Imagine driving down U.S. 64 in northeastern North Carolina and entering the Alligator River National Wildlife Refuge. The scene — a watery mix of bogs, swamps, and marshes — is home to a plethora of plant and animal life. Black tupelo, Atlantic white cypress, American sweetgum, and red maple tower over smaller shrubbery. Shorebirds, raptors, black bears, alligators, raccoons, quail, and red wolves are common here.

Suddenly, you see something looming in the roadway ahead. A black bear — all 7 feet and 450 pounds of it — seems to have appeared out of nowhere. At nearly 65 miles per hour, you narrowly avoid hitting the animal. You were lucky, but will other drivers be as fortunate?

J. Andrew Trent and Christine Proctor of the department of fish and wildlife conservation in the College of Natural Resources and Environment have conducted research for the past two years aiming to prevent such a calamity. U.S. 64 is being widened from two lanes to four from Raleigh, N.C., to the Outer Banks. As construction progresses west to east, it is approaching the 11-mile stretch that crosses the Alligator River National Wildlife Refuge. So the U.S. Fish and Wildlife Service called for a study to gauge what effects the highway widening will have on the surrounding wildlife, particularly the refuge’s populations of black bear and red wolf.

The effort was pushed forward at the urging of Professor Emeritus Mike Vaughan and Dennis Stewart of the U.S. Fish and Wildlife Service. The North Carolina Department of Transportation funded the study, with the Fish and Wildlife Service providing equipment, personnel, and storage facilities.

“Back around 2004,” Vaughan said, “I had black bear research projects on three national wildlife refuges on the Virginia and North Carolina coasts. We knew that the widening project would continue to route U.S. 64 through the Alligator River refuge. Dennis Stewart and I started planning early, and we submitted a research proposal to the state’s transportation department two to three years before the research was approved and funded.”

Marcella Kelly, an associate professor of fish and wildlife conservation who has taken the reins on black bear research since Vaughan retired, is thrilled.

“The field of road ecology is rapidly taking off, so this study is pretty unique and one of the first to explore those issues,” Kelly said. “We were able to get information not just on black bears and red wolves, but on many other species. The experience took us in a different direction of research and allowed us to see what future research will probably look like.”

Where to cross?

“The most pressing question the N.C. Department of Transportation wanted answered was where to put wildlife crossings,” said Proctor, a graduate student in wildlife science who worked on the red wolf portion of the study. Wildlife crossings — typically bridges or culverts, depending on the size of the target species — are constructed to allow animals safe passage across roadways.

The researchers focused on where animals were currently crossing the roadway and the locations of their preferred habitat. Ultimately, the N.C. Department of Transportation will
decide what type of wildlife crossing structure to install in the
refuge, but will likely use underpasses, as it did in the previously
widened section of U.S. 64.

“There were major concerns with bears, since the refuge
has such a large black bear population,” explained Trent, who
served as the overall project leader. “Every year a large number
of black bears are hit on that highway. We’re not only interested
in saving black bears and red wolves from being hit, but more
importantly, we’re concerned about human safety when driving
on that section of the highway.”

Thanks to innovative and vigilant wildlife management
practices, black bear populations have increased dramatically
across North Carolina in the past 40 years. In 1971, only 4,000
bears lived in a 2.5 million-acre area; today, 11,000 bears live
across nearly 10 million acres.

“Eastern North Carolina probably has the highest density
of black bears in North America,” Trent said. “The bears there
are very large. They benefit greatly from the habitat, which is a
mixture of agricultural, swamp, and forested land.”

In sharp contrast, red wolves have been on the federal
endangered species list since 1973 and were even considered
extinct in the wild by 1980. Four wolf pairs were released in the
refuge in 1987 as part of a recovery plan. Today, roughly 100
red wolves throughout five counties in eastern North Carolina
remain the world’s only wild population.

The recovery program is still active, utilizing a number of
strategies to protect the delicate wolf population. About two
years ago, two captive-bred pups from Lincoln Park Zoo in
Chicago were brought to the refuge and placed in a mother
wolf’s litter.

The U.S. 64 study was initially intended to concentrate
only on black bears. However, the presence of the U.S. Fish
and Wildlife Service’s Red Wolf Recovery Team in the area made it
relatively easy for Virginia Tech researchers to incorporate red
wolves into a single study that would predict the effects of the
highway construction on two of the region’s important species.

The wolf population study area extended west along U.S.
64 outside of the refuge, where most of the packs reside. Proctor
explained that the highway-widening project, as it stands now,
would affect only two wolf packs. “It’s different for each pack,”
Proctor said. “The highway widening ultimately won’t have a
huge impact on the overall population, which fluctuates between
20 and 22 packs, but could potentially lead to a shift in those
two packs.” Still, Proctor noted, it is important to make sure the
construction will cause as little disturbance as possible.

Bear tracking

To track black bear movements across and near the
highway, Trent and his team used three methods: GPS collars,
hair traps, and remote camera traps.

Bears first had to be captured before they could be fitted
with GPS collars. All of the captured bears were weighed,
measured, and given ear tags and lip tattoos. With only 30
collars to work with, though, not all bears were collared.
Researchers attempted to keep an even mix of males and
females throughout the study. The majority of the captures were
unique individuals rather than repeat captures, owing to the
sheer numbers of bears found refuge.

“I was amazed at how these bears were in such close
proximity with one another, even though they are normally very
solitary animals that like to keep their space,” Trent said. “The
resources seem to be so plentiful that they’ve learned to tolerate
each other.”

Trent and his colleagues installed barbed wire on the
guardrails that line the length of the highway within the refuge
to collect hair samples from bears as they crossed the road.
About 890 bear crossings from 2009 to 2011 were documented
from hair samples.

“We hoped that this would not only provide data on where
and when bears cross the highway, but also leave a source of
DNA that could allow for genetic identification to record which
individual bears were crossing,” said Trent. “If just one bear is
crossing repeatedly, it will be less of a focus than if a dozen bears
are crossing.”

The barbed wire turned out to be very effective: hair
samples were collected from 54 bears. The vast majority of them
crossed the highway between one and six times, but one bear
was particularly mobile, crossing 24 times.

Red wolf movements were studied using GPS collars
and remote camera traps. Since the red wolf is an endangered
species, all trapping and collaring was handled by the U.S. Fish
and Wildlife Service Red Wolf Recovery Team. At first, the
distribution of collars was limited to wolves that were known
or suspected to cross the road. Since the population is so small,
however, many wolves found throughout the recovery area were
collared.

Determining how often to collect GPS locations of the
collared bears and wolves in order to capture road-crossing
events proved to be challenging. GPS locations had to be taken frequently enough to record as many crossing events as possible; however, the life of the collar battery diminishes significantly with each recording. After a brief trial, collars were programmed to collect GPS locations at 30-minute intervals for several hours each day.

The GPS collars likely did not record all highway crossing events, so the team placed remote cameras within 100 meters of the roadside at canal crossings along U.S. 64, where breaks in the guardrail offered animals unimpeded access to the roadway. Twelve cameras were placed within the boundary of the refuge and an additional 27 cameras were placed west of the refuge.

In addition, road-kill surveys, conducted every week or two, provided data on bears and wolves, as well as many other species, which had been hit by vehicles while trying to cross the highway.

“We found that both species, and red wolves in particular, have places that they really like to cross,” said Proctor. “Black bears are mostly generalists, so they cross in more areas, but red wolves really like to cross between specific habitats they use. But overall, there were specific areas where both species preferred to cross, and they were directly related to access to food sources. Those are the places we suggested would be best to install underpass crossings.

“Usually, the red wolves that were crossing were those that had set up home ranges right next to the highway,” she added. “Those with home ranges farther from the highway typically weren’t crossing — with the exception of a few dispersing animals.”

Proctor and Trent were asked by the N.C. Department of Transportation to rank which suggested underpass locations they thought were most essential, but as Proctor explained, “that’s impractical for red wolves, because they cross within a home range. Even though we only found two packs that will be affected by the widening project, there’s no telling where a pack will set up a home range in the future.”

Based on the data, Trent and Proctor made two recommendations that six underpasses be built on the 11-mile stretch of road that runs through the refuge, along with three underpasses along U.S. 64 west of the refuge. The underpasses can accommodate either species.

Ultimately, the decision will be based on discussions between the N.C. Department of Transportation and the U.S. Fish and Wildlife Service.

“In terms of politics, things can be difficult. The Fish and Wildlife Service has to make a compatibility determination (a legal process) before they will approve widening the highway through the refuge,” Vaughan said. “They are unlikely to make a favorable compatibility determination unless the Department of Transportation agrees to put in the nine crossing structures recommended by the research.”

Meanwhile, Proctor said, “Installing wildlife crossings will obviously make the project more expensive, but the transportation department seems committed to including these structures as part of the highway widening project.”

The cornerstone of the effort is safety.

“It is inevitable that people driving this road will hit bears simply because of the sheer number of bears out there,” Trent said. “With so many cars using the highway on a daily basis, it’s worth a few million dollars to install wildlife underpasses that will help save lives.”

Written by Neel Patel of Fairfax, Va., who graduated with a degree in biological sciences from the College of Science in May 2012. Patel served as a communications intern for the College of Natural Resources and Environment. Wolf photos courtesy of Red Wolf Recovery Program.

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