



LINKING LANDSCAPES FOR MASSACHUSETTS WILDLIFE

by David Paulson and Tim Dexter

Starless and moonless beneath a blanket of storm clouds, the night was as dark and featureless as a black bear's hide. A car navigated a winding, rain swept highway. A huge, frightening shape suddenly loomed on the roadside. The driver slammed on the brakes, skidded dangerously, but somehow managed to bring the vehicle to a stop just short of a seemingly unconcerned bull moose that ambled across the road inches from the front bumper. Pale and full of adrenaline, the driver let out a long breath, relieved that what would have been a very serious accident had been avoided.

Why does wildlife cross the road? It's an age-old question that begs new and possibly more important questions: Can wild animals cross our roads without jeopardizing both their safety and that of the public? Does anybody aside from a startled but very relieved driver even care? Indeed, here in Massachusetts your state wildlife agency, the Division of Fisheries and Wildlife (MassWildlife), and your state highway agency, the Department of Transportation Highway Division (MassDOT), do care. They are partnering in innovative initiatives with goals to provide safe passage for both wildlife and people while addressing the conservation needs of rare fish and wildlife listed under the Massachusetts Endangered Species Act (MESA).

Where survey data indicates high road mortality for turtles and salamanders, a good option for replacing a corrugated pipe culvert is a wide design like this with a natural floor that invites the passage of turtles and salamanders.

At first glance, a partnership between a state transportation agency and a state wildlife agency would appear unlikely; however, by working together, both agencies have found they can improve how well they meet their respective mandates and exceed expectations. The location and design of transportation infrastructure such as roadways, bridges, and culverts has an impact on wildlife. The reality facing the two agencies is the fact that nearly 12,000 miles of state highways and major roads and 24,500 miles of local roads lace their way throughout the Commonwealth. A glance at a state road map shows road densities are highest in the eastern part of the state; a veritable web of roadways radiates out from Boston, Worcester, and the highly developed coastal communities. Other areas of high road density include portions of the Connecticut River Valley in Franklin, Hampshire, and Hampden counties.

With 6 million people sharing 5 million acres of water and land with wildlife, these roadways impact (no pun intended) both people and wildlife. The most obvious impacts are vehicle collisions, usually resulting in wildlife mortality and



Photo © David Paulson

potentially resulting in property damage and sometimes personal injury. A less obvious, but perhaps more influential impact to wildlife populations is fish and wildlife habitat fragmentation and degradation caused by the presence of roads.

The agency partnership began in 2008 when MassWildlife formalized an inter-agency service agreement (ISA) with MassDOT. The initial goal of the ISA was to improve the efficiency of state-level environmental project review of roadway development and maintenance. MassDOT provided MassWildlife with the ability to hire a biologist dedicated to transportation project reviews. In simple terms, every year there are many state roadways, bridges, culverts, and other transportation infrastructure which need replacement, maintenance, or expansion. Many of these state road projects occur within or intersect rare and unique wildlife habitats which require MassWildlife review. With initial design, permitting, and required construction review, many highway project timelines are measured in years. The provision of

an environmental review biologist who concentrates on state transportation projects allows MassWildlife to address MassDOT's permitting requirements in a more timely fashion, develop a better understanding of roadway design/construction, and lay the foundation for a productive partnership.

Highway Division Chief Engineer Patricia Leavenworth reports: "The ISA has allowed MassDOT to efficiently meet the environmental review needs of our transportation program. Moreover, we've been able to work more closely with MassWildlife on addressing their conservation interests." Early involvement by MassWildlife in highway projects coordinated with MassDOT has helped incorporate road ecology into the everyday transportation planning process from design to maintenance.

The use of bio-engineering (the incorporation of biological and ecological elements in habitat management) has become commonplace to control erosion and stabilize soils. Examples include the use of live stakes (sections of dormant,



woody plants with the branches trimmed off, driven through seed mats or directly into bare dirt, that will quickly grow leaves and soil-stabilizing roots) and the placement of coarse woody debris and boulder deflectors to stabilize disturbed stream and river banks. The restoration of native plants; the installation of infiltration systems that gradually release, clean, and cool storm water runoff to minimize impact to coldwater fisheries; and improved aquatic/terrestrial passage at culvert/bridge sites are a few more examples.

From MassWildlife's perspective, the ISA has provided the agency an opportunity to minimize the negative effects of roads on wildlife and gain a greater knowledge of road ecology in Massachusetts. Over the past six years, the two agencies have expanded their agreement to include proactive projects that reduce wildlife-vehicle collisions, improve public safety, and restore high priority roadside habitats for the conservation of state-listed (under MESA) wildlife.

Linking Landscapes

One partnership project is a state-wide, long-term, and multifaceted volunteer-based wildlife monitoring and conservation planning collaboration that involves the University of Massachusetts in Amherst, state agencies, and citizen scientists. Called Linking Landscapes for Massachusetts Wildlife (LLMW), its objectives are to: 1) reduce wildlife-vehicle collisions and improve public safety; 2) enhance, protect, and restore habitats impacted by roads; 3) control invasive species within habitats of high conservation priority; 4) incorporate conservation priorities into transportation planning; and, 5) implement wildlife transportation research projects to inform transportation and conservation decision making.

Utilizing expertise from the program partners, a research project was designed to collect information on wildlife roadway sightings and mortalities through volunteer participation. Partnering with the University of Massachusetts in Amherst since 2010, MassWildlife and MassDOT trained over 350 citizen scien-



Photo © Tim Dexter

Left, a deteriorating old bridge presents a barrier, rather than easy passage, for wildlife movement. The replacement, above, is an ideal example of stream simulation that offers a more natural stream bed for fish and other aquatic species to negotiate, plus provides plenty of inviting terrestrial passage for animals that inhabit stream corridors and might otherwise attempt to cross the road rather than wade or swim.

The American Kestrel has distinctive facial markings and is often sighted hovering low over its hunting grounds.

tist volunteers to gather and contribute data to a website or volunteer to survey road segments during key seasonal periods and report that information to the LLMW. Participants include state and independent biologists, members of conservation and watershed organizations, and other interested citizen scientists.

The LLMW website, hosted by UMass (<http://www.linkinglandscapes.info/>), features three separate databases: 1) road-crossing observations of vernal pool-breeding amphibians during spring migration; 2) turtle road crossing mortality during nesting season; and 3) all other wildlife road related mortality. Online data forms available on the LLMW website use a Google Map interface that allows users to identify the exact location of a recorded observation and all of its associated data, including species and numbers of animals observed, date of the observation, observer name, contact information, and additional comments. Multi-year wildlife mortality observations and the presence of any rare wildlife are also recorded.

The citizen scientist volunteers documented over 3,500 mortalities representing 49 species at 1,161 locations throughout the state. Nine species of



Photo © Mark Wilson

current or former state-listed salamanders and turtles were among the mortalities recorded. Sites of highest conservation need were identified and targeted by MassWildlife and MassDOT to develop on-site improvements such as new signage, enhanced culvert design, or installation of wildlife barrier fencing. One successful fencing example at the highest turtle mortality hot spot documented in the state (Littleton) reduced turtle mortality by 90%.

In addition to community engagement through citizen science, the collected data from LLMW has informed the agencies where best to install improved crossing structures and other wildlife barriers to enhance public safety and protect endangered species. The LLMW collaboration has helped the partners prioritize and implement invasive species control, and conduct habitat restoration activities on scenic uplands and calcareous wetlands that are hot spots for biodiversity.

To prevent or reduce turtle road mortality – one of the most pernicious and devastating threats to this group of reptiles – new initiatives are providing barriers to road crossings, placing turtle crossing signs at reported high mortality areas, and enhancing culvert/bridge designs to favor turtle survival.



Photo © Tom Tynning

Right, a DOT crew installs a kestrel nesting box on the back of an interstate road sign, providing an otherwise sterile road structure of little use to wildlife with a significant benefit to wildlife. Below, Drew Vitz, state ornithologist, examines and bands one of 14 kestrel chicks that demonstrated the success of the program this year. Plans to expand the program are already underway.

Photos © David Paulson



Nest Boxes for Kestrels

Massachusetts's smallest and most colorful falcon, the American Kestrel (*Falco sparverius*), also called a Sparrow Hawk, can be spotted hovering like a dragonfly or hummingbird in midair as it hunts insects, snakes, small birds, and mammals in fields and meadows. The expanses of open, grassy habitats adjacent to some roads provide suitable nesting areas for kestrels. Unfortunately, partly due to fewer expanses of grasslands, this beautiful bird's population is dwindling not only in Massachusetts, but

throughout the eastern United States. MassDOT and MassWildlife teamed up in a statewide American Kestrel conservation program modeled after a successful partnership between Iowa's natural resource and transportation agencies in the early 1990s.

Like wood ducks, kestrels nest in tree cavities. With the program's ultimate goal to increase kestrel nesting opportunities, the project entails installing kestrel nest boxes on the back of highway signs or on posts within highway right-of-ways and adjacent to grassy hunting habitat. Kestrel boxes built by Boy Scouts are donated to the program and then installed by MassDOT staff on suitable roadway habitat. In 2013, nine nesting boxes were installed in the Pioneer Valley and kestrels were found successfully nesting in one box, fledging five young. This year, three boxes were used for nesting and all were successful, producing 14 fledglings in total. This early success is extremely encouraging, and staff in both agencies plan to expand the program. Not only is this effort helping kestrels, but it is also a great way to raise awareness and engage the public on conservation issues and the habitat requirements of this little raptor.

Bringing Back the Habitat

MassDOT and MassWildlife are implementing habitat management programs to enhance, protect, and restore degraded lands adjacent to highway rights-of-way that provide habitat for rare species. Management activities range from the removal of invasive plants, to restoration of basking habitat for state protected snakes, to roadside habitat restoration for a state protected moth. These habitat projects align with the Highway Division's GreenDOT goal to enhance the ecological performance of MassDOT impacted land in conjunction with MassWildlife's fish and wildlife conservation mission.

Not only do plant or wildlife communities benefit from this program, but some management actions also address public safety issues. One example is a restoration project designed to benefit the Orange Sallow Moth (*Pyrrhia aurantiago*), a state-listed invertebrate that feeds on the false foxglove plant. The habitat restoration activity required removing small to medium-size trees along a steep slope to provide the open woodland habitat the moth and its host plant require. This action also prevents trees from falling into the roadway during storm events.

Another collaborative habitat restoration project is underway at the Agawam Lake Wildlife Management Area (WMA) located in Great Barrington and Stockbridge and bisected by Route 7, a state highway. One portion of Agawam Lake WMA includes calcareous wetlands that are home to many rare and imperiled species of plants and wildlife. Calcareous wetlands are extremely rare in Massachusetts, and the Calcareous Basin Fen at Agawam Lake is considered to be one of the best examples of this plant community in the state.

Agawam Lake also supports one of the Commonwealth's best examples of the unusual, imperiled, Black Ash-Red Maple-Tamarack Calcareous Seepage Swamp Community. Within these communities are several important occurrences of a diverse group of state-listed, watch-listed, and more common calciphilic (lime-loving) plants, along with various species of secretive marsh birds. Unfortunately, this unusual wetland is threatened by the presence of the highly invasive exotic plant *Phragmites australis*, also known as the Giant Reed. The MassWildlife/MassDOT partnership is targeting this non-native invasive and has been conducting removal operations on over 40 acres with a goal of restoring the habitat and maintaining the biodiversity of one of the Commonwealth's most important wetlands.

Symbiosis: Peregrines and Bridges

Symbiosis is defined as an interaction between two different organisms living in close physical association, typically to the advantage of both. Although bridges are not alive, they do have a lifespan, and in Massachusetts both Peregrine Falcons (*Falco peregrinus*) and bridges are benefiting through the presence of each other. The Peregrine Falcon is a majestic bird of prey and known as the fastest animal on the planet. In level flight it can fly about 60 mph, but in a dive or stoop, one bird was clocked at 242 mph! These speedy falcons hunt pigeons, ducks, and other birds in flight, and are listed under the Massachusetts Endangered Species Act (MESA).



MassDOT and MassWildlife personnel examine a peregrine chick during banding operations at one of several nest boxes now placed beneath tall bridges across the state. Right, an adult and chicks in nest box under the I-90 bridge over the Connecticut River.

Historically, peregrines in Massachusetts nested on narrow ledges on cliffs. The effects of chemicals such as DDT resulted in thin, extremely fragile eggshells that caused widespread reproductive failure. The last nesting pair in Massachusetts was observed on Monument Mountain in Great Barrington in 1955. With the ban of DDT use in the United States and the implementation of aggressive restoration efforts involving captive-bred falcons, the Peregrine Falcon population has since rebounded to over 25 pairs in the state.

Although bridges are not natural cliff habitat, they provide ample perching opportunities for sight hunting and nesting, and some breeding peregrines have taken up residence on these structures. Peregrines don't build nests, but lay their eggs on accumulated debris on exposed ledges. This leaves eggs and chicks vulnerable to the elements. To boost nesting success, MassDOT and MassWildlife installed seven nest boxes on bridges (such as the Calvin



Photo © Don Cooper

Coolidge Bridge in Northampton, Braga Bridge in Fall River, Tobin Bridge near Boston, and the I-90 MassPike bridge spanning the Connecticut River in Chicopee) across the state where breeding falcon pairs have been documented. Over time, MassWildlife biologists have observed increased numbers of falcon chicks produced by peregrines using the boxes. The best location for the public to view a peregrine nesting box on a bridge is from the public boat launch area below the I-90 bridge in Chicopee. In addition, a bald eagle nest on a tree by the river can also be observed from this location.

So how do bridges benefit from falcons? It is all too well known by engineers (and birders) that bridges are a favorite roosting habitat for pigeons, birds whose guano can pile up on bridge surfaces. Pigeon guano traps moisture and speeds up the oxidation of structural steel, creating rust. Rusting structures increase maintenance requirements and can reduce a bridge's lifespan.

Fortunately for the bridges, peregrine falcons excel at hunting pigeons, and state biologists and engineers have seen a reduction in pigeon populations at bridges with nesting falcons. "Since we started adding the nests to our taller bridges," says Bill Drosehn, MassDOT District 2 Bridge Inspection Engineer, "we have seen a significant drop in the pigeon population as well as the residue that is left behind. This program is helping protect our structures by curbing the damage caused by pigeons." The success of the peregrine falcon nest box program will be featured this fall on the TV show *Ocean Mysteries* with Jeff Corwin (airs Saturday mornings on ABC).

Moose Crossing – For Real

Yes, Virginia, there really are moose in Massachusetts. Common in the early colonial era, moose were extirpated from the state by the early 1700s. As early settlers cleared the extensive forests for pastures and farming, moose habitat disappeared and so did the moose. A moose sighting was still considered rare as recently as the 1970s. Moose began to reappear regularly in the late 1980s in northern Worcester County, and then expanded their range south and west. MassWildlife estimates as many as 1,000 moose are currently residing in the state.

The presence of moose on roadways, particularly at night, brings us back to this article's beginning. Moose are difficult for drivers to see because of their dark coloration and those long legs that raise moose eye-shine above automobile headlight level. On high-speed state highways, these factors result in very short detection distances for drivers when moose cross roadways. Those long legs combined with a large body mass create another hazard: cars often take the legs out from under a moose, causing the

main mass of the animal to come crashing through the windshield of the car. The lack of warning combined with the nature of these accidents often results in devastating damage to the vehicle and serious injury or fatality to the driver and any passengers. There have been three human fatalities in Massachusetts involving moose-vehicle accidents that occurred in 2003, 2007, and 2012, and over 60 serious injuries.

To improve public safety and driver awareness of moose, MassWildlife and MassDOT took advantage of recent research by Dave Wattles and Steve DeStefano of the USGS Massachusetts Cooperative Fish and Wildlife Research Unit (see issue #4, 2009). They investigated moose movements and habitat use in Massachusetts by capturing moose, fitting them with GPS collars, and tracking their movements over time. MassWildlife's Deer and Moose Project Leader David Stainbrook also has a collection of reported moose vehicle collisions, providing location and other useful information.

Using all of this information, biologists identified moose-crossing hotspots along routes 2 and 202 and other corridors where moose habitat use and collisions were highest. New permanent moose crossing signs were installed by MassDOT and mobile LED message signs will be deployed during the September through November rut (breeding season) when moose are more active. The signs are meant to alert drivers to slow down. Although DOT signage is only placed along the documented moose crossing hotspots, moose are crossing roads over much of central and western Massachusetts. Drive slowly and be on the look-out from dusk till dawn, especially in the fall when the rut is in full swing. Always wear your seatbelt, and if you see a deer or moose crossing the road, hit the brakes and try not to swerve off the road.

Be Alert, Take Action, Get Involved

Citizen interest and involvement also benefits wildlife and the public's conservation and safety interests. One of the ways you can help is to be an alert driver and watch out for wildlife. If you see a



Locations for erecting moose warning signs are now determined by where solid wildlife research data indicates the animals are crossing the roads most frequently.

turtle crossing a local road and it is safe to assist, move the turtle in the direction it's going. Please don't take it home or to a nearby body of water; these animals know where they want to go (they are very persistent) and taking them from their familiar haunts can be harmful for that individual and impact the reproductive success of the local turtle population. If you would like to do more, report your observations on the LLMW website (www.linkinglandscapes.info/). You can document wildlife mortality, amphibian road crossings, and participate in our turtle roadway survey. You can also contact the LLMW team with any questions that you may have, ask about upcoming citizen scientist trainings, and learn more about the partnership.

Although the interests of transportation and conservation can sometimes conflict, the MassDOT and MassWildlife partnership has demonstrated that state agencies can work together to help achieve each other's goals with synergistic results. Moving into the future, partnership efforts, citizen involvement, adaptive management, and innovation will continue to be critical to meeting state transportation and wildlife goals.



The authors would like to acknowledge Frank DePaola, Patty Leavenworth, the MassDOT District Highway Directors, Jack Buckley, Tom French, Jonathan Regosin and the many other DOT and DFW staff, partners, and citizen scientists who make this partnership possible, but space does not permit. David Paulson is an endangered species biologist with MassWildlife and also serves as the transportation liaison to MassDOT for regulatory review and road ecology/research. David resides in Wrentham, enjoys exploring the natural history of the Commonwealth, and is an avid outdoorsman. Tim Dexter is a wildlife biologist and wetland scientist at MassDOT Highway Division, and conducts water resources, fisheries, and endangered species permitting to support the department's transportation program. Tim lives in Groveland and enjoys camping, paddling, fishing, and spending time in the outdoors with his wife and daughter.