



41ST ANNUAL

natural  
areas

CONFERENCE

# Deeply Rooted in Restoration

DAYTON, OHIO • OCTOBER 15-17, 2014





PRESENTED BY THE NATURAL AREAS ASSOCIATION WITH CO-HOST FIVE RIVERS METROPARKS

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## Hello and Welcome,

### I am so pleased you are able to join us for this year's Natural Areas Conference!

This event is *the* gathering for professionals working in natural areas conservation. It offers a chance to network, learn, and re-energize by spending time with individuals who have a similar passion for the work that we do. It's also a forum in which we all can share our experiences and research and discuss new ideas in a welcoming, positive atmosphere.

This will be my 20th year of attending Natural Areas Conferences, and I often reflect on how essential this event was to my work in the early years of my career as a natural areas manager in western Pennsylvania. There weren't many people in my state doing what I was doing. The Natural Areas Conference was my chance to interact with individuals who had new ideas and more experience, and then bring that knowledge back to my job. To this day, I feel that it is so important to encourage students and young professionals to attend the conference and make the most of their time while they're here.

I'm particularly looking forward to our opening plenary session, which will feature speakers Emma Marris, Hugh Safford and Guy Denny. Their presentations promise to be thought-provoking and engaging, and the panel discussion that follows is sure to spark some healthy give and take. I think it will get everyone revved and ready for the rest of the conference.

You may have noticed that the conference format has changed. That is by design. Many of you told us that you would be more likely to attend a shorter conference. We listened, and have condensed the conference proceedings into two days and devoted the third to optional field trips. While I hope you'll stay for all three days, I think you'll agree that any amount of time you can spend at the Natural Areas Conference is worthwhile.

Many thanks to our host, Five Rivers MetroParks, and our sponsors. Their generosity and cooperative spirit have made this event possible. Additional thanks go to all of our speakers, volunteers, and staff members working behind the scenes to make this conference come together and be the exceptional event that it is.

Sincerely,

Lisa L. Smith  
Executive Director, Natural Areas Association

## Welcome to Dayton!

The Natural Areas Association and Five Rivers MetroParks extend a sincere welcome to those attending the 41st-annual Natural Areas Conference. Whether you are visiting us from another country or state, or from in or around the Dayton area, you will discover plenty to do, learn, and enjoy.

Southwest Ohio long has been a center for innovation. It's the place where such important inventions as the powered airplane, cash register, pop-top can, automobile starter, and flood conservancy district were created. The region has also fostered innovation in natural areas conservation, as reflected by our conference theme, *Deeply Rooted in Restoration*. (The Natural Areas Association itself has some history here, as its second conference was held at nearby Glen Helen Nature Preserve in 1975.)

The region's longstanding focus on conservation has achieved significant results. Montgomery and adjacent counties boast 11 park districts, five land trusts, a National Historical Park, six state parks, 10 state nature preserves, two state scenic rivers, and the United States' largest system of paved, connected bikeways, with 330 miles to explore. Five Rivers MetroParks itself protects 16,000 acres of land. Since 1963, it has led the region in land protection, reforestation efforts, restoration of urban parkland, nature play for children, and sustainable outdoor recreation. Field trips will visit several of the outstanding forests, fens, prairies, streams and wetlands that have been protected in the region.

This year's conference will not be all work: Conference attendees can enjoy an open mic musical event on Wednesday night, where you can either perform or listen to music at the beautiful RiverScape MetroPark Pavilion along the Great Miami River in downtown Dayton. Fun and fellowship will prevail at the annual Natural Areas Association awards dinner and silent auction on Thursday evening.

Outstanding public attractions in the area include the National Museum of the United States Air Force, the National Aviation Hall of Fame, the Dayton Aviation Heritage National Historical Park, and the Dayton Dragons minor league baseball team. Conference-goers will find a vibrant public market, three microbreweries, and outstanding food, art, and entertainment in the nearby Oregon District.

We look forward to learning, discovering, and laughing with you during the upcoming days!

Sincerely,

Mary Klunk  
Conservation Manager, Five Rivers MetroParks

Welcome



### Conference Planning Team

— NAA Committee Members —

- **Renee Boronka**
- **Deb Kraus**
- **Lisa Smith**

— Conference Coordinators —

- **Mary Klunk**, Five Rivers MetroParks
- **David Nolin**, Five Rivers MetroParks

— Program Chair —

- **Ryan McEwan**, University of Dayton

— Field Trips Chairs —

- **Rick Gardner**, ODNR Division of Natural Areas & Preserves
- **Tom Borgman**, Great Parks of Hamilton County

— Marketing and Promotions —

- **Trish Butler**, Five Rivers MetroParks
- **Kristen Wicker**, Five Rivers MetroParks

— Exhibits Chair —

- **Katrina Arnold**, Five Rivers MetroParks
- **Joe DiMisa**, Woolpert

— Auction Chair —

- **Yvonne Dunphe**, Five Rivers MetroParks

— Volunteer Coordinator —

- **Yvonne Dunphe**, Five Rivers MetroParks

— Student Involvement —

- **Alyssa Balter**, Five Rivers MetroParks

— Zero Waste Coordinator —

- **Tim Pritchard**, Five Rivers MetroParks

2014 Natural Areas Conference

## Questions and Conference Updates

The staff at the conference registration desk will be happy to help answer any question you might have. This is also where the “lost and found” is located. Check for last-minute updates to the conference schedule and other important information on the message board stationed near the registration desk.

## Name Badges

Please wear your name badge to all conference events. It is your ticket to sessions, workshops, breaks and socials.

## Cell Phones

Please silence cell phones during sessions as a courtesy to presenters and participants.

## Meals

Your full conference registration fee includes: coffee breaks, hors d'oeuvres at the poster session, field-trip box lunch (pick up Friday morning before departing) and, if you selected the option during registration, attendance to the Thursday NAA membership luncheon and evening awards dinner and auction (tickets to these events will be in your name-badge sleeve).

## Auction

Want to bring home a souvenir from the 41st-annual conference and help the NAA continue its work? Stop by the auction display in Room 103. You'll find T-shirts, notecards, artwork, pottery, books and local foods up for bid at the silent auction. Want something more substantial? Check out the live auction items. Either way, there will be something for everyone! Bid a little, bid a lot, but bid often to make it yours! An annual tradition at the live auction is the spirited bidding to win the Prairie Fire Kit. The winning team will have bragging rights for a year and have its name and final bid amount engraved on the drip torch.

2014 Natural Areas Conference

Auction items will be on display throughout the conference. Silent auction bids are welcome anytime. The live auction will be held during the awards dinner. The silent auction will close shortly afterward. Cash and credit cards are accepted for payment. All proceeds benefit the NAA. If you have arranged to donate an item for the auctions, please drop it off in Room 103 on Tuesday evening or Wednesday morning.

## Exhibitors

The third floor of the Dayton Convention Center will be open from Wednesday morning through Thursday at 4 pm to provide participants time to meet exhibitors and browse their displays.

## Field Trips

If you are a full conference or Friday daily registrant who preregistered for a field trip, you will find a ticket indicating your field trip choice behind your name badge. Should you have questions regarding a scheduled trip, please visit the conference registration desk. We ask that you not change your field trip selection, but if you feel you must, the deadline for doing so is Wednesday at 2 pm (on a space-available basis).

## Student Competition

We thank those who entered the student awards presentation. A team of judges will evaluate student posters and oral presentations. The top student presenters will receive their monetary awards and certificates on Thursday night at the awards dinner.

## Conference T-Shirts

Official 41st-Annual Natural Areas Conference T-shirts are available at the NAA exhibit booth. These 100 percent organic cotton shirts make great gifts or souvenirs!

Information

## Schedule at a Glance

### Tuesday, Oct. 14

5 pm – 7 pm Registration/Check-in (Outside of Room 306)

### Wednesday, Oct. 15

7 am – 5 pm Registration/Check-in (Outside of Room 306)

7 am – 7 pm Silent & Live Auction items on display (Room 103)

7 am – 9 am Federal Natural Areas Roundtables (Room 304)

8 am – 9 am *Natural Areas Journal* Meeting (Room 303)

8 am – 9 am State Natural Areas Roundtable (Room 302)

9 am – 12:15pm Conference Welcome, Plenary Session & Panel Discussion (Room 306)

12:15 pm – 1:30 pm Lunch (on your own) or Student/Professional Speed Networking (Room 202)

1:30 pm – 3 pm Concurrent Sessions (Rooms 302, 303, 304, 307, 308, 309)

3 pm – 3:30 pm Break

3:30 pm – 5 pm Concurrent Sessions (Rooms 302, 303, 304, 307, 308, 309)

5 pm – 7 pm Poster Session & Reception (Room 103)

7:30 pm – 10 pm RiverScape Pavilion Musical Event (111 E. Monument Avenue, Dayton)

### Thursday, Oct. 16

7 am – 6 pm Registration/Check-in (Outside of Room 306)

7 am – 10 pm Silent & Live Auction items on display (Room 103)

8:30 am – 10 am Concurrent Sessions (Rooms 302, 303, 304, 307, 308)

10 am – 10:30 am Break

10:30 am – noon Concurrent Sessions (Rooms 302, 303, 304, 307, 308)

Noon – 1:30 pm Membership Meeting & Luncheon (Room 103) Note: Pre-registration required

1:30 pm – 3 pm Concurrent Sessions (Rooms 302, 303, 304, 307, 308, 309)

1:30 pm – 5 pm Keys to Conservation Careers (Room 309)

3 pm – 3:30 pm Break

3:30 pm – 5 pm Concurrent Sessions (Rooms 302, 303, 304, 307, 308, 309)

6 pm – 10 pm NAA Awards Dinner & Auction (Room 103)

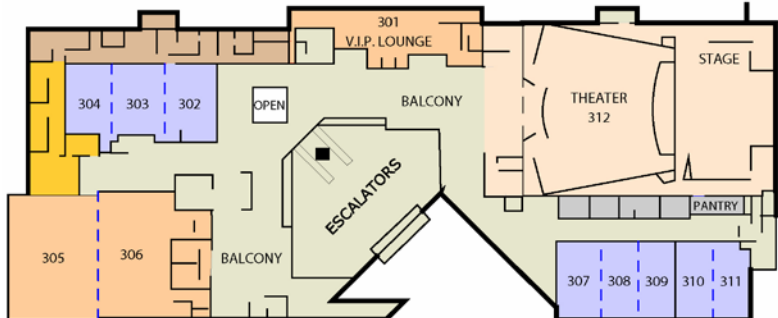
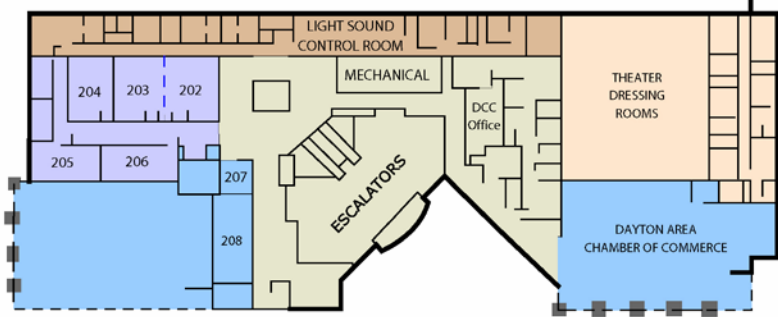
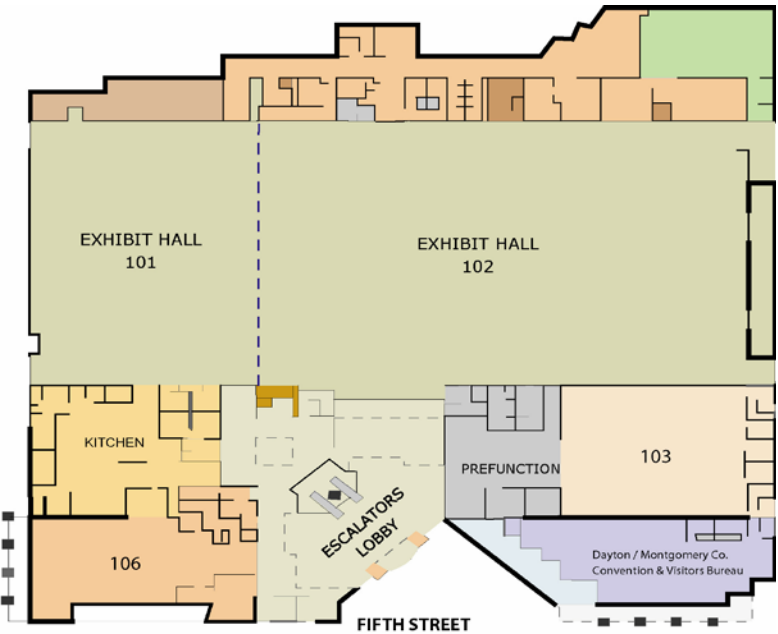
### Friday, Oct. 17

7 am – 5 pm Field trips (depart from the front of the Dayton Convention Center)

## Information

## Venue Map

**Dayton Convention Center**  
22 E. Fifth Street / Dayton, OH 45402 / (937) 333-4700



### Zero Waste

**The 2014 Natural Areas Conference is striving to be a Zero Waste event.**

Large gatherings generate a large amount of waste through the use of disposable items such as food and beverage containers, especially those that cannot be recycled or composted. Zero Waste is a strategy for interrupting the waste stream through infrastructure, operations and education.

A Zero Waste event aims to eliminate landfill-bound solid waste and achieve maximum efficiency of all utilized resources. This goal must be shared by both organizers and participants.

Organizers have provided the proper receptacles for trash, compost and recycling. Participants are asked to make sure that all items are properly discarded in the right receptacles and to utilize reusable beverage and food containers as much as possible. Thank you for your participation in this effort!

## Information



## Plenary Session

Natural areas in North America face major challenges: expanding human populations and economies, changes in climate and precipitation patterns, air and water pollution, fires, floods, invasive species, and more. This year's plenary session challenges us to consider whether current approaches to natural areas management can keep pace with the changes wrought by these environmental trends, or if something different is in order.

MODERATOR: RYAN MCEWAN

9 am – 9:15 am

**Welcome** by Lisa Smith, Executive Director, Natural Areas Association

9:15 am – 9:45 am / OPENING TALK

**Reading the Ohio Landscape** by Guy Denny  
Guy L. Denny, an interpretive naturalist, writer and photographer, opens the session with a look at the natural history of Ohio and conservation challenges and triumphs within the state. His presentation provides context for the two talks that follow.

9:45 am – 10:30 am / KEYNOTE ADDRESS

**Diversity, Wildness, Inspiration: The Value of Smaller, Fragmented Natural Areas** by Emma Marris  
Keynote speaker Emma Marris, an environmental writer, champions the idea that because no place on Earth remains unchanged by humans, we should embrace and work with the world's changed habitats. She discusses the underappreciated conservation value of smaller, fragmented natural areas where nature and human society intersect.

10:30 am – 11:15 am / PLENARY ADDRESS

**Deeply Rooted in Reality: Bringing Federal Lands Conservation and Restoration into the 21st Century** by Hugh Safford  
Our plenary speaker, USDA Forest Service ecologist Hugh Safford, looks at the large, protected landscapes managed by the U.S. federal agencies. As

climate change and other factors constantly refashion the “new normal” for these areas, he discusses some of the ways in which conservation of these vast lands can and must change to meet the challenges of the 21st century.

11:15 am – 12:15 pm

**Panel Discussion** with Emma Marris, Hugh Safford, Reed Noss and Keith Bowers  
Keith Bowers, president and founder of Biohabitats and Ecological Restoration and Management, and Reed F. Noss, Provost's Distinguished Research Professor at the University of Central Florida, join our speakers for a panel discussion that promises to engage the audience in a lively exchange of ideas about future directions for natural areas management.



12:15 pm – 1:30 pm / ROOM 202

### Student-to-Professional Speed Networking

Students and recent grads, take advantage of this unique opportunity to make connections with professionals in your desired field! You'll be able to share your background and career aspirations with potential employers and professionals. Speed networking is a fast-paced activity consisting of 10 rotations in which students will speak to a professional for four minutes before moving to the next person. Everyone should come ready to ask – and answer – questions. Lunch will be provided to participants. Must be pre-registered to participate.

Wednesday, Oct. 15

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## About the Speakers & Participants



● **Guy L. Denny**  
Guy L. Denny is an interpretive naturalist, writer and photographer with a wealth of knowledge about the natural history of Ohio. In 1999, he retired from his position as chief of the Ohio Department of Natural Resources Division of Natural Areas and Preserves after a professional career spanning 33 years of public service. He is author of several booklets and articles on Ohio natural history, and is past editor of the DNAP newsletter, in which he published numerous articles and photographs. Since retiring, Denny has served on several boards. Currently, he serves as president of the Ohio Natural Areas & Preserves Association, which he helped establish in 2013, and is secretary-treasurer for the Outdoor Writers of Ohio.

● **Keith Bowers**  
Keith Bowers is a landscape architect and wetland scientist who has been at the forefront of applied ecology, land conservation, and sustainable design for nearly three decades. He is founder and president of Biohabitats and its sister company, Ecological Restoration and Management.



● **Emma Marris**  
Emma Marris is a freelance environmental writer. She has a master's degree in science writing from Johns Hopkins University and worked for many years as a reporter for the journal Nature. In 2011, she published her first book, *Rambunctious Garden: Saving Nature in a Post-Wild World*. The book highlights alternative conservation strategies that do not focus on holding or returning land to a historical baseline. From managed relocation of species threatened by climate change to the embrace of so-called novel ecosystems, she champions a blurring of the lines between nature and people, and a conscious and responsible care of our humanized planet. She grew up in Seattle, Washington, and lives with her husband and two children in Klamath Falls, Oregon.

● **Reed Noss**  
Reed Noss is Provost's Distinguished Research Professor at the University of Central Florida and president of the Florida Institute for Conservation Science. His research interests include climate adaptation strategies; road ecology; ecosystem conservation; and ecological changes along urban-rural-wildland gradients.



● **Hugh Safford**  
Hugh Safford is the regional ecologist for the USDA-Forest Service's Pacific Southwest Region (California, Hawaii, Pacific territories) and a research faculty associate at the University of California-Davis. Safford manages a staff of ecologists who provide expertise in vegetation and fire ecology, climate change, inventory and monitoring, land management and planning efforts on the national forests in the Pacific Southwest Region. He is the manager of the Regional Research Natural Area program, the Sierra Nevada region leader for the California Fire Science Delivery Consortium, and a member of the science advisory boards for a number of environmental collaboratives and NGOs.

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Wednesday, Oct. 15

Schedule of Presentations

	ROOM 302	ROOM 303	ROOM 304	ROOM 307	ROOM 308	ROOM 309
TOPIC / TIME	<b>Wetlands</b> MODERATOR: MIKE LEAHY	<b>SYMPOSIUM: Deer and Invasive Species</b> MODERATOR: DAVE GORCHOV	<b>Human Dimensions – Education</b> MODERATOR: TRACY BOUTELLE FIDLER	<b>SYMPOSIUM: Restoration of Southeastern Grasslands</b> MODERATOR: MATTHEW ALBRECHT	<b>Land Conservation/Restoration</b> MODERATOR: DAVID KRISKA	<b>Grassland Restoration and Management</b> MODERATOR: DAVE NOLIN
1:30 PM	High frequency soil monitoring to understand greenhouse gas emissions in a restored wetland. <i>Karla M. Jarecke</i>	Are invasive plants an emergent property of deer overabundance? <i>Christopher R. Webster</i>	Five Rivers MetroParks’ green schoolyards initiative. <i>Douglas Horvath</i>	A review of the glades, outcrops, barrens, prairies, savannas, and riverscours communities of the mid-South U.S. <i>Dwayne Estes</i>	Measuring restoration success of arthropod functional groups using floristic quality assessment index (FQAI) and the novel Ant Quality Index (ANTQI). <i>Kaitlin U. Campbell</i>	Evaluation of native plant seeding density for high quality prairie reconstructions. <i>Malissa Underwood</i>
2:00 PM	Great Miami wetland mitigation bank: Creation, management, and goals. <i>Michael P. Enright</i>	Effects of the invasive shrub, <i>Lonicera maackii</i> , and a generalist herbivore, White-tailed Deer, on forest floor plant community composition. <i>Jessica R. Peebles-Spencer</i>	Connecting to urban woodlands through student service-learning. <i>Eric Knackmuhs</i>	Drivers of plant diversity and woody encroachment in Ozark dolomite glades. <i>Jesse Miller</i>	Tracking the rare butterfly <i>Pieris virginiensis</i> through space and time. <i>Samantha Davis</i>	Restoration efforts at Huffman Prairie: Floristic and avifaunal changes on a disturbed 109-acre blacksoil prairie remnant after 22 years of management. <i>Dave Nolin</i>
2:30 PM	<i>Juncus fasciatus (Juncaceae)</i> a newly recognized endemic species obscured by a widespread weed of eastern North America. <i>Wesley M. Knapp</i>	Interactions between invasive plants and deer in the herb layer of metropolitan forests: Effects on invasive recruitment and native trees. <i>Janet A. Morrison</i>	The magnificent classroom: Project-based science and service learning in the Oak Openings Region. <i>Todd D. Crail</i>	Effects of disturbance in granite rock outcrop communities. <i>Melissa Caspary</i>	Changes in the spider (Order: Araneae) and ground beetle (Family: Carabidae) communities after an EF-2 tornado impacted a north-central Ohio forest. <i>Sarah J. Rose</i>	Minimizing bird strikes at Dayton International Airport: Converting cropland to native grasses and forbs. <i>Terry Slaybaugh and Charity Krueger</i>
3:00 PM	Mid-afternoon Break	Mid-afternoon Break	Mid-afternoon Break	Mid-afternoon Break	Mid-afternoon Break	Mid-afternoon Break
TOPIC / TIME	<b>Community-Engaged Management</b> MODERATOR: REBECCA HAEFNER	<b>SYMPOSIUM: Deer and Invasive Species</b> MODERATOR: DAVE GORCHOV	<b>Human Dimensions – Education</b> MODERATOR: TRACY BOUTELLE FIDLER	<b>SYMPOSIUM: Restoration of Southeastern Grasslands</b> MODERATOR: MATTHEW ALBRECHT	<b>Forests: Response to Ecosystem Drivers</b> MODERATOR: CLIFF CHAPMAN	<b>Biology and Management of Aquatic Habitats</b> MODERATOR: JUDY SEMROC
3:30 PM	A college conservation collaboration for monitoring and adaptive management of natural ares. <i>Lisa Brush</i>	Allelopathic disruption of the mycorrhizal-plant mutualism in a native forest herb reduces carbon acquisition, allocation, growth and depresses vital rates: Evidence from greenhouse and field experiments. <i>Susan Kalisz</i>	Student-based models for conservation of Kentucky’s bluegrass region. <i>David Brown</i>	Reconstructing pre-European fire regimes, forests and wildlife habitats in the eastern United States: Mammoth Cave National Park and the barrens of Kentucky and Tennessee. <i>Cecil Frost</i>	Variable gene dispersal conditions and differing spatial deforestation patterns affect fragmented tropical tree restoration. <i>Yamini Kashimshetty</i>	The structure and distribution of stream salamander and macroinvertebrate communities across southeastern Kentucky. <i>John C. Bourne</i>
4:00 PM	Community Forest Management in Cameroon: What opportunities are there for local people participation? <i>Mbunya Francis Nkemnyi</i>	Separate and interactive effects of disturbance, deer herbivory, and exotic plant invasions on forest regeneration. <i>John D. Parker</i>	Building conservation advocacy amongst pre-teen youth: A look into conservation kids. <i>Joshua R. York</i>	Population dynamics of an endangered plant provide evidence for historical disturbance regimes of limestone cedar glades. <i>Matthew Albrecht</i>	Climate change and tree species range dynamics in the eastern United States: An integrated modelling approach to facilitate management decisions. <i>Anantha Prasad</i>	Improving construction and restoration techniques for vernal-pool breeding amphibians. <i>Stephen Richter</i>
4:30 PM	Equipping land managers & owners through landscape initiatives with plans to restore conservation corridors. <i>Rudolph Johannes Röscher</i>	Urban deer management: Results of 7 years of controlled bow-hunting in Five Rivers MetroParks and implications for land managers. <i>Robert Ligas</i>	From backyard forest to world biome; teaching connectedness, conservation, and world significance of America’s eastern forest. <i>Nancy Stranahan</i>	Climate change, lightning fire, stressful soils, megaherbivores, and other non-human factors created and maintained most southeastern grasslands. <i>Reed Noss</i>	People and deer and earthworms, oh my! How and where do we determine restoration priorities in a landscape influenced by various disturbance types? <i>Sarah Eysenbach</i>	Opportunities and challenges in urban stream restoration. <i>Jessica Miller</i>
5:00 PM	All Sessions Adjourn	All Sessions Adjourn	All Sessions Adjourn	All Sessions Adjourn	All Sessions Adjourn	All Sessions Adjourn
5:00 – 7:00 PM	Poster Session / Room 103					



## Symposia

1:30 pm – 5 pm / ROOM 303

### The Role of White-tailed Deer in the Invasion of Deciduous Forests of Eastern North America

MODERATOR: DR. DAVID GORCHOV

The density of White-tailed Deer (*Odocoileus virginianus*) in many areas of eastern deciduous forest is much higher than estimated densities before European settlement. These high deer densities have many impacts on forests, including reduced hardwood tree regeneration and perennial herb diversity. Many of the same forests have been invaded by non-native plants—many of which also have negative effects on native plants. Experimental studies at sites across the Midwestern and eastern U.S. tease apart the effects of deer and invasive plants, as well as explore how they interact to impact native plants and other components of forest ecosystems. Scientists from Maryland, Michigan, New Jersey, Ohio, and Pennsylvania have been invited to this special session to share their research findings, and discuss the implications for deer and invasive species management.

1:30 pm – 5 pm / ROOM 307

### Historical and Contemporary Perspectives on the Restoration of Southeastern Grasslands

MODERATOR: DR. MATTHEW ALBRECHT

In the Southeastern United States, edaphic grasslands, glades, and outcrop systems are centers of endemism and support a disproportionate amount of regional biodiversity. However, much debate remains on their origin, how historical and contemporary factors shaped them, and what role management and restoration should play in maintaining them. Using historical and contemporary data, this session explores the geographic distribution of these systems, evidence that fire, grazing, and other disturbances shaped them, and how modern-day plant populations and communities respond to habitat restoration and management.



7:30 pm – 10 pm

FIVE RIVERS METROPARKS,  
RIVERSCAPE PAVILION  
111 E. MONUMENT AVE.  
DAYTON, OH 45402

### Open Space Mic Night: Calling All Musicians!

This year, Natural Areas Conference attendees have the chance to not only enjoy musical entertainment but provide it. Join us Wednesday evening after the Poster Session at Five Rivers MetroParks RiverScape Pavilion, located along the Great Miami River in downtown Dayton. Conference-goers with musical talent (or just a lot of nerve) can sign up to perform 1 to 3 songs. A sound system, food vendors, and refreshments will be available at the event, but we need you to provide the talent! Nature-themed songs are preferred. If you are interested in being a part of Open Space Mic Night, please contact Dave Nolin (937) 275-7275 before 4 pm on Wednesday.

## Poster Session

5 pm – 7 pm / ROOM 103

Join us for the poster session and reception. Talk with poster presenters and mingle with fellow attendees. Complimentary hors d'oeuvres and cash bar.

- Examining the genetic diversity of a successful plant reintroduction for the Federally Endangered Cumberland Sandwort (*Minuartia cumberlandensis*). *Megan E. Philpott, University of Cincinnati*
- Propagule production and propagule pressure: A new perspective for managing *Lonicera maackii*. *Jessica Wright, Southern Illinois University Edwardsville*
- Knowing the enemy: Cultural requirements for germinating invasive Japanese hops in experimental situations. *Jonathan Clark, Southern Illinois University Edwardsville*
- Predicting the effects of Emerald Ash Borer on hardwood swamp forest structure and composition in southern Michigan. *Anna K. Miller, Miami University*
- Feasibility of installing a sustainable multiuse trail at Eku's Maywoods. *Andrew J. Wiley, Eastern Kentucky University*
- Acacia Reservation ecological restoration master plan. *Kevin A. Grieser, Biohabitats*
- Barely scratching the surface: Pilot studies on the impact of *Amyntas* earthworms in northeast Ohio. *Nidia Arguedas, Cleveland Metroparks*
- Developing an outdoor education disturbance impact index: Assessing effects of stream study classes on aquatic organisms. *Jon P. Bossley, Ohio State University*
- Human-carnivore conflict in the Sierra Gorda biosphere reserve Querétaro, Mexico. *Violeta Anaya-Zamora, Autonomous University of Querétaro*
- Land residency and interest in conservation easements in Southern Indiana: A behavioral approach. *Eric Knackmuhs, Indiana University*

- Assessing and mapping woody invasive coverage in the riparian buffer habitat of Miller Creek prior to restoration. *Shana Byrd, the Wilds*
- Butterfly surveys as a tool to measure conservation success and population shifts. *Michelle Banker, Marianst Environmental Education Center*
- Making sound decisions: An online invasive plant management decision analysis tool. *Chris Zimmerman, The Nature Conservancy*
- Crane Hollow State Nature Preserve, Hocking County, Ohio: Research, inventory, and monitoring. *Heather Stehle, Crane Hollow Preserve*
- Identification and characterization of microsatellite loci and levels of genetic variation in *Hedeoma tod-senii*. *Omer Donmez, University of Cincinnati*
- Following in the footsteps of E. Lucy Braun: Restoring a xeric limestone prairie – Agave Ridge Prairie, Adams County, Ohio. *Rick Gardener, Ohio Department of Natural Resources*
- Developing a vegetation-based index of biotic integrity for wetlands of Kentucky. *Noelle Smith, Eastern Kentucky University*
- Rates of establishment and spread of mesic prairie species ten years after initial seeding. *William J. Sluis, Trine University*
- Loss of bird species diversity in phragmites-dominated habitats in two Lake Erie coastal wetlands. *Robert S. Whyte, California University of Pennsylvania*
- Developing an amphibian index of biotic integrity and validating a rapid assessment method for Kentucky's wetlands. *Kari Dupler, Eastern Kentucky University*
- Commercial harvest pressure and regulation strategies to manage Snapping Turtles (*Chelydra serpentina*) among U.S. states. *Benjamin Colteaux, Virginia Commonwealth University*

Schedule of Presentations (morning)

	ROOM 302	ROOM 303	ROOM 304	ROOM 307	ROOM 308
TOPIC / TIME	<b>SYMPOSIUM: Ecology and Management of Oak Forests</b> MODERATOR: TODD HUTCHINSON	<b>Threatened and Endangered Plants</b> MODERATOR: MARLEEN KROMER	<b>Forests</b> MODERATOR: TIM OSBORNE	<b>Human Dimensions</b> MODERATOR: DOUG STEVENSON	<b>Forests: Invasive Plant Ecology</b> MODERATOR: TERRI HOGAN
8:30 AM	Climate, fire, and humans in oak ecosystems of North America. <i>Rich Guyette</i>	Using SNPS to examine genetic population structure and identify units for conservation of endangered northeastern bulrush, <i>Scirpus ancistrochaetus</i> , across its range. <i>Kendra Cipollini</i>	GIS inventory and map of canopy trees in an Indiana old-growth forest. <i>Stephanie L. Schuck</i>	Sunwatch Indian Village/Archaeological Park: A partnership success story. <i>William E. Kennedy</i>	Assessing management effectiveness in the Rocky River (Ohio) watershed using multi-year treatments of lesser celandine ( <i>Ranunculus ficaria</i> ). <i>Jennifer Hillmer</i>
9:00 AM	Disturbance and long-term dynamics in oak forests. <i>Ryan McEwan</i>	An evaluation of management strategies for running buffalo clover at the Blue Grass Army Depot, KY. <i>Alexi Dart-Padover</i>	A robust population of beechdrops in Central Indiana. <i>Spencer Wesche</i>	Managing forest birds in southeast Ohio: Guidelines for land managers. <i>Amanda M. Duren</i>	An assessment of plant community and succession in grasslands following invasive shrub removal. <i>Rachael Glover</i>
9:30 AM	Restoration for the future in Missouri: Setting endpoints based on historic reference conditions. <i>Daniel C. Dey</i>	Restoration of the federally threatened Lakeside daisy in Ohio. <i>Jennifer L. Windus</i>	Seed success, vegetative propagation, and plant associates of the federally endangered perennial, <i>Thalictrum cooleyi</i> . <i>Renee Fortner</i>	Inspiring conservation action through informal dialogue. <i>Joshua R. York</i>	Wavyleaf grass, a new invader of eastern forests: Early detection and response efforts in Virginia. <i>Kevin E. Heffernan</i>
10:00 AM	Mid-morning Break	Mid-morning Break	Mid-morning Break	Mid-morning Break	Mid-morning Break
TOPIC / TIME	<b>SYMPOSIUM: Ecology and Management of Oak Forests</b> MODERATOR: TODD HUTCHINSON	<b>Management in the Wake of Emerald Ash Borer</b> MODERATOR: MARLEEN KROMER	<b>Grassland Restoration and Management</b> MODERATOR: LARRY SMITH	<b>Human Dimensions</b> MODERATOR: BECKY DONALDSON	<b>Forests: Invasive Plant Ecology</b> MODERATOR: RACHEL MCNEISH
10:30 AM	Status and characteristics of <i>Quercus stellata</i> in xeric habitats across northwest Arkansas. <i>James F. Rosson Jr.</i>	Preservation of ash regeneration and stable age structure by protecting mature ash during the Emerald Ash Borer invasion. <i>Erin M. O'Brien</i>	Efforts to preserve and restore the native prairies of the Darby Plains in Ohio. <i>John Watts</i>	Manage the chaos of volunteers and registrations with NatureTracker. <i>Zoë Whyman</i>	Invasive species in the forests of Virginia. <i>Anita Rose</i>
11:00 AM	Biotic and abiotic factors associated with white oak decline and mortality in southern Ohio. <i>Robert P. Long</i>	Biodiversity from the ashes: Concepts and methods for community-engaged forest restoration in response to an insect pest catastrophe. <i>Meredith Cobb</i>	Planting and monitoring efforts of Mead's milkweed populations in Missouri. <i>Malissa Underwood</i>	Inspiring action in response to ecological disaster: A community-based conservation response to invasive species impact. <i>Joshua R. York</i>	The role of ornamental gardening in forest plant invasions across an urban-rural gradient in southwestern Ohio. <i>Allison Mastalerz</i>
11:30 AM	Impacts of wildfire recency and frequency on an Appalachian oak forest in southern West Virginia. <i>Melissa Thomas-Van Gundy</i>	The effect of Emerald Ash Borer-caused tree mortality on forest regeneration. <i>Brian Hoven</i>	Natural seed bank expression following <i>Frangula alnus</i> removal in the Oak Openings Region of northwestern Ohio. <i>Timothy L. Walters</i>	The (pleasant) side effects of sustainable hiking trail design and construction. <i>Michael Osborne</i>	Epizoochory as a seed dispersal mechanism for garlic mustard ( <i>Alliaria petiolata</i> ). <i>Chris Loebach</i>
12:00 PM	Lunch	Lunch	Lunch	Lunch	Lunch

Schedule continues on page 14



Schedule of Presentations (afternoon)

	ROOM 302	ROOM 303	ROOM 304	ROOM 307	ROOM 308	ROOM 309
TOPIC / TIME	<b>SYMPOSIUM: Ecology and Management of Oak Forests</b> MODERATOR: TODD HUTCHINSON	<b>Watersheds</b> MODERATOR: BEN BRAEUTIGAM	<b>Grassland Restoration and Management</b> MODERATOR: RANDY HEIDORN	<b>Human Dimensions</b> MODERATOR: TOM BORGMAN	<b>Forests: Invasive Plant Ecology</b> MODERATOR: RACHEL MCNEISH	<b>Keys to Conservation Careers</b> MODERATOR: LISA SMITH
1:30 PM	Thinning and prescribed burning alters hardwood seedling sprouting in the Willaim B. Bankhead National Forest, Alabama. <i>Callie Schweitzer</i>	Influence of GRASS filter strips on structure and function of riparian habitats of agricultural headwater streams in central Ohio. <i>Peter C. Smiley Jr.</i>	An ecological conundrum: Just what makes good Lesser Prairie-Chicken habitat? <i>Steven Olson</i>	Funding conservation through stream and wetland mitigation. <i>Devin B. Schenk</i>	Cross-system subsidy changes associated with the removal of a riparian forest invader ( <i>Lonicera maackii</i> ) alter stream ecosystem processes and macroinvertebrate dynamics. <i>Rachel McNeish</i>	<i>Open</i>
2:00 PM	Thinning and burning oak woodlands in the Ozark Highlands region. <i>Carter Kinkead</i>	Moving upstream: Collaborative leadership in water quality improvement. <i>Sarah Hippensteel Hall</i>	Weevils, deer, and fire effects on flowering diversity of tallgrass prairie forbs. <i>Roger Anderson</i>	Restoring a golf course: An Ohio case study in progress at Acacia Reservation. <i>Constance E. Hausman</i>	Earthworm and macroinvertebrate activity responses after removal of invasive shrub honeysuckle from an urban woodland park. <i>Robert P. Pipal</i>	Hugh Safford, Ecologist, U.S. Forest Service
2:30 PM	Long-term dynamics of managed oak-hickory ecosystems: Early results from the hardwood ecosystem experiment in Southern Indiana. <i>Andy Meier</i>	Water resources assessment and management in Wujraba micro-watershed. <i>Amberber Eneyew</i>	Nectar resources for butterfly restoration. <i>Helen Michaels</i>	The value of urban vacant lot seed banks in Cleveland, Ohio. <i>Nicole Hoekstra</i>	Entrenched invaders: Potential for evolutionary specialization of Amur honeysuckle ( <i>Lonicera maackii</i> ) seedlings in response to light and drought. <i>Kurt Schulz</i>	Jody Shimp, Project Manager, Illinois IDNR-Natural Heritage
3:00 PM	<i>Mid-afternoon Break</i>	<i>Mid-afternoon Break</i>	<i>Mid-afternoon Break</i>	<i>Mid-afternoon Break</i>	<i>Mid-afternoon Break</i>	<i>Mid-afternoon Break</i>
TOPIC	<b>SYMPOSIUM: Ecology and Management of Oak Forests</b> MODERATOR: TODD HUTCHINSON	<b>Lakes: Coast, Shore and Shallows</b> MODERATOR: CLIFF CHAPMAN	<b>Savanna &amp; Woodlands</b> MODERATOR: RANDY HEIDORN	<b>Wildlife</b> MODERATOR: SCOTT PEAK	<b>Forests: Invasive Plant Management</b> MODERATOR: RACHEL MCNEISH	<b>Keys to Conservation Careers</b> MODERATOR: LISA SMITH
3:30 PM	Red and white oak regeneration survival during severe oak decline and fire in Arkansas. <i>Martin A. Spetich</i>	Balancing shoreline restoration with public perception of shoreline aesthetics and lake recreation habitats. <i>Alicia Douglass</i>	Manipulation of over-story regulations on a black oak sand barren community. <i>David J. Kriska</i>	Strengthening wildlife crime control in Nepal. <i>Deependra Joshi</i>	Eddmaps: Using technology to map invasive species across the U.S. <i>Rebekah D. Wallace</i>	Michael Enright, Conservation Manager, Five Rivers MetroParks
4:00 PM	The silviculture of oak woodland restoration. <i>Daniel C. Dey</i>	Great Lakes coastal ecological restoration challenges and successes at Middle Bass Island, Ohio. <i>Joe DiMisa</i>	Changes in tree species composition, abundance, and diversity in a remnant historic prairie grove in central Illinois, USA over a thirty-four year period (1977-2011). <i>Roger Anderson</i>	Genetic diversity in the major histocompatibility complex of the Artic Fox and Southern Elephant Seal: Implications for survival in a changing climate. <i>Krystaal McClain</i>	Effective methodologies for invasive woody vegetation control: Strategies for local governments. <i>Megan Statt-Blake &amp; David J. Goerig.</i>	Michael Adams, Senior Project Scientist, Cardno JFNew
4:30 PM	Increasing ecological resilience in southern Indiana forests as adaptation for future climate change regimes. <i>Chad Bladow</i>	Management experiments on Lake Erie flowering rush ( <i>Butomus umbellatus</i> ). <i>Alyssa K. Dietz</i>	Changes in vegetative structure across 10 years of restoration management in an old-growth mountain longleaf pine forest. <i>Martin L. Cipollini</i>	Trophic cascades, habitat fragmentation and climate change: The need to reconnect, rewild and restore terrestrial landscapes. <i>Keith Bowers</i>	Creating a weed watch list for the National Capital Region national parks. <i>Mark Frey</i>	Renee Kivikko, Director of Education, Land Trust Alliance
5:00 PM	<i>All Sessions Adjourn</i>	<i>All Sessions Adjourn</i>	<i>All Sessions Adjourn</i>	<i>All Sessions Adjourn</i>	<i>All Sessions Adjourn</i>	<i>All Sessions Adjourn</i>

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# Symposia

8:30 am – 5 pm / ROOM 302

## Ecology and Management of Oak Woodlands and Forests

MODERATOR: DR. TODD F. HUTCHINSON

Oak (*Quercus* spp.) is a dominant and ecologically important tree in many forests of eastern North America. Oak forests and woodlands face a number of management challenges, including the loss of regeneration on many sites coupled with increases in maple (*Acer* spp.) and other competitive tree species. Another important issue in oak forest ecology and management is the loss of forest trees due to “oak decline.” Fire and forest harvesting are common tools used to enhance the success of oaks, and experimental data on the results of these practices are becoming more widely available. This session brings together scientists from across eastern North America to address these and other issues related to oak woodlands and forests.

Noon - 1:15 pm / ROOM 103

## NAA Annual Membership Meeting & Luncheon

All current NAA members are invited and encouraged to attend. Meet your fellow members and reunite with old friends! The meeting will also include: an update on the NAA, election of NAA board members, and the opportunity to network with other NAA members. Lunch is provided for those who pre-registered.

1:30 pm – 5 pm / ROOM 309

## Keys to Conservation Careers

MODERATOR: LISA SMITH

College students, recent grads and others interested in exploring careers in conservation fields will get firsthand knowledge of how to prepare for a successful career, and what you can expect from a variety of different jobs in conservation. Employees from federal and state agencies, non-government conservation groups and private firms will give brief presentations about how they got started in their professional careers and the kind of knowledge, skills and abilities they look for when hiring new staff.

Thursday, Oct. 16



# Natural Areas Association Awards Dinner & Auction

6 pm - 10 pm / ROOM 103

The awards dinner kicks off at 6 pm with a cash-bar social. Mingle with friends and colleagues, and bid on an array of silent auction items! Dinner will be served at 6:45 pm. Full-conference attendees and those who pre-registered for the awards dinner will have dinner tickets in the sleeve of their name badge. The NAA will honor recipients of the Carl N. Becker Stewardship Award and the George B. Fell Award. Please join us in acknowledging these very deserving individuals. Also, plan to participate in the exciting live auction and attempt to win the Prairie Fire Kit for your team! All auction proceeds benefit NAA programs.

## Silent & Live Auctions

Throughout the conference, please visit Room 103 to browse and bid on an assortment of silent auction items. Proceeds from the auction benefit the programs of the Natural Areas Association.

We have four fabulous items to offer in this year’s live auction, which will take place after the awards dinner on Thursday.

**Calaveros Crooners by Walter Matia. Value: \$1,800**  
Walter Matia has been casting bronze sculptures since 1980. Initially, he concentrated on bird life; over the years he has worked on sporting dogs and other mammals. In 1987, he began a series of large fountain and garden pieces. In 1989 the Blair House Restoration Committee placed one of his fountains in the formal garden of the United States President’s Guest House. Mr. Matia’s sculptures can be found at the Merrill Lynch corporate regional offices in New Jersey, Denver, Jacksonville and Singapore, and outside Reliant Stadium in Houston, Texas.

**Clothed in Bark by Frank Lowenstein. Design by Sallie Lowenstein. Value: \$150**  
This unique book is decoratively hand-punched with a soft leather cover and hand-bound in a woven, medieval longstitch binding. Limited, numbered artisan edition.

**Long-eared Owls by Judy Semroc. Framed print. Value: \$150**

**Prairie Fire Kit. Value: Priceless!**  
Our final item up for bid is the traditional Prairie Fire Kit. Please choose your teams wisely! Perhaps there will be a revival of the 2007 Ohio Burning River Coalition, who raised a total of \$2,300 for the Natural Areas Association.

Thursday, Oct. 16



## Conference Field Trips

Your field trip selection is indicated on a ticket in the sleeve of your name badge. If you have questions regarding your scheduled trip or if you'd like to change your trip, visit the registration table between Wednesday at 7 am and 2 pm (changes can only be made on a space available basis). No changes can be made after Wednesday at 2 pm.

Field trips will depart from the front doors of the Dayton Convention Center on East 5th Street. **Please arrive 20 minutes before your scheduled departure time to pick up your lunch in the lobby and assemble with your group.** Bring appropriate outdoor gear and your water bottle. Transportation will depart promptly at the scheduled departure time.

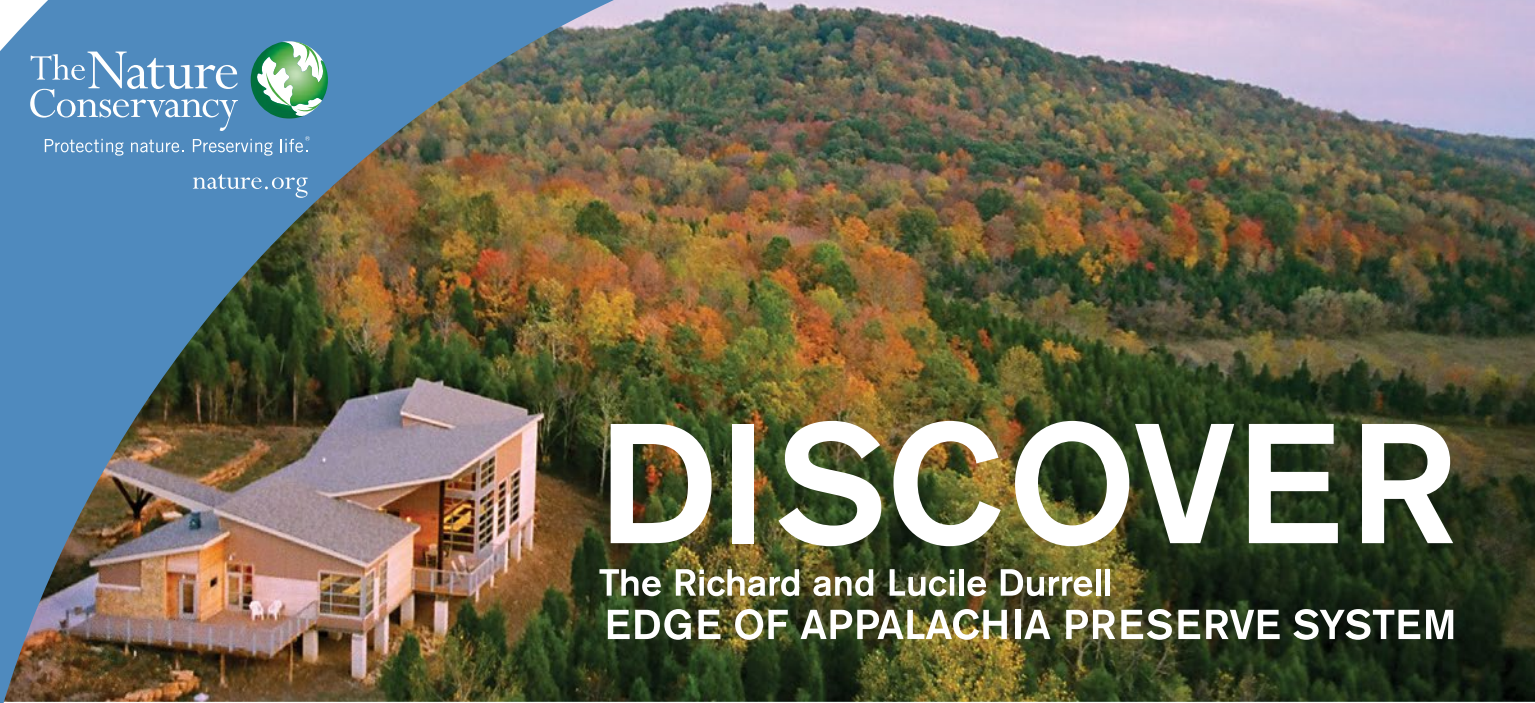
- FT-1** Fentastic: Cedar Bog & Gallagher Fen / 8 AM – 5 PM
- FT-2** Prairie and Fen Restoration Projects / 8 AM – 3 PM
- FT-3** Old-Growth Forests of Southwest Ohio / 7:30 AM – 3:30 PM
- FT-4** Study the Fen Restoration Process / 7:30 AM – 4:30 PM
- FT-5** Hershner Reserve & Zimmerman Prairie Wetlands / **CANCELED**
- FT-6** Canoeing the Little Miami National and State Scenic River / 7 AM – 4 PM
- FT-7** Ecological Restoration at Fernald Preserve & Tour of the Shaker Trace Nursery / 7:30 AM – 4:30 PM
- FT-8** Into the Gorge / 8:30 AM – 4:30 PM
- FT-9** Wetland and Stream Rehabilitation / **CANCELED**
- FT-10** River Restoration & Kayak the Mad River Run / 7 AM – 4:30 PM
- FT-11** Darby Plains Remnant Prairie Areas / 8 AM – 4 PM
- FT-12** Personal Connection to Nature: Biking Five Rivers / 7 AM – 3 PM
- FT-13** Highlands Nature Sanctuary / 7 AM – 5 PM

## Post-Conference Trip

**Saturday, Oct. 18 at 9 am – Sunday, Oct. 19 at noon**

Leaders will meet you at Shawnee State Park on the morning of Saturday, Oct. 18, at 9 am. They will be your guides through the area until Sunday at noon. Participants are responsible for all arrangements and costs associated with travel, lodging, meals, etc. Camping is available at no charge, but participants must provide own gear. If not camping, participants must make their own reservations at the Shawnee State Park Lodge [4404B State Route 125, West Portsmouth, Ohio 45663, Phone: (740) 858-6621]. Pre-registered participants only.

**Friday, Oct. 17**



# DISCOVER

The Richard and Lucile Durrell  
EDGE OF APPALACHIA PRESERVE SYSTEM

### The Wilderness Preserve Trail

A two-and-a-half-mile loop, this trail goes through an area termed "a howling wilderness" in 1961 by Dr. Edward Thomas, a nature writer for the Columbus Dispatch. Visitors will cross the most diverse of the preserve areas with more than 744 plant species recorded.

### Buzzardroost Rock Preserve Trail

This three-mile, one-way hike traverses the front of the Appalachian Escarpment to a rock promontory situated 900 feet above the Ohio Brush Creek. The panoramic scene awaiting visitors has been called Ohio's most spectacular view.

### Lynx Prairie Preserve Trail

Designated a National Natural Landmark in 1967, Lynx Prairie has three interconnecting loop trails, with a combined length of one-and-a-half miles, that meander through 10 prairie openings in an otherwise forested area.

Did you know that just 75 miles east of Cincinnati you can find a 16,000-acre nature preserve that is considered one of the most biologically diverse collections of natural systems in the Midwest? The Richard and Lucile Durrell Edge of Appalachia Preserve System, located in Adams County, Ohio, boasts more than 100 rare plant and animal species within 11 unique preserves, including four that have been recognized as National Natural Landmarks — a testimony to their national significance and ecological importance. Cincinnati Museum Center and The Nature Conservancy in Ohio have been working together to protect these areas for more than 50 years. We invite you to explore Ohio's largest privately owned protected natural area!

### Edge of Appalachia Eulett Center

The Eulett Center is available to rent for conferences, business meetings and community events.

### Edge of Appalachia Science Camp

Science Camp has been providing kids with the opportunity to reconnect with nature and have the time of their lives since 1978.

### Edge of Appalachia Advanced Naturalist Workshops

Advanced Naturalist Workshops offer field training for those interested in nature study and help to continue the study and cataloging of preserve resources.

Please visit [cincymuseum.org/nature](http://cincymuseum.org/nature) OR [nature.org/edgeofappalachia](http://nature.org/edgeofappalachia) for more information and directions.





# Exhibitors

## Wednesday, Thursday / 3RD FLOOR

The NAA thanks this year's exhibitors. Be sure to stop by the exhibits area on the third floor of the Dayton Convention Center.

- Arkansas Natural Heritage Commission
- Cardno JFNew
- Davey Resource Group
- Fernald Preserve, Department of Energy Office of Legacy Management
- Five Rivers MetroParks
- Forrest Keeling Nursery
- Miami Conservancy District
- The Nature Conservancy
- Noxious Vegetation Control, Inc
- ODNR Division of Natural Areas & Preserves  
*(Funded by an anonymous donor in honor of Rick Gardner's dedication to the flora of Ohio.)*
- Ohio Invasive Plant Council
- Precision Laser & Instrument
- Society for Ecological Restoration, Midwest Great Lakes Chapter
- Truax
- USDA, Animal and Plant Health Inspection Service (APHIS)
- USDA, US Forest Service
- Woody Warehouse Nursery, Inc.



# Colophon

## COVER

Virginia Bluebells grow on the high dolomite and limestone cliffs above the Little Miami River as it flows through Clifton Gorge State Nature Preserve near the village of Clifton in Greene County, Ohio. Clifton Gorge State Nature Preserve, John Bryan State Park and Glen Helen Nature Preserve form a contiguous corridor along the Little Miami River. Together they protect nearly 2,000 acres between the villages of Clifton and Yellow Springs. The second Natural Areas Conference took place at Glen Helen in 1975. Photo by Tom Arbour.

## EDITORIAL SERVICES

Sarah Riehl

## PHOTOGRAPHY

**PP. 16–17:** Calaveras Crooners bronze photo by QuickSilver Photographers, LLC, Takoma Park, MD; Long-eared Owls by Judy Semroc; Randy Nyboer by Renee Boronka. **P. 18:** Pembroke Savanna Nature Preserve, IL, by Judy Semroc. **P. 20:** Photo by Linda Sekura. **INSIDE BACK COVER:** Headlands Dunes State Nature Preserve, OH, by Elizabeth Russell.

## CONFERENCE LOGO DESIGN

Kayann Legg, (Retired) Lioness Designs

## CONFERENCE GRAPHIC DESIGNER

Juliano Boronka



Supporting professionals  
protecting nature

For over 35 years the Natural Areas Association (NAA) has provided support and vital resources to individuals and organizations concerned with the protection and stewardship of natural areas.

As defined by NAA’s founder, George B. Fell, natural areas are “areas of land which have scientific, educational and esthetic value by reason of distinctive natural features.”

NAA provides natural areas “defenders” with the tools and information they need to be successful, whether they are natural areas managers, educators, students, researchers, program staff, or volunteers.

To support those who are committed to natural areas conservation, the NAA:

- Publishes the “Natural Areas Journal”
- Hosts the annual Natural Areas Conference
- Informs and connects members via our new interactive website
- Publishes industry reports such as “The Status of State Natural Area Programs”
- Facilitates programs and working groups such as the State and Federal Natural Areas Programs Roundtables
- Provides education and outreach to the land trust community
- Sponsors student chapters to inspire and mentor those interested in conservation careers
- Serves as a portal to natural areas information and resources
- Is the voice for natural areas practitioners on issues of legislation, funding, and policy

The NAA is a professional association and a 501(c)(3) non-profit organization.

Visit [www.naturalareas.org](http://www.naturalareas.org) to become an NAA member, to donate, to become a conference sponsor, or to learn more about the Natural Areas Association.





PLAN TO ATTEND THE 42ND ANNUAL  
NATURAL AREAS CONFERENCE  
NOVEMBER 3-5, 2015  
LITTLE ROCK, ARKANSAS



CONSERVATION  
THROUGH  
COLLABORATION

