# Conserving the Rare Cerulean Warbler in Indiana Forests

*By Kamal Islam*

The Cerulean Warbler was once considered a common migratory songbird and breeder in Indiana, primarily in the southern parts of the state. Currently, it is considered a 'Species of Conservation Concern' throughout its distribution in the USA. In the State of Indiana and in Canada, it is listed as 'Endangered'. Based on Breeding Bird Surveys conducted annually since 1966, there has been a decline by 70% throughout its breeding distribution that includes the mid-western and eastern parts of the United States and southern Canada. It has the unfortunate distinction of being the fastest declining migratory warbler.

The Cerulean Warbler is 4.5 inches in length and weighs less than 2 nickels (Figure 1). It migrates each year from its wintering grounds on the slopes of the Andes in northern South America to its breeding grounds that include forests in southern Indiana. The Cerulean Warbler faces many challenges and threats to its survival on its annual migration, which encompasses thousands of miles, from loss of habitat and severe weather events, to collision with tall, lighted buildings and windows.

*Figure 1. Male (left) and female (right) Cerulean Warbler.*

Once this songbird arrives in Indiana in mid- to late April, it establishes territories in structurally diverse mature forests characterized by large-sized trees interspersed with younger trees and with openings in the upper canopy. Research suggests that male Cerulean Warblers use these openings in the forest canopy to project their songs to attract females while defending territories against rival males. Historically, these openings resulted from wildfires and by wind storms and tree falls. However, the natural occurrences of many of these forest disturbances that allow canopies to open are prevented from the practice of fire suppression. More recently, openings were created from logging roads to extract timber along ridgetops.

Scientists that have conducted research on the breeding biology of Cerulean Warblers have documented a life history strategy that is self-limiting to its current survival. Unlike other songbirds that successfully produce 2 to 3 clutches per breeding season, the Cerulean Warbler is unusual in that it only produces one clutch of 3 or 4 eggs per breeding season unless the nest fails. We have observed females making up to three nesting attempts when earlier nests have failed. The female Cerulean Warbler gathers wild grapevine fibers and bark, and uses spider web to hold the nest materials together to construct a tiny cup-shaped nest. This nest is typically located 60 feet from the ground primarily in oaks and hickories. It is one of the earliest songbirds to leave southern Indiana departing by mid-to late July.

Cerulean Warbler research, conducted in various parts of its breeding range, has contributed to our basic understanding of Cerulean Warbler biology and habitat needs. However, there are some habitat differences between the various breeding grounds in North America. Informed decisions on forest management to maintain and improve Cerulean Warbler habitat should be location specific and based on scientific research conducted in the specific breeding ground. We were provided an opportunity to study the breeding biology and habitat needs of the Cerulean Warbler in Indiana through the Hardwood Ecosystem Experiment.

## *The Hardwood Ecosystem Experiment*

The Hardwood Ecosystem Experiment (HEE), a 100-year study initiated in 2006, examines the effects of timber harvest and prescribed burns on plant and animal populations. The primary objective of this research is to develop even and un-even aged forestry systems that maintain oak dominated forest communities and landscapes. The HEE is a multi-disciplinary, collaborative project between the Indiana Department of Natural Resources, Division of Forestry, and scientists from a number of universities. Researchers study a variety of organisms that include moth, butterfly, beetle, and bird communities, small mammals, effects of prescribed burns on regeneration of oak seedlings, endangered Indiana bat, salamanders, eastern box turtles and timber rattlesnakes, and the state endangered Cerulean Warbler among other groups.

A total of 9 management units, 4 in Morgan-Monroe State Forest and 5 in Yellowwood State Forest in Morgan, Monroe, and Brown counties in southern Indiana were selected for the HEE. Three forest treatment sites received 8 small openings ranging in size from 1-5 acres where either single trees or groups of trees were removed; these areas will produce a future stand of trees of mixed or uneven-age. Another three treatment sites received two 10-acre clearcuts and two 10-acre shelterwood cuts to create a future stand of even-aged trees. And three sites will serve as controls where no harvest will occur for the duration of the 100-year study.

We started our research at the HEE in 2007 and obtained two years of pre-treatment data before the specific forest treatments were applied at the study sites in the fall and winter of 2008/2009. Our objectives examined 1) how Cerulean Warblers responded to different forest treatments across all management units, 2) if territory sizes changed depending on the treatment, 3) if canopy gaps were a preferred habitat characteristic of male Cerulean Warbler territories, 4) the effects of these different forest treatments on Cerulean Warbler reproduction and productivity, and 5) the species of trees that produced the most amount of caterpillars that were important prey items selected by the parents to feed to their young.

## *Key Findings*

Based on our HEE research, relative abundance estimates of Cerulean Warblers changed between pre-treatment and post-treatment years but territory sizes remained the same. Our data on relative abundance estimates suggests that Cerulean Warblers were attracted to forest sites with even-aged treatments initially based on an increase in detection rates during 4-years post-harvest but have since started to decline in these units (Figure 2). In contrast, they appeared to respond negatively to uneven-aged treatment sites based on decreases in detection during point count surveys two years after harvest; however, there is much fluctuation in numbers of Cerulean Warblers across years. There was little change in detections at control sites from 2007-2017. Preliminary data suggests that Cerulean Warblers are declining in our study sites (black line in Figure 2). This decline in population may be a reflection of the overall decline of the species across its range wide distribution, rather than from timber harvesting.

We examined 83 male Cerulean Warbler territories for canopy gaps and found that 38 territories did not have a canopy gap, which we defined as >greater than 215 square feetft2. The remaining 54% of territories had canopy gaps that ranged from 216- to 5,167 square feetft2 with a mean of 1,109 square feetft2, which is near the average size of a single tree-fall gap (753-1076ft2)created by a natural disturbance in mature forest systems. Therefore, emulating single tree fall canopy openings up to ~ 1076ft2/0.74acre(i.e. one large tree removed per average Cerulean Warbler territory size) would increase vegetative growth in the lower strata, and further increase the vertical vegetation density. However, it should be noted

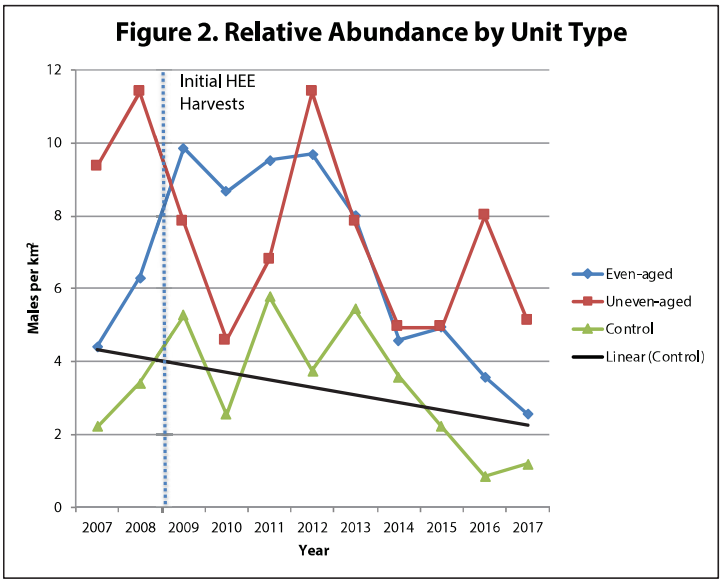


*Figure 2. Relative abundance estimates of Cerulean Warblers across nine HEE management units in Morgan-Monroe and Yellowwood state forests, Indiana, 2007-2017. While there is much variation in abundance from year to year, we observed a general decline. The cause is unclear, but given declines in the controls timber harvesting is not the cause.*

that this is not a long-term management approach to habitat conservation because oaks and hickories require sunlight to germinate and to out-compete more shade tolerant species. Based on our studies of Cerulean Warbler reproduction, oaks (particular white oak), and hickories are the most important tree species.

Nests were found in all forest management types and in all of the nine HEE units except for one of the control units. More nests were found in even-aged units than in uneven-aged or control units, despite intensive searching in all management types. Between 2011 and 2015, 93 Cerulean Warbler nests were found at our study sites. Of these, nearly half were located in species of the white oak group (*Quercus alba, Q. montana* [*prinus*], or *Q. muhlenbergii*), with white oaks (*Q. alba*) comprising the vast majority of nest trees (n = 37). Smaller numbers of Cerulean Warbler nests were found in a variety of other tree species. The preference for white oaks by Cerulean is likely due to an association with high food availability in the canopy and the presence of grapevines in areas where white oaks are also found. Of 101 territories demarcated in 2011 alone, grapevines were present in 83% of territories. At our

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# Sierra Club and Audubon say Active Forestry can be Very Good for Songbirds

## *By Allen Pursell*

The spring of 2018 saw several unusual announcements about forest management. First, the Cornell Laboratory of Ornithology published an article in *All About Birds* entitled, "**Old-growth is great, but here's why we need young-growth forests as well**", explaining why the lack of young forests may be negatively affecting songbird populations.

The second was an article that appeared in *Sierra*, the magazine of the national Sierra Club, with the headline, "**Cutting Trees to Save the Birds**" highlighting efforts in Maine to encourage forest management that will benefit breeding songbirds.

And finally, there was a press release from the American Forest Foundation and the paper company Domtar announcing a cooperative effort with the National Audubon Society's New York and Pennsylvania programs to encourage forest landowners to manage their woods in a way that produces more birds.

This all seems so unexpected. Yet it makes sense.

- In the Central Hardwood Region the amount of early successional habitat and young forest (20 years old or less) has declined to only 5% of what it was in 1950.
- Young forest and shrub habitats are still declining at 3.3% per year in the eastern US.
- 70% of young forest/shrubland bird species have declined over the past 40 years.
- Many mature forest-nesting birds are declining as well, including the wood thrush, which has lost 59% of its population since 1970.

Those are striking statistics, but it is important to acknowledge one thing – in the early to mid-20th century we had too much young forest habitat in Indiana. A great amount of marginal farmland was being abandoned and naturally returning to young forest, and huge swathes of remaining forest had been cutover very hard. But now the pendulum appears to have swung too far in the other direction. In 2018 we need more young forest.

The Cornell Laboratory of Ornithology article put it this way,

> "Ornithologists have also recently discovered that early successional habitats can benefit the birds most closely associated with big, mature woodlands. Starting in the late 1990s, biologists began tracking where the chicks of deep-forest birds, such as Wood Thrushes and Ovenbirds, went after they left their nests. To their surprise, in the weeks and months before fall migration, the chicks and adults alike were moving into thickets, shrublands, and regenerating clearcuts—the kind of "edge" habitat that was thought to be anathema to these birds, but that provides lots of food like the late-summer fruit essential for laying on premigratory fat."

Audubon Vermont is so convinced that active forest management holds the key to better songbird conservation that they have initiated a program to assist both woodland owners and foresters. Called "Foresters for the Birds" this program has also been adopted by Audubon in Massachusetts.


One outgrowth of the Vermont Audubon's forest management efforts is a program called the Bird Friendly Maple Project, designed to recognize maple syrup producers who intentionally integrate bird habitat into their stewardship plans. Those who do so can place a special label on their maple syrup. Their promotional material states, "Remember that maple sugarbushes are inherently good for birds, but forests that are intentionally managed with birds in mind are even better!

Surely, the same thing can be said about managing hardwoods in Indiana.

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*Vermont Audubon's Bird-Friendly Maple Project label with sugar maple leaf and scarlet tanager (*http://vt.audubon.org/conservation/working-lands/forest-bird-initiative-1*)*

*An aerial view of shelterwood harvest showing the canopies of the large residual trees and the gaps created between the trees to allow sunlight to strike the ground. Photo: C.Neggers, TNC*

# Sidebar: What is a Shelterwood Harvest?

A shelterwood harvest intentionally leaves many of the largest and best trees in the woods as seed trees and future timber, while at the same time thinning heavily, even in the mid-story. One-third of the mature trees might be removed during harvest. This creates abundant space around the remaining trees and allows much sunlight to strike the ground, encouraging a new generation of trees to start.

While the shelterwood technique is still an uncommon method of managing hardwood timber, research has shown that a shelterwood can benefit some forest songbirds, including Cerulean Warbler, Hooded Warbler, Kentucky Warbler, and Eastern Towhee. Forest bats may benefit as well.

A recent grant from the Alcoa Foundation to The Nature Conservancy will promote the practice of shelterwood harvesting and enhance songbird conservation on properties managed by Nature Conservancy foresters in southern Indiana. For more information contact Dan Shaver at dshaver@tnc.org.

*Mature oak stand following a shelterwood harvest and midstory removal. The remaining high quality trees are widely spaced providing room for sunlight to strike the ground and provide good foraging opportunities for Cerulean Warbler. Photo: C. Neggers, TNC*