

FOREST MANAGEMENT FOR GOLDEN-WINGED AND CERULEAN WARBLERS—LESSONS LEARNED FROM FOREST MANAGEMENT EXPERIMENTS

David A. Buehler, Douglas W. Raybuck, Justin A. Lehman,
Patrick D. Keyser, Than J. Boves, and Jeffrey L. Larkin



Extended abstract—Golden-winged Warbler (*Vermivora chrysoptera*) and Cerulean Warbler (*Setophaga cerulea*) are two of the most rapidly declining forest songbird species that occur in oak-dominated forests in eastern North America. Both species are considered species of national conservation concern by the U.S. Fish and Wildlife Service (USFWS 2008) and are listed as endangered, threatened, or in need of management by most States throughout their breeding range (Roth and others 2012, Wood and others 2013). Both species occupy large forested landscapes but generally nest at opposite ends of the successional spectrum with Golden-winged Warbler preferring young forests for nesting and Cerulean Warblers preferring mature forests for nesting. Comprehensive, science-based management strategies have been developed for both species individually (Roth and others 2012, Wood and others 2013). Because the two species are sympatric throughout much of their Appalachian Mountains range, holistic, forest-wide management approaches are needed to allow for the strategic management of forested landscapes to meet the life history requirements of both species simultaneously.

Management opportunities focused where both species co-occur have been discussed previously in general terms (Hamel and others 2005). Recently, we conducted two forest management experiments on the North Cumberland Mountains Wildlife Management Area in eastern Tennessee specifically focused on these two species where they co-occur to identify their response to various forest management prescriptions and to identify how to optimize management of both species on the same managed forest landscape. The Cerulean Warbler forest management experiment implemented in 2007 involved two replicates of four treatments: control-unharvested (~30 m²/ha basal area), light harvest (~25 m²/ha residual basal area), intermediate harvest (~17 m²/ha residual basal area), and heavy harvest (~7.5 m²/ha residual basal area) (Boves and others 2013)2013. The Golden-winged Warbler experiment involved three replicates of four treatments implemented by clearcutting mature hardwood forest stands in 2010 (control), followed by combinations of prescribed burning and/or herbicide treatments of stump sprouts in 2012 (Lehman 2017). In both experiments, we monitored experimental stands for 1–2 years prior to treatments to establish baseline conditions, and we monitored stands for 3–4 years post-treatment. We monitored territory densities with spot-mapping, habitat selection, and nest survival on both studies; we monitored post-fledging survival and habitat selection via radio telemetry on the Golden-winged Warbler experiment. We evaluated results from Raybuck (2016) from Pennsylvania to infer how Cerulean Warblers use similar forest conditions during the post-fledging period.

Cerulean Warbler territory occupancy occurred across the entire range of treatments, with the greatest positive density response occurring in intermediate and heavy harvest treatments, whereas densities on controls (no harvest) actually declined. In contrast, nest survival was greatest in the controls, and generally declined with harvest (Boves and others 2013)2013. Golden-winged Warbler territory occupancy occurred across all four treatments post-harvest, although the greatest densities occurred in stands with prescribed burning and/or herbicide treatments. We detected no differences in nest survival among treatments, although sample sizes were limited and statistical power was low (Lehman 2017).

Post-fledging habitat selection differed from nesting habitat selection for both Cerulean Warblers in Pennsylvania (Raybuck 2016) and Golden-winged Warblers (Lehman 2017). For Ceruleans, fledglings occupied forest stands with trees of lesser diameters and greater midstory cover. Fledglings moved >1600 m from the nest over the first

Author information: David A. Buehler, Professor, Department of Forestry, Wildlife and Fisheries, The University of Tennessee, Knoxville, TN 37996; Douglas W. Raybuck, Graduate Research Assistant, Department of Forestry, Wildlife and Fisheries, The University of Tennessee, Knoxville, TN 37996; Justin A. Lehman, Graduate Research Assistant, Department of Forestry, Wildlife and Fisheries, The University of Tennessee, Knoxville, TN 37996; Patrick D. Keyser, Professor and Director, Center for Native Grasslands Management, The University of Tennessee, Knoxville, TN 37996; Than J. Boves Assistant Professor, Department of Biology, Arkansas State University, Jonesboro, AR 72467; and Jeffrey L. Larkin Professor, Department of Biology, Indiana University of Pennsylvania, Indiana, PA 15705.

Citation for proceedings: Clark, Stacy L.; Schweitzer, Callie J., eds. 2019. Oak symposium: sustaining oak forests in the 21st century through science-based management. e-Gen. Tech. Rep. SRS-237. Asheville, NC: U.S. Department of Agriculture Forest Service, Southern Research Station. 192 p.

30 days post-fledging (Raybuck 2016). Golden-winged Warbler fledglings occupied forest stands with greater shrub/sapling cover and lesser herbaceous cover, although paradoxically, fledgling survival was negatively linked to shrub/sapling cover. Fledglings used all cover types, occurring in generally older-aged stands than nests occurred in, although generally not in mature, closed-canopy forest. Golden-winged fledglings moved extensively across the landscape, averaging >400 m per day after 2 weeks post-fledging (Lehman 2017).

Combining the forest management experiment results for territory occupancy and density, nest and post-fledging survival, and habitat selection for both species, some clear conclusions emerge (fig. 1). First, nest-site selection by Golden-winged Warblers and Cerulean Warblers occurs over a fairly broad range of forest stand conditions, ranging from 2.5–10.0 m²/ha basal area for Golden-winged Warblers to 7.5–30+ m²/ha for Cerulean Warblers. Interestingly, there is a region of overlap (7.5–10.0 m²/ha) in which both species can actually co-occur nesting. Secondly, the optimal conditions for nest survival are much more restrictive for both species, occurring in the lower end of the basal area range for Golden-winged Warblers (2.5 m²/ha) and in the upper end of the basal area range for Cerulean Warblers (>25 m²/ha). Finally, in the case of both species, post-fledging habitat use differed significantly from nesting habitat use. Golden-winged Warblers used forest stands with well-developed shrub/sapling layers, whereas Cerulean Warblers used forest stands that were smaller in diameter with greater midstory cover than forest stand conditions at nest sites. Although we did not monitor Golden-winged Warbler and Cerulean Warbler fledglings via telemetry on the same sites, presumably both species of fledglings could co-occur in the same stand conditions.

Given what we have learned from these forest management experiments, we have developed the following management considerations to promote the goal of supporting both of these high-priority species. First, both species require hardwood forest-dominated landscapes, generally >70 percent forest cover within 10 km, to establish breeding territories in the first place. Second, because the nesting habitat requirements for both species are at opposite ends of the successional spectrum, because nesting habitat differs from post-fledging habitat, and because fledglings move over such a large area, both species require a dynamic forest landscape with the juxtaposition of a diversity of age classes and structural conditions. Third, sustainable timber harvest is the most likely tool to provide the diversity of forest age classes and structural conditions required to meet the nesting and post-fledging habitat requirements of these species. Finally, it is possible to manage for viable populations of both species on the same forest landscape with strategic forest management planning. Managing to optimize full season productivity of both species will require the balancing of the provision of quality nesting habitat with the provision of adjacent quality post-fledging habitat (Streby and others 2014).

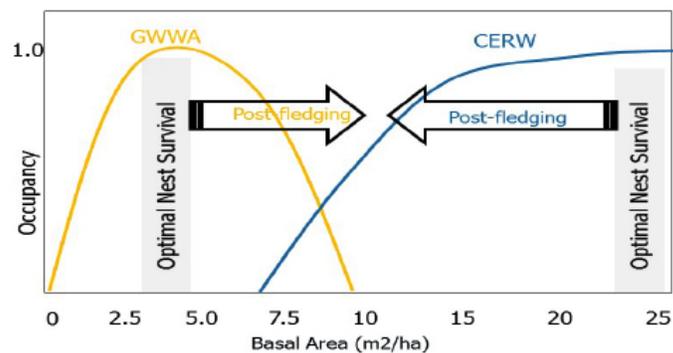


Figure 1—Territory occupancy, nest survival, and post-fledging survival and habitat use for Golden-winged Warblers and Cerulean Warblers on the North Cumberland Mountains Wildlife Management Area, Tennessee.

