

# HEE



# Hardwood Ecosystem Experiment

**The  
Hardwood Ecosystem Experiment**

**Summary of outputs**

**For the contract period  
May 1, 2014 – April 30, 2016  
And preceding contracts**

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## Introduction

The Hardwood Ecosystem Experiment (HEE) is a collaborative project between the Indiana Department of Natural Resources, Division of Forestry (DoF) and researchers from Purdue University, Indiana State University, Ball State University, and Drake University (Iowa).

The main goal of HEE is to understand the ecological and social impacts of long-term forest management on public and private lands in Indiana and the Central Hardwoods Region. Our primary objectives include:

1. Develop even-aged and uneven-aged silvicultural systems that maintain oak-dominated forest communities and landscapes;
2. Determine both the positive and negative impacts of these systems on communities of herbaceous, avian, and terrestrial amphibian species groups;
3. Determine the social and economic ramifications of these systems in both the local and regional communities; and
4. Provide demonstration sites and develop novel educational materials and techniques to engage the public concerning forest management.

The HEE is designed as a long-term field experiment to study forest management and its impacts. In collaboration with DoF, we created a replicated series of study areas at Morgan-Monroe and Yellowwood State Forests, on which the most common approaches to forest management will be implemented and monitored. This framework of study sites will be used to study the long-term response of selected species both in the treated areas themselves and the surrounding forest. Simultaneously, we will conduct surveys of the landowners and general public in the immediate vicinity of the study areas to assess their attitudes towards active land management.

The purpose of this document is to provide a summary of HEE research products from project initiation to the present. It provides metrics of total project productivity as well as a comprehensive listing of research, technical, and extension publications and presentations by author, year, and title.

## HEE Summary through 1 March 2016

The HEE has completed nearly 10 years of data collection, analysis, and dissemination related to the impacts of forest management on forest ecosystems and human communities in southern Indiana. The project to date has involved nearly 20 principal investigators from 7 different universities and state agencies (Table 1). The project has trained more than 150 undergraduate and post-baccalaureate students as field technicians and undergraduate researchers. Over 30 graduate students have conducted, or are currently conducting, graduate research on the HEE; the large majority of these student projects have focused entirely on the HEE (Table 1).

**Table 1.** Principal investigators and university participation on the HEE from 2006-16.

<b>Principal Investigator</b>	<b>Project(s)</b>	<b>Institution</b>	<b>Start date</b>	<b>Finish date</b>	<b>Grad students<sup>1</sup></b>
<b>2006-16</b>					
Carter, Tim	Bats, fawn dispersal	Ball State University	5/1/12		4
Chapman, Rob	Salamanders	Purdue University	5/1/11		0
Dunning, John	Birds, owls	Purdue University	5/1/06		2
Haulton, Scott	Deer exclosures, ruffed grouse	Indiana DNR - Division of Forestry	5/1/08		0
Holland, Jeff	Wood-boring beetles	Purdue University	5/1/06		0
Islam, Kamal	Cerulean warblers	Ball State University	5/1/07		10
Jenkins, Mike	Vegetation, deer exclosures	Purdue University	5/1/08		0
O'Keefe, Joy	Bats	Indiana State University	5/1/12		4
Saunders, Mike	Vegetation, deer exclosures	Purdue University	5/1/08		3
Summerville, Keith	Lepidoptera	Drake University	5/1/07		0 <sup>2</sup>
Swihart, Rob	Small mammals, mast, owls	Purdue University	5/1/06		4 <sup>3</sup>

Principal Investigator	Project(s)	Institution	Start date	Finish date	Grad students <sup>1</sup>
<b>2006 –14</b>					
Amberg, Shannon	Human dimensions	Purdue University	5/1/09	4/30/10	0
Duchamp, Joe	Bats	Indiana University of Pennsylvania	5/1/10	2/28/13	1
Hoover, Bill	Human dimensions	Purdue University	5/1/06	4/30/15	1
MacGowan, Brian	Box turtles, rattlesnakes	Purdue University	5/1/07	4/30/11	0
Shelton, Angie	Spring ephemerals, deer exclosures	Indiana University	5/1/11	4/30/14	0
Whitaker, John	Bats	Indiana State University	5/1/06	4/30/11	2
Williams, Rod	Salamanders, box turtles, rattlesnakes	Purdue University	5/1/07	4/30/11	3

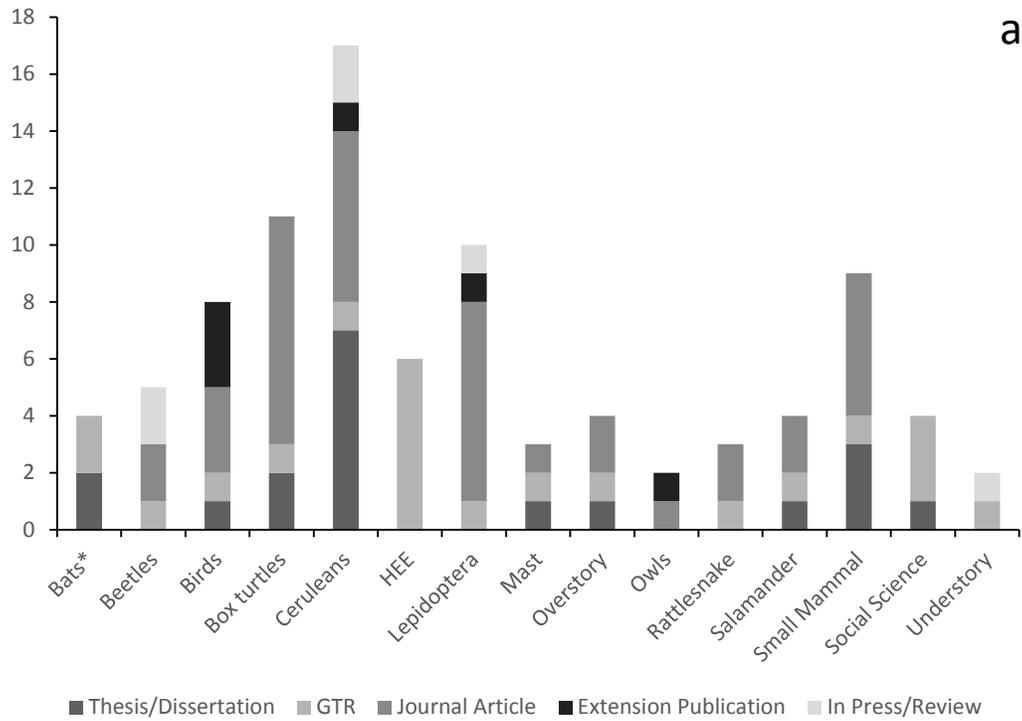
<sup>1</sup> This column includes current graduate students who have not completed their projects. Therefore, the total number of students in this column is greater than the number of theses/dissertations listed below.

<sup>2</sup> Drake University is an undergraduate-only institution.

<sup>3</sup> This value includes one graduate student who completed an M.S. degree and continued on to a Ph.D. degree on the same project.

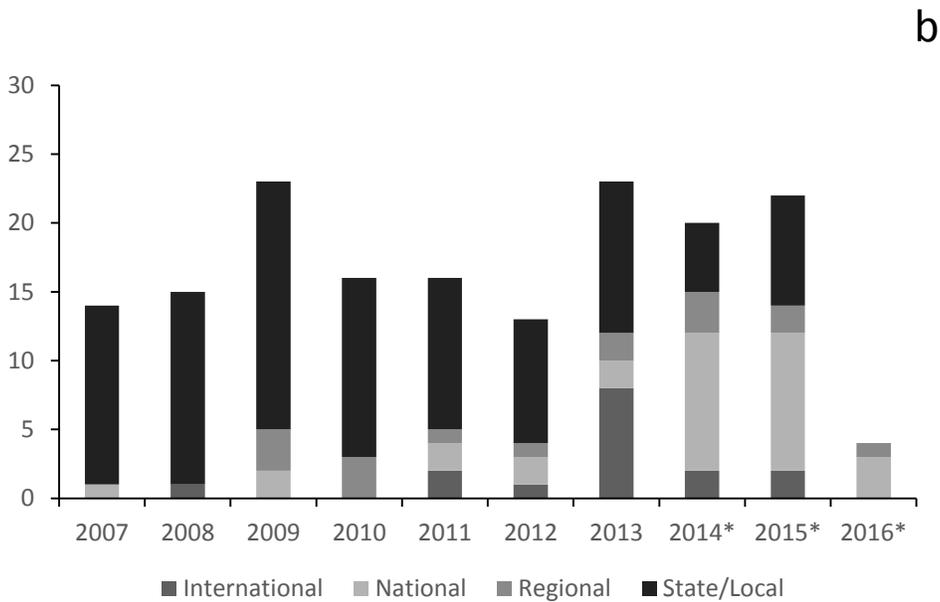
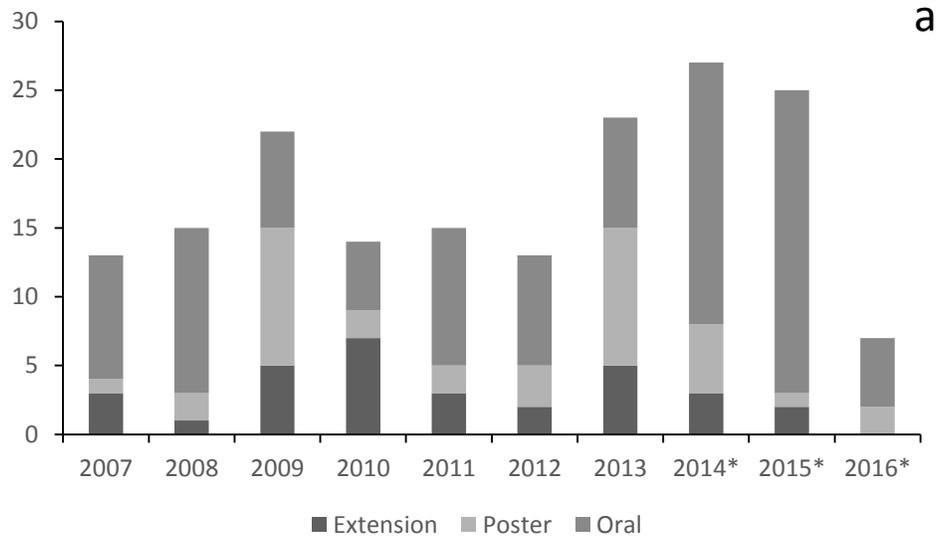
Results of this research have been disseminated via a large body of publications (Figure 1) and presented to a wide array of audiences (Figure 2). HEE researchers have begun to accumulate sufficient data to describe short-term responses of various ecosystem components to forest management, while numerous graduate students have completed their projects and data analysis. This research is being published in peer-reviewed academic journals. Figure 1a shows a breakdown of publications by individual HEE inventory. Figure 1b shows the breakdown by year.

Further, data from the Hardwood Ecosystem Experiment has been presented at numerous venues, both scientific and non-scientific (Figure 2a). Substantial effort was made early in the project to provide numerous extension opportunities to the general public and to natural resources professionals in the state of Indiana (Figure 2a). As more years of data have become available, there has been a large increase in the number of presentations to scientific audiences, with a particular increase in presentations at venues with regional, national, and international impact (Figure 2b).



**Figure 1.** Hardwood Ecosystem Experiment publications by publication type for a) individual inventories and by b) year. GTR refers to the HEE General Technical Report

\*Do not include publications on HEE bat research for 2014-2016



**Figure 2.** Hardwood Ecosystem Experiment presentations by a) presentation type and by b) presentation scope. Extension and poster presentations are not included in 2b resulting in lower total numbers.

\*Do not include presentations on HEE bat research for 2014-2016

## **2014-16 HEE Publications**

### **Journal articles**

- Auer, S. A., K. Islam, J. R. Wagner, K. S. Summerville and K. W. Barnes. *In press*. Cerulean Warbler Nestling Diet and Adult Nest Provisioning Behaviors in Southern Indiana. *The Wilson Journal of Ornithology*.
- Barnes, K.W., K. Islam and S.A. Auer. 2016. Integrating LIDAR-derived canopy structure into Cerulean Warbler habitat models. *The Journal of Wildlife Management* 80(1):101-116.
- Kellner K.F., J.K. Riegel and R.K. Swihart. 2014. Effects of silvicultural disturbance on acorn infestation and removal. *New Forests* 45: 265-281.
- Kellner K.F. and R.K. Swihart. 2014. Changes in small mammal microhabitat use following silvicultural disturbance. *American Midland Naturalist* 172: 348-358.
- LaGrange, S., S.J. Kimble, B.J. MacGowan and R.N. Williams. 2014. Seasonal variance in hematology and blood plasma chemistry values of the timber rattlesnake (*Crotalus horridus*). *Journal of Wildlife Diseases* 50(4): 990-993.
- Leonard O.D., J.W. Moore, J.K. Riegel, A.R. Meier, J.B. Dunning, K.F. Kellner and R.K. Swihart. 2015. Effect of variation in forest harvest intensity on winter occupancy of barred owls and eastern screech-owls in deciduous forests of the east-central United States. *Journal of Field Ornithology* 86: 115-129.
- Nemes, C.E., K. Islam and D.M. Pirtle. 2015. First documentation of a “double-decker” Cerulean Warbler (*Setophaga cerulea*) nest. *The Wilson Journal of Ornithology* 127(3): 534-538.
- Olson, Z.H., B.J. MacGowan, M.T. Hamilton, A.F.T. Currylow and R.N. Williams. 2015. Survival of timber rattlesnakes: Investigating individual, environmental, and ecological effects. *Herpetologica* 71:274-279.
- Powell, G., R.M. Brattain and J.D. Holland. 2015. New distributional records for the genus *Pytho*. *The Coleopterists' Bulletin* 66: 761–765.
- Ruhl, P. J., and J. B. Dunning. 2015. Morphometrics of Worm-eating Warblers in south-central Indiana: hatching year and after hatching year comparison. *North American Bird Bander* 43:81-84.
- Ruhl, P. J., J. K. Riegel and J. B. Dunning. 2015. Confirmation of successful chestnut-sided warbler breeding in south-central Indiana. *Proceedings of the Indiana Academy of Science* 124:38-42.
- Summerville, K.S. 2015. Species traits fail to consistently predict moth species persistence in managed forest stands. *Great Lakes Entomologist* 48: 114-124.

Summerville, K.S. 2014. Do seasonal temperatures, species traits, or timber harvest disturbance predict variation in moth species richness and abundance in unlogged eastern deciduous forests? *Agricultural and Forest Entomology* 16: 80-86.

Wagner, J., K. Summerville and K. Islam. *Accepted pending revisions*. Territory size in the Cerulean warbler: an influence of prey-rich tree abundance. *Proceedings of the Indiana Academy of Science*.

Wagner, J. R. and K. Islam. 2014. Nest-site Selection and Breeding Ecology of the Cerulean Warbler in Southern Indiana. *Northeastern Naturalist* 21(4): 515-528.

### **Articles in review**

Abdel Moniem, H.A.M., B. Schemerhorn, A. DeWoody and J.D. Holland. *Revision submitted*. Landscape genetics of a pollinator longhorned beetle [(*Typocerus* v. *velutinus* (Olivier))] on a continuous habitat surface. *Molecular Ecology*.

Kellner, K.F., N.I. Lichti and R.K. Swihart. *In preparation for submission in March 2016*. Midstory removal reduces effectiveness of oak (*Quercus*) acorn dispersal by small mammals in the Central Hardwood Forest region.

Kissick, A.L., J.B. Dunning and J.D. Holland. *Submitted for publication*. Functional diversity of predators and prey shows different threshold responses to fragmentation. *Functional Ecology*.

Murray, B. D., C. R. Webster, M. A. Jenkins, M. R. Saunders and G. S. Haulton. *In revision*. Ungulate impacts on herbaceous-layer plant communities in even-aged and uneven-aged managed forests. *Ecosphere*.

Summerville, K.S. and R.J. Marquis. *In preparation for submission in March 2016*. Comparing the responses of larval and adult lepidopteran communities to timber harvest using long-term, landscape-scale studies in oak-hickory forests. *Forest Ecology and Management*.

### **Graduate student dissertations and theses**

Auer, S. A. 2014. Cerulean warbler (*Setophaga cerulea*) provisioning behaviors and the effects of forest management practices on nest success in southern Indiana. M.Sc. Thesis, Ball State University, Muncie, IN. 82pp.

Barnes, K. W. 2014. Assessing the influence of social information and habitat structure on Cerulean Warbler breeding distribution in southern Indiana. M.Sc. Thesis, Ball State University, Muncie, IN. 118pp.

Kellner KF. 2015. Interactive effects of animals and silviculture on the early life history of oak. Ph.D. Dissertation. Purdue University, West Lafayette, IN.

## Oral presentations

- Auer, S., K. Islam., J. Wagner, K. Summerville and L. Barnes. 2014. Diet Composition of Cerulean Warbler (*Setophaga cerulea*) nestlings in relation to prey availability and breeding phenology. 129<sup>th</sup> Annual Indiana Academy of Science meeting, Indianapolis, IN, March 15, 2014.
- Barnes, K., K. Islam and S. Auer. 2014. Cerulean warbler settlement cues: a conspecific attraction study. 2014 Joint spring meeting of the Indiana Chapters of The American Fisheries Society and The Wildlife Society, Muncie, IN, February 27-28, 2014.
- Barnes, K. and K. Islam. 2014. Cerulean Warbler settlement cues: a conspecific attraction study. 74th Midwest Fish & Wildlife Conference, Kansas City, MO, January 26-29, 2014.
- Barnes, K., K. Islam and S. Auer. 2014. Integrating LiDAR derived canopy structure into Cerulean Warbler (*Setophaga cerulea*) habitat models. 129<sup>th</sup> Annual Indiana Academy of Science meeting, Indianapolis, IN, March 15, 2014.
- Delancey, C., C. Nemes and K. Islam. 2016. Cerulean Warbler research in the Hardwood Ecosystem Experiment. Annual Meeting of The Hardwood Ecosystem Experiment, Purdue University Wright Center, West Lafayette, IN, February 2, 2016.
- Delancey, C., C. Nemes and K. Islam. 2016. Habitat use of fledglings and site fidelity of Cerulean Warblers in Southern Indiana. 76th Midwest Fish & Wildlife Conference, Grand Rapids, MI, January 24-27, 2016.
- Hale, V., S.B. Thompson, L.A. Corriveau, B.J. MacGowan and D. Huse. 2014. Post Surgical Meloxicam Use in *Crotalus horridus*. Biology of the Pitvipers 2, Tulsa, OK, June 4-7, 2014.
- Hennessy, C., P.J. Ruhl, J. Holland and K. Summerville. 2015. The effects of downed coarse woody debris on salamanders, moths, and beetles: a forest ecology study in southeastern Indiana. 75th annual Midwest Fish and Wildlife conference in Indianapolis, IN. February 9th, 2015.
- Holland, J.D. and A.L. Kissick. 2015. Novel functional diversity traits of insect communities. 131<sup>st</sup> Annual Indiana Academy of Science Meeting, Indianapolis, IN, USA, March 26, 2015.
- Holland, J.D. and A.L. Kissick. 2015. Silviculture and functional diversity of wood-borers. Oral presentation. 75th Midwest Fish & Wildlife Conference, Indianapolis, IN, USA, Feb. 8–11, 2015.

- Holland, J.D. 2014. Stand and landscape influences on wood-borers. Invited seminar at the Northeastern Area Association of State Foresters State Land Management Committee, Nov. 4, 2014.
- Islam, K., K. Barnes and S. Auer. 2014. Response of a declining wood warbler to forest treatments: Preliminary results from a 100-year study. 26<sup>th</sup> International Ornithological Congress in Tokyo Japan, 18-24 August, 2014.
- Islam, K. and C. Nemes. 2015. The response of *Setophaga cerulea* to different forest treatments: Preliminary results from a long-term study. X Neotropical and XXII Congresso Brasileiro de Ornitologia in in Manaus, Brazil, July 17-24, 2015.
- Kellner K.F. and R.K. Swihart. 2015. Oak seedling survival and growth in recently harvested hardwood stands. 75th Midwest Fish and Wildlife Conference, Indianapolis, IN, February 8-11, 2015.
- Kellner K.F. and R.K. Swihart. 2015. Individual-based models at the intersection of wildlife and forestry: modeling impacts of seed predators, herbivores, and competitors on oak regeneration success. 75th Midwest Fish and Wildlife Conference, Indianapolis, IN, February 8-11, 2015.
- Kellner K.F. 2015. If you give a mouse an acorn: trophic interactions driving the oak life cycle in managed forests. Invited seminar at Wheaton College, Wheaton, IL, February 2015.
- Kellner K.F. and R.K. Swihart. 2014. Small mammals as predators and dispersers of acorns: effects of silviculture. Wildlife Society Annual conference, Pittsburgh, PA, October 2014.
- Kellner, K.F., and R.K. Swihart. 2015. Oak seedling survival and growth in recently harvested hardwood stands: interactions of vertebrate herbivory, interspecific competition and habitat. 11<sup>th</sup> North American Forest Ecology Workshop, Veracruz, Mexico, June 2015.
- Kissick, A.L. and J.D. Holland. 2015. Stability mechanisms in beetle functional groups. 130<sup>th</sup> Annual Indiana Academy of Science Meeting, Indianapolis, IN, USA, March 21, 2015.
- Kissick, A.L. and J.D. Holland. 2015. Hardwood Ecosystem Experiment harbors greater functional diversity of longhorned beetles and their generalist predators. 130<sup>th</sup> Annual Indiana Academy of Science Meeting, Indianapolis, IN, USA, March 21, 2015.
- Kissick, A.L. and J.D. Holland. 2014. Functional groups affected differently by disturbance and landscape. 99<sup>th</sup> Ecological Society of America Annual Meeting, Sacramento, CA, USA. August 15, 2014.
- Kissick, A.L. and J.D. Holland. 2014. Predators go the distance. 129<sup>th</sup> Annual Indiana Academy of Science Meeting, Indianapolis, IN, USA, March 15, 2014.

- Meier, A.R., M.R. Saunders and R.S. Swihart. 2014. Long-term dynamics of managed oak-hickory ecosystems: early results from the Hardwood Ecosystem Experiment in southern Indiana. 2014 Natural Areas Conference, Dayton, OH, October 15-17, 2014.
- Murray, B., J. Dunning, J. Holland, M. Jenkins, J. O’Keefe, M. Saunders and K. S. Summerville. 2015. Multi-taxon community responses to disturbance: taxonomic versus functional responses to forest management. Ecological Society of America. Baltimore, MD. August 15, 2015.
- Murray, B. D., K. S. Summerville, J. B. Dunning Jr., J. D. Holland, J. M. O’Keefe, M. R. Saunders, A. R. Meier and M. A. Jenkins. 2015. Functional diversity responses to forest management across taxa. Midwest Fish & Wildlife Conference. Indianapolis, IN. February 8-11, 2015.
- Murray, B. D., M. A. Jenkins, J. B. Dunning Jr., J. D. Holland, K. S. Summerville, A. R. Meier and M. R. Saunders. 2014. Multi-taxa functional diversity response to forest management in Central Hardwood Forests. Restoring Forests Conference. Lafayette, IN. October 16, 2014.
- Murray, B.D., C.R., Webster, M.A. Jenkins, M.R. Saunders and S. Haulton. 2014. Concurrent effects of forest management and white-tailed deer herbivory drive spatial patterning in herbaceous-layer plant communities. 99<sup>th</sup> Ecological Society of America Meeting, Sacramento, CA, August 10-15, 2014.
- Nelson, D.L. 2015. Small mammal population responses to disturbance induced by forest management. Ball State University chapter of The Wildlife Society, 2015.
- Nemes, C., C. Delancey and K. Islam. 2016. Nest site and territory selection by Cerulean Warblers *Setophaga cerulea* in Southern Indiana. 76th Midwest Fish & Wildlife Conference, Grand Rapids, MI, January 24-27, 2016.
- Nemes, C. and K. Islam. 2015. The response of a mature forest dependent species to silvicultural treatments. 2015 Annual Joint American Ornithologists' Union and Cooper Ornithological Society, Norman, OK, July 28-August 2, 2015.
- Nemes, C., K. Islam. and D. Pirtle,. 2015. Cerulean Warbler (*Setophaga cerulea*) reproductive success and relative abundance estimates in the Hardwood Ecosystem Experiment. 130th Annual Indiana Academy of Science meeting, Indianapolis, IN, March, 20 2015.
- Nemes, C., K. Islam, and D. Pirtle. 2015. Relative abundance and reproductive success of Cerulean Warblers in Southern Indiana. 75th Midwest Fish & Wildlife Conference, Indianapolis, IN, February 8-11, 2015.
- Olson, Z.H., B.J. MacGowan, M.T. Hamilton and R.N. Williams. 2015. Survival of timber rattlesnakes: investigating individual, environmental, and ecological effects. Midwest Fish and Wildlife Conference, Indianapolis, IN, February 8-10, 2015.

- Pirtle, D. and K. Islam. 2014. Cerulean Warbler monitoring. Annual Meeting of The Hardwood Ecosystem Experiment Indianapolis, IN, October 20, 2014.
- Ruhl, P. 2015. A Summer of Bird Banding in Southern Indiana. Monthly meeting of the Sycamore Chapter of the Audubon Society, in West Lafayette, IN November 12, 2015.
- Ruhl, P., R.N. Chapman and J.B. Dunning Jr. 2014. Effects of biomass harvest on eastern red-backed salamanders (*Plethodon cinereus*) Joint meeting of Ichthyologists and Herpetologists, in Chattanooga, TN August 01, 2014.
- Ruhl P.J., R.N. Chapman and J.B. Dunning Jr. 2014. Effects of biomass harvest on eastern red-backed salamanders (*Plethodon cinereus*). Harding University Biology Department Seminar Series, in Searcy, AR. September 08, 2014.
- Saunders, M.R. 2016. Overview of the Hardwood Ecosystem Experiment. 20<sup>th</sup> Central Hardwood Forest Conference, Columbia, MO, March 28 – April 1, 2016.
- Saunders, M.R. 2016. Overstory and fire programs on the HEE. HEE Annual Researcher Meeting, West Lafayette, IN, February 2, 2016.
- Saunders, M.R. 2015. The prescribed fire program on HEE. 35<sup>th</sup> Central States Forest Soils Workshop, Martinsville, IN, October 13-14, 2015.
- Saunders, M.R. and P. Ma. 2015. An introduction to HEE. 35<sup>th</sup> Central States Forest Soils Workshop, Martinsville, IN, October 13-14, 2015.
- Saunders, M.R. 2015. HEE: the little known experiment in IU's backyard. School of Public and Environmental Affairs, Indiana University, Bloomington, IN, April 16, 2015.
- Saunders, M.R. 2014. The Hardwood Ecosystem Experiment. 8<sup>th</sup> Annual Nature Daze, Nashville, IN, September 13, 2014.
- Summerville, K.S. 2014. Effects of silvicultural disturbance and climate stochasticity on forest Lepidoptera. Society for Ecological Restoration International World Conference, Madison, Wisconsin. September 2-6, 2014. *I also chaired the session in which I gave this paper.*
- Summerville, K.S. 2014. Are lepidopteran communities resilient to timber harvest? Ecological Society of America Annual Meeting, Minneapolis, MN. August 9-13, 2014.
- Thompson, S.B., L.A. Corriveau, B.J. MacGowan and D. Huse. 2014. Coelomic implantation of Holohil transmitters in *Crotalus horridus*. Biology of the Pitvipers 2, Tulsa, OK, June 4-7, 2014.

## Poster presentations

- Auer, S., J. Wagner, K. Barnes and K. Islam. 2015. Diet composition of Cerulean Warbler (*Setophaga cerulea*) nestlings. X Neotropical and XXII Congresso Brasileiro de Ornitologia Conference, Manaus, Brazil, July 17-24, 2015.
- Auer, S., J. Wagner, K. Barnes and K. Islam. 2014. Diet composition of Cerulean Warbler (*Setophaga cerulea*) nestlings. 26<sup>th</sup> International Ornithological Congress, Tokyo, Japan, August 18-24, 2014.
- Auer, S., K. Islam, J. Wagner, K. Summerville and K. Barnes. 2014. Diet composition of Cerulean Warbler nestlings in Southern Indiana. Joint spring meeting of the Indiana Chapters of The American Fisheries Society and The Wildlife Society, Muncie, IN, February 27-28, 2014.
- Auer, S., K. Islam, J. Wagner, K. Barnes and K. Summerville. 2014. Diet composition of Cerulean Warbler nestlings in Southern Indiana. 74th Midwest Fish & Wildlife Conference, Kansas City, MO, January 26 –29, 2014.
- Kellner, K.F., and R.K. Swihart. 2016. Applications of an individual-based model of early oak life history. Poster presentation, Joint meeting of Indiana TWS/SAF/AFS, Bloomington, IN, March 2016.
- Kissick, A.L. and J.D. Holland. 2014. Beetle functional diversity response to habitat fragmentation. Ecological Science and Engineering Interdisciplinary Graduate Program Symposium, West Lafayette, IN, USA, October 20, 2014.
- Nelson, D.L. and R.K. Swihart. 2016. Effects of prescribed burns and timber harvests on small mammals. Joint meeting of Indiana TWS/SAF/AFS, Bloomington, IN, March 2016.
- Shao, G., M. Saunders, S. Fei and G. Shao. 2014. Using LiDAR data to estimate canopy gaps in Yellowwood State Forest, IN. Purdue FNR Poster Symposium, West Lafayette, IN, April 11, 2014.

## Extension presentations

- Murray, B.D. 2014. The Hardwood Ecosystem Experiment: Community response to timber harvest. Northeastern Area Association of State Foresters, Public Lands Management Committee Annual Meeting.
- Murray, B.D. 2014. The Hardwood Ecosystem Experiment: Functional Diversity. Indiana Forest Stewardship Committee Annual Meeting.

Nelson, D.L. 2015. Small mammals module presented as part of the workshop: “Integrating wildlife habitat into forest management prescriptions: a hands-on workshop,” at the joint winter meeting of the Indiana Society of American Foresters and The Wildlife Society, Nashville, IN, March 2015.

Ruhl, P. 2015. Benefits of Early-Successional Habitat for Mature Forest Birds: Field Day and Mist-Net Demonstration. -Hardwood Ecosystem Experiment Field Day, in Monroe County, IN October 2, 2015.

Ruhl, P., R.N. Chapman and J.B. Dunning Jr. 2014. Effects of biomass harvest for cellulosic biofuel on eastern red-backed salamanders (*Plethodon cinereus*). Southeast Purdue Agricultural Center Field Day, in Jennings County, IN May 31, 2014.

### **Extension publications and videos**

MacGowan, B.J. and R.N. Williams. 2015. Managing Woodlands for Birds, Purdue University Cooperative Extension Service Publication, FNR-517-WV.

MacGowan, B.J. and R.N. Williams. 2015. Hardwood Ecosystem Experiment - Forest Birds, Purdue University Cooperative Extension Service Publication, FNR-518-WV.

Meier, A. R., A. Pizzo, M. Malloy, J. K. Riegel and J. B. Dunning. 2015. Breeding birds and forest management in the Hardwood Ecosystem Experiment and the Central Hardwoods Region. Purdue University Cooperative Extension Publication FNR-500-W.

### ***2006-2014 HEE Publications***

#### **Journal articles**

Auer, S.A., K. Islam, K.W. Barnes and J.A. Brown. 2013. Documentation of Red-bellied Woodpecker predation of a Cerulean Warbler nestling. *The Wilson Journal of Ornithology* 125(3) 642-646.

Currylow, A.F., A.J. Johnson and R.N. Williams. 2014. Ranavirus infections among sympatric populations of larval amphibians and Eastern Box Turtles (*Terrapene carolina carolina*). *Journal of Herpetology* 48(1): 117-121.

Currylow, A.F., B.J. MacGowan and R.N. Williams. 2012. Short-term forest management effects on a long-lived ectotherm. *PLoS ONE* 7(7):e40473.

Currylow, A.F., B.J. MacGowan and R.N. Williams. 2013. Hibernation thermal ecology of eastern box turtles within a managed forest landscape. *Journal of Wildlife Management* 77(2): 326-335.

- Currylow, A.F., M.S. Tift, J.L. Meyer, D.E. Crocker and R.N. Williams. 2013. Seasonal variations in plasma vitellogenin and sex steroids in male and female eastern box turtles (*Terrapene c. carolina*). *General and Comparative Endocrinology* 180:48-55.
- Currylow, A.F., P.A. Zollner, B.J. MacGowan and R.N. Williams. 2011. A survival estimate of Midwestern adult Eastern box turtles using radio telemetry. *The American Midland Naturalist* 165(1): 143-149.
- Holland, J.D. 2010. Isolating spatial effects on beta diversity to inform forest landscape planning. *Landscape Ecology* 25(9): 1349-1362.
- Islam, K., J. Wagner, R. Dibala, M.M. MacNeil, K.J. Kaminski and L.P. Young. 2012. Cerulean Warbler (*Setophaga cerulea*) response to changes in forest structure in Indiana. *Ornitologia Neotropical* 23: 335-341.
- Kaminski, K.J. and K. Islam. 2013. Effects of forest treatments on abundance and spatial characteristics of cerulean warbler territories. *American Midland Naturalist* 170:111 – 120.
- Kellner, K.F., N.A. Urban and R.K. Swihart. 2013. Short-term responses of small mammals to timber harvest in the Central Hardwoods. *Journal of Wildlife Management*. 77: 1650-1663.
- Kellner, K.F., J.K. Riegel. and R.K. Swihart. 2014. Effects of silvicultural disturbance on acorn infestation and removal. *New Forests* 45(2) 265-281.
- Kimble, S.J.A. and R.N. Williams. 2012. Temporal variance in hematologic and plasma biochemical reference intervals for free-ranging eastern box turtles (*Terrapene carolina carolina*). *Journal of Wildlife Diseases* 48: 799-802.
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