



ECOLOGY AND POPULATION GENETICS OF EASTERN BOX TURTLES IN INDIANA



Eastern box turtle (Photo by Sara Johnson)

Current Status

Second year of five-year project

Funding Source

State Wildlife Grants, Purdue University,
DNR Nongame Fund

Project Personnel

Rod N. Williams (PI), Brian MacGowan (co-PI),
Steve Kimble (Ph.D. Student), Andrea Currylow
(M.S. Student),

Technicians:

Heather Powell (2009)
Kat Lillie (2009)
Sara Johnson (2009)
Keith Norris (2009)

Jami MacNeil (2009)
Lucas Woody (2009)
Michele Baragona (2010)
Matt Cook (2010)
Mike Wildnauer (2010)
Kevin Creely (2010)
Lindsey Keener-Eck (2010)

Background

Eastern box turtles are long-lived reptiles that are native to forested regions across the eastern United States. Their numbers are declining across the country, most likely because of habitat loss, collection from the wild for sale as pets, and mortality on roadways. Some habitat alterations, such as timber harvests, are a common and sustainable type of habitat management but these activities may impact forest animals in different ways. It is



Steve Kimble attaches a radio transmitter to an Eastern box turtle. (Photo by Sara Johnson)



Eastern box turtle with radio transmitter and temperature logger attached to its carapace (Photo by Matt Cross)



Steve Kimble prepares DNA samples in the lab. (Photo by Marcia Kremer)

unclear if box turtles will be impacted (either positively or negatively) by these types of activities.

Objectives

The purpose of this project is to use modern genetic tools and radio telemetry methods to clarify the ecology and population organization of Eastern box turtles in Indiana for use in conservation programs for this species. In general, we are interested in the impacts of timber harvesting on Eastern box turtles movement, home range size, and overwinter use. We are also interested in using molecular methods to assess the genetic health of Indiana box turtle populations. In addition, we can use these same genetic tools to determine whether a turtle has been taken out of the wild in Indiana (which is illegal) or some other state (which might be legal).

Methods

To understand how much to expect turtles to move over their daily activities and lives, we have glued tiny radio transmitters to about 40 box turtles in Morgan-Monroe and Yellowwood state forests. Many highly skilled people spend all summer and fall hiking in the woods, finding each turtle three times a week and making maps of each turtle's movements. These movements are studied before and immediately after timber harvests so that biologists understand how box turtles respond in the wild. Any changes in movement patterns in response to timber harvests might affect turtle mating, foraging and energetics (health).

While it is important to study how turtles respond to timber harvests during the summer months, it is equally important during the winter months when box turtles are hibernating. Turtles are monitored during the winter months using very small temperature dataloggers affixed to their shells. Dataloggers were also used to monitor temperatures throughout the turtle's habitats from multiple fixed locations. These dataloggers record temperatures every 45 minutes and provide critical information on the

thermal environment within timber harvest openings versus uncut areas of the forest.

Spending so much time in the woods means we see other box turtles. From every box turtle we find we take a small blood sample and take it to a lab for DNA analysis. Just like the DNA fingerprinting used to uniquely identify humans for parentage or forensic purposes, each turtle has a unique DNA fingerprint. More similar fingerprints are found among more related turtles, and less related turtles have fewer similar fingerprints, so we can make a family tree showing how the turtles captured are related.

In our laboratory we use blood collected from each turtle to obtain a sample of its DNA. Using this DNA we are able to create a unique “DNA fingerprint” for each individual, as well as get a good picture of the genetic characteristics of the whole box turtle population sampled. To accomplish this we use DNA markers, called microsatellites, that have been developed in our lab specifically for use in Eastern box turtles. All this may sound simple but is costly in time, money and skilled labor.

While it takes all summer to track the turtles, it takes all winter (while the turtles are hibernating) to complete the genetic analyses. Next year this process will be scaled up to all of Indiana and in the next year to the four surrounding states.

Progress

The radio telemetry portion of the project is completed. We tracked more than 40 turtles throughout the 2009–10 field season and have now collected two years of post-harvest movement data. Preliminary analyses of pre-harvest versus post-harvest movements suggest that Eastern box turtles tend to avoid the centers of large timber harvests but gravitate toward the edges of harvest openings during the summer months. During winter, when Eastern box turtles are hibernating, they choose one spot in which to burrow to escape the cold. The deeper they go, the more moderate the temperature

Eastern box turtles in Indiana may hibernate for five-to-seven months of the year; that’s nearly half their life spent underground. We found that turtles prefer to overwinter at temperatures of approximately 3.3 Celsius and at an average depth of 10 centimeters. Although most turtles hibernated in the forest, we recorded one turtle that hibernated in a timber harvest.

Previously it was thought that overwintering turtles would not use timber harvests because of the absence of a tree canopy and the lack a leaf-litter floor mat to buffer them from extreme cold. We found that the timber harvests were colder all winter, but that if turtles burrowed deeply enough, warmer temperatures could be reached and maintained. We also found that the timber harvests warm more quickly during spring when turtles emerge from hibernation, possibly energetically benefiting those turtles that overwintered very close to the harvest edge.

We have nearly completed the genetic sampling within Indiana. More than 600 box turtles were genetically sampled from 2009–2010, from across Indiana and neighboring states. During the past year, we have obtained DNA from all of the blood samples we have collected and begun to DNA-fingerprint each individual turtle. The six techni-

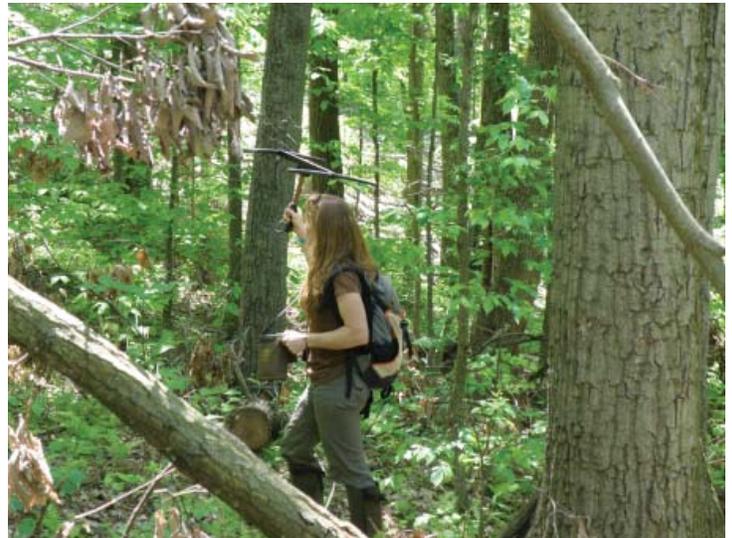
cians and two graduate students acquired valuable skills during the field and lab work performed this past year.

Data from this project will be used to help graduate and undergraduate students to learn and earn their degrees, as well as to help protect the Eastern box turtle.

Cost: \$683,694 for the complete five-year project



Andrea Currylow records data on the location of an Eastern box turtle. (Photo by Rod Williams)



Andrea Currylow uses radio telemetry to locate an Eastern box turtle. (Photo by Rod Williams)