tote road or a hiking trail running along the side-hill.

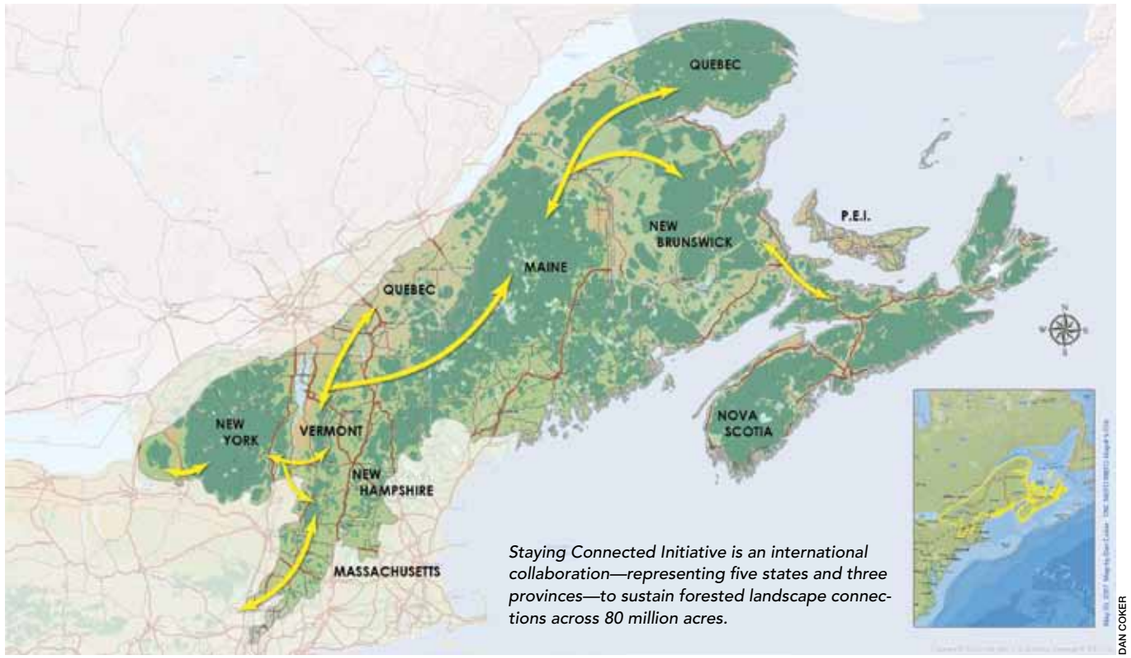
The two scientists scrambled down the slope and followed the shelf. Red fox and bobcat tracks in the fresh snow confirmed that animals were using the underpass. Game cameras mounted on concrete bridge supports—part of Vermont's fleet of 124 cameras used to monitor wildlife interactions with roads—have photographed deer, fishers, and mink. Hilke mentioned that, along with the investment in infrastructure, conservation easements will need to be secured—or zoning changed—to ensure that adjacent private lands between these wildlife crossings and the nearby state forests are not developed.

Close collaboration between transportation and wildlife agencies and other partners is essential for implementing projects like this. Vermont's state agencies have worked together on wildlife crossings for almost two decades. Before VTrans draws up plans, Fish and Wildlife reviews the projects, and its input is incorporated into the design. Education on road ecology for VTrans staff, such as training sessions on wildlife ecology and track identification—run by the not-for-profit organization Keeping Track, Inc., founded in 1996 by naturalist Susan Morse and based in Richmond, VT—have been instrumental in generating support, said Hilke.

Such projects as Vermont's bridge underpasses are being carried out around the Northeast as states work to help wild animals move across developed landscapes. Animals cross roads and other man-made infrastructure, such as railroad tracks, every day, or during certain seasons, to find food, escape predators, search for mates, give birth, or lay eggs. Yearling moose, lynx, and other juveniles need to disperse to new areas. Some snakes seek special underground hibernacula before winter. Larger animals and predators tend to move longer distances than smaller animals, but all need to move. And wildlife movement across a region is important for maintaining gene flow between populations to prevent inbreeding.

A study of bobcats in New Hampshire found a genetic difference between bobcats on the east and west sides of Interstate 93, indicating that the spotted felines are not crossing the highway frequently to breed. This effect has also been documented in other species. Animals can be deterred from crossing roads by traffic volume, noise, pollutants, and lack of passage opportunities. Collisions with vehicles is the leading cause of wildlife mortality in the United States. A study by the Federal Highway Administration estimates that between one and two million large animals are killed on America's roads each year. Likewise, collisions with wildlife poses a hazard to drivers.

In Massachusetts, the first projects to improve road crossings for wildlife were in 2000.They were designed specifically for rare turtles, according to Tim Dexter, fish and wildlife program coordinator with the Massachusetts Department of Transportation, and David Paulson, an endangered species biologist with the state's Division of Fish-



Staying Connected Initiative is an international collaboration—representing five states and three provinces—to sustain forested landscape connections across 80 million acres.

DAN COKER

eries and Wildlife. After numerous reports of turtle mortality across the state, the two agencies partnered with various concerned organizations and local citizens to collect data on road-killed turtles. The study identified hotspots; at the worst one, more than 100 turtles were killed in a single year. The turtles there were attempting to cross between extensive wetlands on both sides of the road or to dig nests in the gravel of road banks. Because of low reproductive rates, losing even a few adult turtles can dramatically affect a population, especially for the rare Blanding's, wood, and box turtles. In response, the agencies installed wide tunnels with natural bottoms beneath roads, fences to guide turtles toward the passages, and roadside signs to caution motorists. As a result, mortality has been reduced at these locations by as much as 90 percent.

In addition to the standard wildlife crossing signs common around the region, Massachusetts uses temporary flashing signs erected during prime crossing seasons, such as when moose are in rut in the fall. Massachusetts has been working on wildlife road crossings for almost two decades and has completed more than 100 projects, mainly retrofits of existing structures. As in other states in the region, because of budget constraints, there is usually no provision for construction of new structures solely for wildlife, except for major projects—such as new interchanges or highway widening—where federal funding is available. Much good work, though, can be done on a smaller scale. For instance, at stream crossings in Massachusetts, and in other northeastern states, large culverts with natural bottoms have replaced undersized culverts, providing larger passageways for aquatic and terrestrial animals and greater flow of floodwaters, thereby achieving multiple goals.

Initiatives of this type in the Northeast are part of a national and international movement to improve connectivity across human-dominated landscapes. America's western states have been at this work longer and have, in some cases, built huge overpasses above highways specifically to accommodate wildlife. Overpasses of this magnitude are expensive and are not common in the Northeast, which does not have high densities of large mammals or herds migrating seasonally. Also, most of the land is privately owned, which makes acquiring land or easements for crossings more challenging. In the West, overpasses often connect large blocks of public land.

Game camera photos document bears using a wildlife underpass beneath Interstate-91 in Massachusetts.

MEDOT

Wild animals tend to follow riparian corridors through the landscape, but some animals do not like to get wet. Some states have installed "critter shelves" in culverts or have upgraded underground crossing structures large enough to maintain streambanks inside. Alissa Rafferty, wildlife monitoring project manager, and Dirk Bryant, director of conservation programs for the Adirondack Chapter of The Nature Conservancy (TNC) in Keene Valley, NY, worked with the New York Department of Transportation (DOT) to install a 138-foot-long critter shelf for small–to medium-sized mammals, such as raccoons and fishers, in a culvert under Route 12 near Boonville. The wildlife shelf is a platform constructed of steel mesh that is positioned above the water and bolted to the inside of the culvert.

Deer using underpass in Gorham, Maine

MEDOT

This installation was New York's first critter shelf project and the first time such a design was used in the Northeast, said Rafferty. The platform, marketed as Critter-Crossing Technology, was developed by University of Montana biology professor Kerry R. Foresman and has been used widely in that state. Through winter tracking studies and remote camera monitoring, TNC identified Route 12 as the biggest barrier to wildlife in the Black River Valley. Many animals weren't using this culvert to cross the road because it is filled with water year-round, explained Rafferty. The ideal solution would have been to replace the culvert with a larger one with a natural bottom and streambanks inside, but that would have been too expensive. The critter shelf, which costs $28,375 and was paid for by TNC, was a relatively low-cost fix and is serving as a pilot project. DOT handled the installation and plantings around the site to encourage wildlife to use the shelf. There is good forest cover on both sides of the crossing, and one side is protected by a conservation easement held by a local land trust. TNC is encouraging nearby landowners to put up game cameras on their properties to help monitor crossings. TNC has found that viewing photos of wildlife on their land has generated enthusiasm for these projects by local people. It may eventually result in more conservation easements.

Richard Bostwick, a biologist with the Maine Department of Transportation, has worked on wildlife crossings for nearly fifteen years. His interest started in 2003 after Maine DOT staff and transportation officials from nearby states attended a workshop on wildlife crossings at the International Conference on Energy and Transportation in Lake Placid, NY. In 2004, he and the others helped organize the first Northeastern Transportation and Wildlife Conference in Vermont. It is now held every other year.

Over the years, Maine has had a variety of projects to help wildlife safely cross man-made barriers. In York County, the state created shelves with a natural substrate under bridges

for endangered turtles and throughout southern Maine encouraged the endangered New England cottontail to cross beneath bridges by providing brush piles and plantings for cover. Farther north, a six-foot-wide dry culvert was installed for lynx passage near Portage; an oversized bridge was built in Gorham to allow moose, deer, and other animals to pass more freely; and dedicated wildlife underpasses were constructed below new highways in Brewer, Holden and Presque Isle. Especially for providing access for large animals, it is usually much easier to add these features when building new roads than to retrofit existing roads. Maine also tracks large animal crashes. To get better data on wildlife crossing sites, Maine DOT partnered with Maine Department of Inland Fisheries and Wildlife, the University of California, Davis Road Ecology Center, and the Maine Audubon Society in a citizen science project, Maine Audubon Wildlife Road Watch. According to a report on the project by Maine Audubon conservation biologist Barbara Charry, "Between July 2010 and December 31, 2014, over 460 volunteers . . . recorded over 4,800 observations, which included 6,000 individual animals recorded. Sixty percent of the observations were dead animals and 40 percent live animals. Volunteers identified 153 different species." Fifty-seven percent were mammals.

NYTNC

New York Department of Transportation Kurt Gardner and crew installing a 138-foot-long critter shelf.

Animals may need to move farther to adapt to climate change. "This region is incredibly important for northward-moving species," commented Jessica Levine of TNC Canada. Levine coordinates the Staying Connected Initiative (SCI), an international collaboration of forty-six northeastern and Canadian transportation and natural resource agencies, conservation nonprofits, and universities working on connectivity. "We are fortunate to live in a relatively intact region of healthy forests, but fragmentation is a threat, and we need to keep pathways permeable for wildlife," she stated of the group's mission. SCI is working to connect large blocks of core forest habitat in critical linkage areas in the Northeast and Canada. The area "stretches from the Berkshires in Massachusetts, through the Green Mountains of Vermont on to the Sutton Mountains of Quebec; from the Tug Hill Plateau in upstate New York across Vermont, Maine and New Hampshire all the way to Quebec's Gaspé Peninsula and Nova Scotia's Cape Breton National Park. Spanning two countries, five states, and three provinces, the region covers over 80 million acres (325,000 square kilometers)." More than eighty people from different organizations are participating in this effort; teams in each linkage area meet regularly to collaborate on projects. Partners also coordinate projects across the region and share success stories and strategies.

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Jens Hilke examines fresh tracks on wildlife shelf in Waterbury, Vermont

In addition to creating wildlife-friendly road crossings, SCI partners are conserving the parcels of land in settled valleys that serve as stepping-stones between core habitats, as well as riparian corridors through farmland. Together, partners have protected more than half a million acres in the linkage areas through acquisition or easements. They also work with towns on planning and zoning. "Landscape context is very important for which road-crossing structures are moving wildlife," said Hilke. "The structure is just the pinch point between forest blocks."

Moose crossing the road in Vermont

Land use planning and conservation at crossings and connecting the crossings to nearby forests are critical to their long-term success. Hilke described an early Vermont wildlife structure as an illustration of why a holistic approach is required: a dry culvert was installed under the Circ Highway in Essex to help deer cross between their summer and winter range, but subsequent subdivision and development compromised the habitat and, at least as far as animals are concerned, the structure is now "a bridge to nowhere."

In a boost to this work regionwide, the significance of landscape connectivity and the need to work across borders was acknowledged by the New England governors and eastern Canadian premiers when they adopted a resolution at their 2016 conference recognizing the Northern Appalachian-Acadian forest "as the most intact, contiguous temperate broadleaf forest in the world" and "the importance of ecological connectivity for the adaptability and resilience of our region's ecosystems, biodiversity, and human communities in the face of climate change."

Back in Vermont, Hilke and Brady traveled west to check out a tall concrete tunnel built to accommodate a brook that leads under Route 2, the Interstate, and railroad tracks. When the water is lower, there is a shelf on one side. This culvert looks like an ideal passage for wildlife, but the state's remote cameras have not shown much use. The cameras *have* photographed people driving ATVs and even Jeeps through the tunnel, perhaps, the reason wildlife are not using it. Hilke and Brady looked at an alternative crossing a couple of miles away, where a brook in a deep ravine flows through a five-foot metal culvert beneath Route 2 and the Interstate. Deer tracks in the snow paralleled the road and led downhill into the gorge. Many other tracks were there, too: coyote, snowshoe hare, mink. Monitoring cameras strapped to trees have shown abundant wildlife activity. However, the culvert's size and metal bottom are not conducive to large mammal passage. When the Interstate was originally constructed in the 1960s, undersized culverts were installed, explained Brady. He and Hilke hope that VTrans can replace this culvert with a larger, wildlife-friendly structure with a natural bottom. But digging through forty feet of fill to get to the culvert will make this an expensive project, so it will probably not be replaced until its useful life is over.

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Despite funding limitations and other challenges, these efforts across the Northeast are adding up and are beginning to reconnect a broken landscape, ensuring that salamanders can slither to vernal pools to breed and lay eggs, that a mother bear and her cubs can visit an oak stand to feed on acorns, and that a bobcat can travel to find a mate.

Susan Shea is a naturalist, conservationist, and freelance writer living in Vermont. "How Did the Moose Cross the Road?" is reprinted with permission from *Northern Woodlands* [Summer 2018]. Shea's article, "Saving New England's Rare Plants," was also first published in *Northern Woodlands* [8/17] and reprinted in *Natural History* [2/18].