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# THE HEE UPDATE

Hardwood Ecosystem Experiment

http://HEEForestStudy.org

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## PRESCRIBED FIRE ON THE HEE

The spring of 2015 will mark another step in the progress of the Hardwood Ecosystem Experiment. There is very strong evidence from research throughout the eastern United States that prior to European settlement low intensity fires on the forest floor were much more common than they are today, and researchers have demonstrated that the use of prescribed fire in combination with other forest management techniques often (though not always) promotes the establishment of oak seedlings. Since one of the primary objectives of the HEE is to develop forest management techniques that maintain oak and hickory forests in southern Indiana, the importance of assessing the impact of periodic prescribed fires on regeneration of these tree species has become increasingly clear.


Prescribed fire in an oak forest.

The prescribed fire program on the HEE will focus on areas that are scheduled for harvests in 2028. Our intent is to develop a large number of oak seedlings and saplings in the forest understory. When canopy disturbance occurs, these new trees will be well positioned to capture newly available sunlight. To understand the impacts of prescribed fire on vegetation and wildlife, we will be installing dozens of survey points within the burn areas where we will track whether or not oak and hickory seedlings are becoming established, how the amount of dead wood and leaf litter on the forest floor relates to intensity of the fire, and how other plants and animals respond to low intensity fires. We plan on using prescribed fire in each of the 2028 harvest areas between 2 and 4 times over the next decade with about 3 years between each fire.

## HEE Birding Day, Project Learning Tree

On June 7, the HEE hosted 20 birders for the first HEE bird day; the attendees spent the morning at three of the HEE research units listening and looking for birds, then spent an afternoon hearing research presentations from the bird researchers on the project. Judging by their responses, the day was a big success and we hope to continue it into the future.

Later in June, 11 teachers also visited the HEE as part of the program Project Learning Tree, a joint effort of the Indiana Department of Natural Resources and the American Forest Foundation to provide training for teachers in forest ecology and to provide them with tools that they can bring back to the classroom for their students. We hope that this program will continue to capitalize on information from the HEE as well.

# HEE RESEARCH SPOTLIGHT

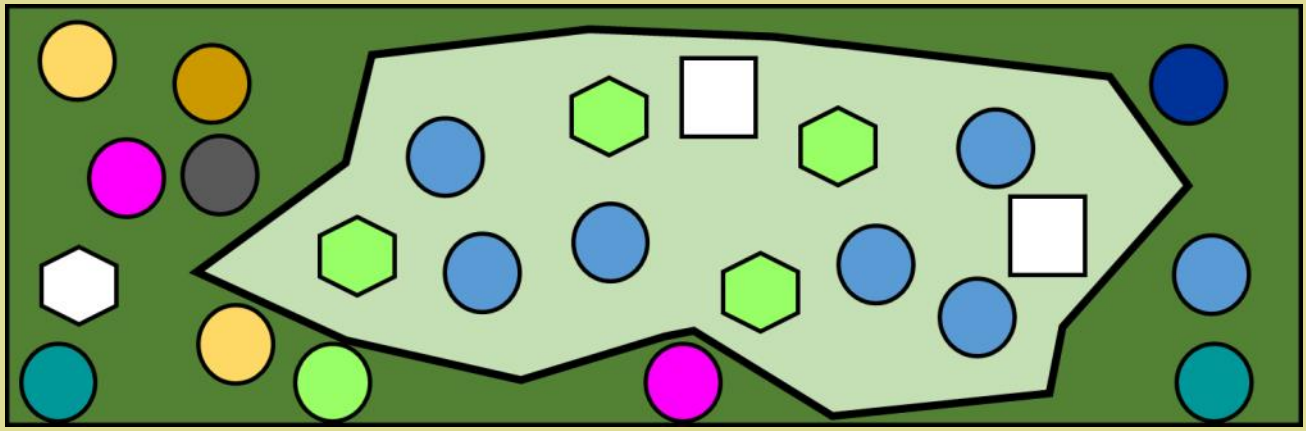
## Functional Diversity Across Taxa on the HEE

***Dr. Bryan Murray, Natural Resources Post-doctoral Scholar, Purdue University***

For many folks, the word biodiversity invokes images of tropical rainforests or coral reefs that are teeming with many different species of plants, animals, and fungi. However, this type of diversity, known as *species* (or *taxonomic*) *diversity*, is only one facet of biodiversity. Diversity can also include the variety of ecological functions performed by the community, such as pollination, decomposition, productivity, resilience, and many others. Organisms possess *functional traits* that determine their influence on ecosystem functions. A functional trait can be any aspect of morphology, phenotype, phenology, or behavior that influences both an organism's fitness and its ecological functions. When taken together, the identity and variety of functional traits within a biotic community comprise its *functional diversity*.

The HEE is a great place to study functional diversity because it is home to a diverse assemblage of species, and many species-rich taxa were sampled before and after harvest. This winter Dr. Bryan Murray began studying the functional diversity of these taxa, how functional diversity may be linked across trophic levels, and how functional diversity responds to forest disturbance. This task began with compiling species abundance data collected on the HEE, and obtaining functional trait values. For some taxa, like beetles and moths, functional traits have been measured in the lab (e.g. wingspan) or observed in the field (e.g. foraging location). For other taxa, like birds and plants, functional traits like body size, maximum height, foraging guild, and seed size, are generally available in the literature.

In addition to influencing ecosystem function, functional traits also affect a species' response to disturbance. Therefore, disturbance affects ecosystem function in part by changing the set of traits in the biotic community. On the HEE, Bryan is compiling abundance and trait data from many of the most diverse taxa, including breeding birds, bats, wood-boring beetles, moths, and trees, before and after the initial timber harvests in 2008. This will be adapted into a framework for studying the response of multi-taxa functional diversity to future planned and unplanned disturbances, such as fire and emerald ash borer.



A diagram showing the difference between functional diversity and species diversity. The dark green area represents an undisturbed forest area, the light green represents a disturbed area. We are interested in determining whether there is greater biodiversity in the undisturbed or disturbed area. Different colors represent different species, while different shapes represent different functional traits. For example, a circle may represent an insect species that pollinates flowers, a square may represent an insect species that feeds on leaves, and a hexagon may represent an insect species that bores into dead trees. In this schematic, then, there are nine different species in the undisturbed area (nine colors) but only two functions (circle and hexagon). In the disturbed area, there are only four different species (four colors) but there are three functions (circle, square, hexagon). We would therefore say the disturbed area has higher functional diversity but the undisturbed area has higher species diversity.

# Some Snapshots from the 2014 HEE Field Season


Photo captions (clockwise from upper left): **a**. The overstory vegetation crew relocating trees for measurement; **b**. A crew on the fawn radio telemetry crew measuring a newly captured fawn and fitting it with a radio collar; **c**. A lively eastern chipmunk just prior to being released after being captured, weighed and fitted with an eartag for monitoring; **d**. The project coordinator providing refuge for a just released white-footed mouse.

***Do you have pictures from any HEE related event or activity?***

***If so, you can submit them to Andy Meier (meiera@purdue.edu) for archiving. Please include any information about the pictures.***

# Congratulations!

Three HEE graduate students defended their M.S. theses in Spring and Summer 2014, all from Ball State University: Holly Badin, Sasha Auer and Kevin Barnes. Holly's thesis focused on roosting ecology and habitat use by northern long-eared bats (*Myotis septentrionalis)* while Sasha and Kevin both completed theses related to cerulean warbler (*Setophaga cerulea*) population dynamics, reproductive success, and breeding territory characteristics. Join me in congratulating all of them on a job well done! To date, 16 graduate students have successfully completed degrees using HEE data.

## HEE Harvest Panoramas, Spring 2014, 6th Year Post-harvest


# New HEE and HEE-Related Publications

**Summerville, K.S.** 2014. Do seasonal temperatures, species traits and nearby timber harvest predict variation in moth species richness and abundance in unlogged deciduous forests? *Agricultural and Forest Entomology* 16: 80-86. http://dx.doi.org/10.1111/afe.12035

LaGrange, S.M., ***S.J.A.Kimble***[a], **B.J.MacGowan** and **R.N.Williams**[a]. 2014. Seasonal variance in hematology and plasma chemistry values of the timber rattlesnake (*Crotalus horridus*) Jounal of Wildlife Diseases. http://dx.doi.org/10.7589/2013-10-267

Emphasis indicates: **HEE principal investigator (PI),** ***HEE graduate student*****, HEE Staff,** [a] Former PI or graduate student

# New HEE Graduate Students

**Jocelyn Karsk**

Jocelyn was raised in Nebraska, but is thrilled to call the Hoosier state her new home. She is a M.S. candidate at Ball State University and is working on a study of northern long-eared bat (*Myotis septentrionalis)* roosting ecology. Jocelyn is mist-netting and radio tracking these bats in order to determine habitat selection at the stand and landscape level in an ecosystem of differing silvicultural treatments.

**Danny Pirtle**

Danny grew up in Wisconsin and has lived in Minnesota, California, and Texas, before beginning graduate school at Ball State University. As a member of the Cerulean Warbler breeding biology lab, he will continue the survey work of the graduate students before him, focusing especially on breeding success and failure. Danny is still determining the exact focus of his thesis, but it will probably involve analyzing silvicultural treatment effects on nesting success, as well as assessing nest site vegetative characteristics.

## *And more to come . . .*

The Winter 2014/15 newsletter will include profiles of two more new graduate students; **Claire Nemes** who began an M.S. project this fall with Dr. Kamal Islam at Ball State University and **Tim Divoll** who began a PhD with Dr. Joy O'Keefe at Indiana State.

# From the Project Coordinator

The new work that Dr. Bryan Murray is doing with HEE data (highlighted in this newsletter) has gotten me to thinking a lot about biological diversity in forested ecosystems, particularly in the eastern United States. Most of what we hear about biodiversity in the media comes from other parts of the world: tropical rainforests in South America, coral reefs off Australia's coast, conifer forests of the Pacific Northwest. High rates of biological productivity, stimulated by ample moisture, long growing seasons or, in the case of coral reefs, nutrient rich waters, allow for these "biodiversity hotspots" to harbor some of the most species rich ecosystems in the world. Naturally, then, most research focused on understanding "biodiversity" has been centered in these areas.

Though the hardwood forests of southern Indiana may be relatively species-poor when compared to areas like the Amazon rainforest, a huge array of plants and animals still occur in Hoosier woodlands. And, unlike in the tropics, scientists only rarely find new species here (at least that you don't have to look at under a microscope). If there is an advantage to having fewer species, it is that we already know a lot about many of the plants and animals that we encounter, and we know the ecological roles that a lot of them play (their *function*, as Dr. Murray is researching). Much like the old anecdote of the blind men and an elephant, where one thought the elephant was a snake, another a thought it was a tree, and yet another thought it was a wall, the more we know about the different parts of an ecosystem, the more accurately we can describe it. What remains particularly challenging, however, is to discern not only the shape of the elephant's trunk or leg or stomach, but also to map all the nerves and vessels that connect the trunk, legs and the stomach to make a functional elephant. Ecologists still struggle to define similar connections within ecosystems, and we hope that Dr. Murray's work will provide some of the first insights about the links between different parts of forested ecosystems, how functional diversity influences the strength of those links and what role forest disturbance plays in the formation and maintenance of those links.

With almost a decade of data collection, the extensive dataset of plant and animal observations maintained by the HEE will continue to be one of the most reliable sources of information for biodiversity dynamics in the east-central United States. It further will allow a balanced comparison of changes in biodiversity in areas under active forest management compared to those subjected to only natural disturbances. I hope that further work will enable us to identify critical biodiversity thresholds in Indiana's oak-hickory forests, the effect of disturbances on biodiversity, and ways that forest management can be improved both to continue to protect existing biodiversity and to increase biodiversity into the future.

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