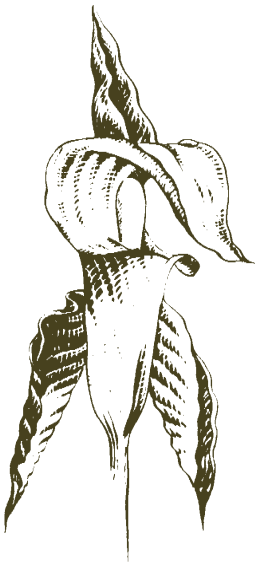

MISSOURI
Natural Areas
NEWSLETTER

2012
Volume 12, Number 1

"...identifying, designating, managing and restoring the best remaining examples of natural communities and geological sites encompassing the full spectrum of Missouri's natural heritage"

Eons in the Making, 35 years of Recognition for Missouri Natural Areas

The Natural Areas Program is 35 years young and as such, it seems like time to review where it has been, where it is now and where it is going. In terms of landscapes, 35 years is a mere instant in a geologic sense of time, yet in that time, through the Natural Areas Program in Missouri, land managers and conservationists have been able to improve and restore existing landscapes, natural communities and ecosystems with amazing results.

There is still much to do and the world is changing. New issues and threats that we could not fathom 35 years ago are now top of mind: new technologies, a changing and growing world population and a planet that is heating up. We need to determine how to mitigate those threats using new tools.

And, sometimes it takes rediscovering something old to find a new path. Consider the effect of fire on the landscape and its vital role now as a land-management tool. In the era of Smokey Bear, 35 years ago, fire was considered harmful to woodlands and woodland creatures.

We also want our children and grandchildren to rediscover the outdoors and spend more time in nature, so that they too can appreciate the natural areas and continue the work of protecting and conserving those areas, and their flora and fauna, for the next generation. It's good for them and good for the natural areas.

Read about our latest progress, new funding, new funding opportunities, natural area expansions and the enigmatic eastern prairie fringed orchid.

Thank you to the impressive group of writers and contributors to this Missouri Natural Area Newsletter. Some have been around since the beginning, 35 years ago, and some are newer faces. Thanks to all who have shared their expertise and for making Missouri a better place.

– Elizabeth Niven, editor

Mike Leahy

What is a natural area?

In Missouri, most of the state's 184 designated Missouri Natural Areas (dots on map) are at the core of Missouri's Conservation Opportunity Areas (shaded areas on map). Natural areas are the landscapes determined to be the best remaining places to conserve and restore biodiversity on a viable scale to carry out Missouri's Comprehensive Wildlife Strategy. Missouri's natural areas are reservoirs of species diversity, serving as reference points for managers and restoration biologists as they seek to improve natural landscapes to benefit both people and natural diversity.

The Nature Conservancy

Missouri Department of Natural Resources

Forest Service U.S. Department of Agriculture

U.S. Fish & Wildlife Service

National Park Service Department of the Interior

Conservation Department Missouri

Serving nature and you

The Missouri Natural Areas Program Celebrates 35 years

Our past and future

By Mike Leahy

Thirty five years ago, folks with the Missouri Department of Conservation and the Missouri Department of Natural Resources had a big idea – to protect, conserve, restore and manage the natural heritage of our state through a system of lands and waters designated as Missouri Natural Areas. The idea for natural areas conservation in Missouri goes back further than 1977, of course, but that is when the program was formalized within both state resource agencies.

Today MDC, MoDNR, the Mark Twain National Forest, the Ozark National Scenic Riverways, the U.S. Fish & Wildlife Service – Missouri Ecological Services Field Office and The Nature Conservancy – Missouri Chapter are all signatories to a memorandum of understanding forming a Missouri Natural Areas Program. This spring, Governor Jay Nixon recognized and commended the program for 35 years of service to the public to protect and conserve Missouri Natural Areas.

From tallgrass prairies to swamps and Ozark streams, Missouri Natural Areas consist of biological communities or geological sites that preserve and are managed to perpetuate the natural character, diversity and ecological processes of Missouri's native landscapes. These areas are stewarded for the enjoyment of all, the education of students and for beneficial scientific studies.

Natural areas are owned by state and federal organizations, conservation organizations, local governments, corporations, private citizens, foundations and other ownership associations. Missourians can be proud of the 184 designated Missouri Natural Areas with more than 70,000 acres for the public to enjoy hiking, bird watching, nature study and photography on. More than half of Missouri Natural Areas are open to hunting and fishing as well.

Back in 1977, the world's human population was around 4.2 billion. At that time, global climate change was not discussed beyond a relatively small group of scientists. In Missouri, our waters did not have zebra mussels nor silver and bighead carp. Japanese stilt grass and garlic mustard were not in the floodplain forests of the Current River. In the 1970s, when the natural areas program emerged, air and water pollution were big issues. Since then, in the U.S., we have made great strides in cleaning up point-source air and water pollutants. Global efforts have abated the threats of acid rain and atmospheric ozone depletion. With the DDT ban and subsequent restoration efforts, bald eagles have recovered to

Missouri Natural Area Committee members meet with Governor Jay Nixon to receive the Governor's proclamation celebrating the success of the Missouri Natural Areas Program for 35 years.

Photo provided by MDC

the point that they are no longer on our endangered species list and are a common sight in Missouri.

Today, the global human population is 7 billion and predicted to reach 9 billion by 2050. Human-induced global warming is now widely agreed upon by the scientific community and the predicted impacts from this warming to climate processes will put additional stresses on ecosystems into the future.

Presently, natural area managers struggle against an onslaught of invasive, exotic species including diseases. It's a good bet that the future will be hotter and more crowded. Global demands for food, energy, water and fiber will continue to pressure our ecosystems. Missouri Natural Areas are not and will not be immune from global and national environmental trends. While these pressures are felt on our "natural" capital – like our agricultural lands, wildlands and water resources – an unprecedented number of young people are disengaged from nature, rarely engaging in outdoor activities. The future of the Missouri Natural Areas Program will rest on continuing to engage Missourians in the outdoors, especially our young folks.

Natural areas conservation will require mentoring and training younger conservation biologists with the fortitude and resolve to continue the program for the next 35 years. Certainly the program will have to adapt to changing conditions. We will have to be realistic about which natural communities and native species populations can be conserved and restored. We will have to continue to engage the broader conservation community in Missouri to keep Missouri Natural Areas relevant and resilient for the next 35 years.

Mike Leahy is a natural areas coordinator for the Missouri Department of Conservation.

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Sharing the Experience with Children in Nature

Rick Hansen/FWS

Rick Hansen/FWS

Paul McKenzie, endangered species coordinator and biologist for the US Fish and Wildlife Service, is passionate about getting kids out in nature. "The kids are amazed by what they see," he said. "The younger they are, the more receptive they are to the creatures and experiences. Some of the older kids have preconceived ideas about things like snakes and spiders and we have to dispel some of the fear of the unknown." McKenzie has joined forces with his own church, with a predominantly African-American fellowship, and a network of other churches drawing members from the inner city in Columbia, Mo., to offer youth camps to kids ranging in age from 2.5 to young teens.

McKenzie's program runs only in Columbia. He did suggest some additional resources for bringing children into nature and natural areas. **See resources below and related story on pages 12 - 13.**

Additional resources:

The U.S. Fish and Wildlife Service initiated a Let's Go Outside campaign, www.fws.gov/letsgooutside/

In addition, http://childreninnature.mo.gov/ also has ideas, activities and resources from cooperating partners in Missouri.

C&NN developed a community action guide, http://www.childrenandnature.org/downloads/CNActGuide11.pdf.

Jamison, catching crayfish at FWS Nature Camp, Rock Bridge State Park. (left)

Jeremiah is excited about his first cricket frog capture at FWS Nature Camp, Rock Bridge State Park. (right)

Reflections from 35 years of Natural Areas

And, the action needed going forward

By Rick Thom

When I left the Illinois Nature Preserves Commission in 1977, my coworkers gave me a copy of Steyermark's *Flora of Missouri*. As the first natural areas coordinator for the Missouri Department of Conservation (MDC) in 1978, I almost wore the book out. This newly created position was part of MDC's Design for Conservation, a blueprint for expanded conservation programs made possible by the new state conservation sales tax.

Before I left Illinois, I had the opportunity to learn from my boss, George Fell, who wrote the legislation for the Illinois system and was a founder of The Nature Conservancy. Fell generously shared his experience with his staff. I also helped with the Illinois Natural Areas Inventory, headed by botanist Jack White at the University of Illinois. With this background, I had gleaned the elements of a strong natural areas program. We needed to identify the best remaining examples of all significant natural features and then protect and manage examples of each feature as units of a formal system of protected areas.

Missouri had made a good start by the time I arrived. Julian Steyermark had created a list of areas in need of protecting for their special botanical values. Wildlife students of Dr. Bill Elder at the University of Missouri-Columbia had completed natural area inventories as master's projects. The Nature Conservancy and the Missouri Prairie Foundation were actively protecting natural lands. Leo Drey's L-A-D Foundation had purchased several tracts of high natural quality and turned them over to MDC and the Missouri Department of Natural Resources (MoDNR) – State Parks Division for management. The Society of American Foresters had begun identifying tracts that would represent SAF forest types.

Former Assistant MDC Director Allen Brohn (l) and John Wylie (r).

Photo provided by the Missouri Department of Conservation

Photo provided by the Missouri Department of Conservation

Thom working on the Trail through Time at Pickle Springs NA in 1986.

MDC created an agency natural areas program in 1970 and it recognized many outstanding areas. Seven years later the MoDNR joined MDC to create a statewide, interagency Missouri Natural Areas System (MONAS) coordinated by a Missouri Natural Areas Committee (MONAC). The program gained momentum as more agencies joined.

I worked with MDC's land management divisions of Forestry, Fisheries, and Wildlife to strengthen, enlarge and otherwise enhance MDC's natural areas. Initially, I served as the staff person for both MONAC and MDC Natural Areas Committee. Back then, MDC Assistant Director Allen Brohn chaired MONAC with MoDNR Director Fred Lafser, and later with Missouri State Parks Director John Karel. Paul Nelson became DNR's first natural areas coordinator, followed by Greg Iffrig, after Nelson's promotion within the agency. The committee was enthusiastic and a sense of excitement pervaded the meetings as members grappled with growth and improvement of the system as well as agency differences in management approaches.

Important building blocks of a strong natural areas system include an ecological framework, a natural community classification system, a comprehensive inventory of the state's natural area resources, a system for tracking those resources, an ability to designate natural areas as protected units of the system, and the capability to manage the natural areas to protect and maintain the values for which they were designated.

Building the Missouri Natural Areas system was a team effort and dozens of people played important roles from agency administrators to land managers and park naturalists. Three key MDC leaders were Brohn, Natural History Chief John Wylie and Wildlife Research Chief Bill Crawford. These men conspired to create a public natural areas program and then they dedicated themselves to its success. I worked for Wylie, who

shared his knowledge of natural history and gave me an early tour of natural areas in the Ozarks. He also connected me to outstanding mentors in Missouri's plants, animals and management concepts, including forest entomologist Ramon Gass and prairie biologist Tom Toney. Gass established plant lists, permanent photo stations and vegetation monitoring plots on most of MDC's natural areas at the time. Toney pioneered the management of our prairies for sustained plant and animal diversity and recommended prairies for public acquisition.

To address the need for an ecological framework, I was able to team up with my MDC coworker, endangered species coordinator Jim Henry Wilson, to write *The Natural Divisions of Missouri* in 1980, with contributions from many. Fisheries biologist Bill Pflieger developed an aquatic classification system for our stream natural areas. Geologist Art Hebrank provided a geological classification system, and assistant state geologist and MONAC member Jerry Vineyard helped us appreciate the geological aspects of the program. MoDNR botanist Paul Nelson provided a landmark contribution with his *Terrestrial Natural Communities of Missouri* in 1986. Also in the early '80s, in a collaborative effort, MoDNR and MDC brought The Nature Conservancy's Natural Heritage Database to Missouri. Rebecca Haefner served as coordinator and plant ecologist for that new program.

Photo provided by the Missouri Department of Conservation

Pickle Springs was designated a National Natural Landmark in 1974 (privately owned). MDC bought Pickle Springs in 1984 and it was designated a Missouri Natural Area in 1986. This photo is from the trail opening and dedication in 1986.

In 1981, MDC hired Don Kurz, a veteran of the ambitious and successful Illinois Natural Areas inventory. Kurz began a comprehensive statewide natural features inventory and trained other biologists in inventory methodology. Although the project began modestly in four counties, during the next 15 years the inventory covered the entire state and documented scores of new natural features, including many properties that were bought for public natural areas. The elements of a strong natural areas system were mostly in place by 1987.

Doug Ladd, director of conservation science for The Nature Conservancy in Missouri, was the naturalist at Bennett Spring State Park at that time, and he provided leadership and insight on the role of fire in maintaining many of Missouri's natural communities. Through his management of the Bennett Spring woodlands and MoDNR's fire management at Ha Ha Tonka State Park, fire strategies were provided throughout the system. In addition, MoDNR natural areas coordinator Iffrig, and later Ken McCarty, applied ecological management concepts to natural areas and then trained Missouri state park staff.

In 1979, Roger Prior with the Coalition for the Environment helped organize a Midwest Natural Areas Workshop at Babler State Park. Attendees of that meeting then put together the Natural Areas Association (NAA) to provide national leadership and share information. Iffrig was the first editor of the Natural Areas Journal. I was elected to the board of the new organization. The NAA is still making a national impact in the protection and management of the world's biodiversity resources.

Looking at the program as a whole, Missouri lacks one important element of a strong state natural areas program: we have no statutory recognition of the system which states its relevance to public welfare. The units of the system are currently protected only by the policies of the agencies that oversee them. And agencies can change policies or make unilateral decisions on individual units within the system. To their great credit, the MONAC agencies have remained firm in defending their natural areas, but a further level of protection would help individual agencies resist future calls to divert an area for another purpose.

A goal for long-term protection of the system should be the passage of a Missouri Natural Areas Protection Act. This law would recognize the public benefits of the Natural Areas System. It would state that designated Missouri Natural Areas are in their highest and best use and that they cannot be diverted to other uses without a legal review process that determines that a specific diversion is a matter of imperative public necessity for which there are no reasonable alternatives. Threats of diversions are many and will increase. Examples are roads, utility corridors, lakes, towers and other public and private developments. Completing this unfinished business would make Missouri Natural Areas the last places that developers would look when considering any type of new project.

Rick Thom retired from the Department of Conservation in 2006, after 28 years of service in the Natural History Division and Wildlife Division. Since 2007, he has served as executive vice president of the Missouri Conservation Heritage Foundation (mochf.org).

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Ha Ha Tonka Oak Woodland NA Expands

Fire stimulates biodiversity and quality of the landscape

By Allison Vaughn

In 1976, Assistant Superintendent Paul Nelson and Park Naturalist Bruce Schuette of Cuivre River State Park conducted a prescribed fire at Sac Prairie, a remnant tract of native prairie in the park. For safety reasons, the burn unit included small portions of the adjacent woodlands. The following growing season, Nelson and Schuette were amazed at the vegetative response in the bordering woodlands. Prior to this time, fire was used as a management tool on prairies and grasslands, but it appeared to also stimulate vegetative growth in the surrounding woodlands.

When the Missouri Department of Conservation and the Department of Natural Resources signed an agreement in 1977 creating the Missouri Natural Areas Committee (MoNAC), fire in natural systems was largely misunderstood. Fire was seen as destructive and not part of the natural process to restore ecosystems. Following the establishment of the Missouri Natural Areas Committee, Nelson, as the new Missouri state parks natural areas coordinator, encouraged other managers to use fire to restore and maintain fire-adapted communities throughout Missouri, based in part on his witnessing results in Cuivre River State Park.

Six years later, in 1983, Nelson made history in the Niangua Basin when he implemented fire on a 40-acre tract of woodlands, called the Demonstration Unit at Ha Ha Tonka State Park. Nelson institutionalized the prescribed fire program for state parks, much to the consternation and ire of foresters and local turkey hunters who remained opposed to woodland burning for perceived negative impacts to timber and turkey populations

Tom Nagel/DNR

Paul Nelson setting the Spencer Creek Glade on fire in the early 1980s.

Coneflowers dot a glade at Ha Ha Tonka State Park.

Photo provided by DNR

Prior to 1983, local landowners throughout the Niangua Basin in the vicinity of Ha Ha Tonka State Park conducted regular burns of woodlands and glades, a tradition that began with Native Americans thousands of years ago. In fact, the recurring spring wildfire season in the Niangua Basin following European settlement partially accounts for the high degree of integrity and rich assortment of woodland flora that dominates the area. Conversely, throughout much of the Ozarks, European settlement resulted in fire suppression.

In the early 1980s, fire was not universally accepted as mainstream woodland management for natural areas. The first edition of Nelson's *Terrestrial Natural Communities of Missouri* (1985) implicated the opposition to burning fire-adapted wooded ecosystems by referring to ecosystems known today as woodlands as "savannas." This agreed-to designation was a result of early resistance and bias of certain key MoNAC members.

With wildfires continuing in and around Ha Ha Tonka following the first prescribed fire in 1983, land managers and biologists alike recognized the benefits of the experimental prescribed fire in stimulating biological richness across the woodland landscape. Due to the success of the 40-acre Demonstration Unit fire, the state parks fire program expanded throughout Ha Ha Tonka and the state park system, ushering in the age of woodland fire management and ecosystem restoration of state park lands. Today, roughly

60 percent of Ha Ha Tonka State Park property is treated with fire. The tract that burned in 1983 became the nucleus of the 953-acre Ha Ha Tonka Savanna Natural Area in 1990.


MDC

The open oak woodlands of the natural area provide habitat for red-headed woodpeckers.

In subsequent years, with fire events recurring on a 3 to 5-year rotation, the Ha Ha Tonka Savanna NA became the showcase for woodland restoration in the Missouri Ozark Highlands. Larry Hedrick, U.S. Forest Service staff officer for Integrated Resource Management for the Ouachita National Forest in Arkansas, was so inspired by the effects of fire at Ha Ha Tonka State Park that he instituted a similar program in the shortleaf pine systems in Arkansas in the 1980s, resulting in thousands of acres of shortleaf pine-bluestem woodlands today.

In January 2012, following 29 years of prescribed fire and a long wildfire history at Ha Ha Tonka, the Missouri Natural Areas Committee overwhelmingly supported the expansion of the Ha Ha Tonka Oak Woodland NA to include 2,995 acres of high-quality woodland, glade and forest complexes. This landscape, combined with the extensive monitoring of fire effects on vegetation and wildlife populations, allowed MoNAC to base their decision to support the expansion on scientific data and research.

The expansion of the Ha Ha Tonka Oak Woodland NA included several management units that incorporate large prescribed fire units: Bank Branch (514 ac.), Spencer Creek (271 ac.), Quarry (75 ac.), River Cave (745 ac.), Niangua (90 ac.) and Turkey Pen Hollow (1,299 ac.). Resting inside the Turkey Pen Hollow Unit is the original 40-acre Demonstration Unit and the 953-acre Ha Ha Tonka Savanna NA, which expanded in 2012 to include an additional 346 acres of fire-adapted woodlands and glades of similar quality to the original natural area. Together, the expansion units encompass high quality woodlands, dolomite glades, caves and small tracts of dry-mesic forest, restricted in the park to steep coves and sinkholes.

Ha Ha Tonka Oak Woodland NA includes high quality woodlands.


Photo provided by DNR

The success of restoring Missouri's fire-adapted woodland landscapes is rooted in Nelson's early insight on the effects of fire on woodland landscapes and the initiation of the woodland burning at Ha Ha Tonka State Park almost 30 years ago. Subsequent plant and animal studies, coupled with woodland restoration workshops and conferences, helped reduce the resistance to burning woodlands within the conservation community and beyond.

Nelson's revised 2005 *Terrestrial Natural Communities of Missouri* embraced the efforts of a science-based classification workgroup, fully integrating the importance of fire in shaping natural communities and their biological diversity. The Ha Ha Tonka Oak Woodland Natural Area exemplifies the desired condition of these distinct natural communities, having been managed with natural processes for the protection and preservation of Missouri's finest examples of our native landscapes.

Allison Vaughn is the Ozark District natural resource steward with the Missouri State Parks.

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Did you know about NAA?

The Natural Areas Association is a professional membership organization founded in 1982 that works to inform, unite and support persons engaged in identifying, protecting, managing and studying natural areas and biological diversity across landscapes and ecosystems. It represents professionals in a variety of fields such as botany, zoology, forestry, wildlife management, aquatic biology and geology who are engaged in the conservation, restoration and assessment of natural areas.

The NAA provides support by:

- Publishing the Natural Areas Journal.
- Hosting the annual Natural Areas Conference.
- Allowing members to stay connected and informed, via working groups such as the State Natural Areas Roundtable and the development of a new interactive website.
- Serving as a portal to natural-areas information and resources.

The NAA is a 501(c)(3) non-profit organization. To become a member or learn more about the NAA, visit www.naturalarea.org.

The Great Drought of 2012 Reviewed

Going into winter with deficits

By Patrick Guinan, Missouri State Climatologist

Missourians faced an extremely challenging year when a dry spell emerged in early spring and evolved into a historic drought by summer's end. More than two-thirds of the country was involved with drought as the summer progressed, a situation not experienced in nearly 60 years. Missouri and Kansas served as the epicenter of the drought, with extreme to exceptional drought conditions extending from Utah to Indiana, and South Dakota to Texas, in July and August (Figure 1). Missouri's first glimmer of widespread relief occurred on the last day of August when remnants of a tropical system brought significant rainfall to much of the state. Unfortunately, by then, significant drought damage had occurred.

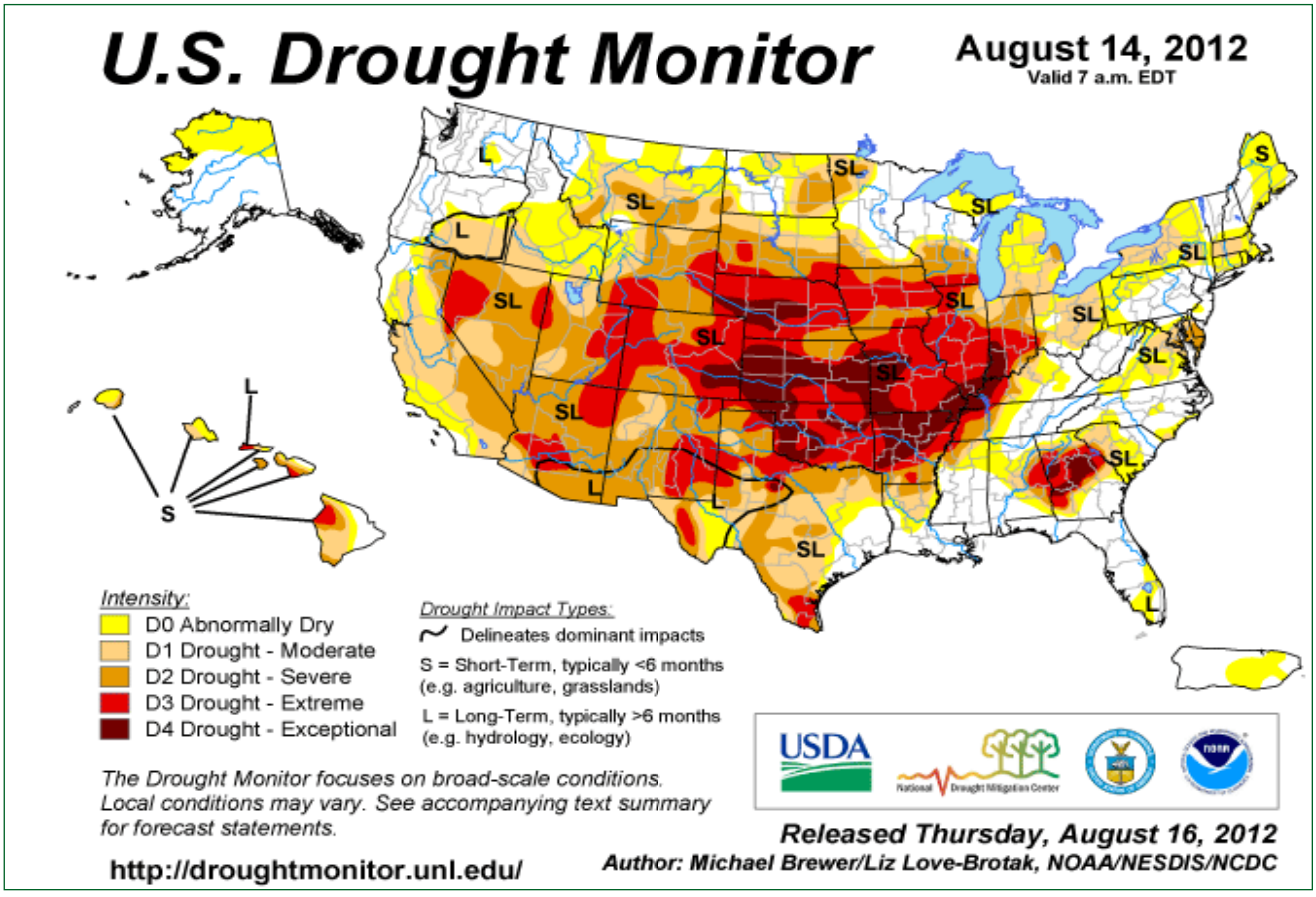
May is typically Missouri's wettest month, but this year conditions were unusually dry, warm and cloud-free. Some locations in northeast, central and east-central Missouri went 24 consecutive days (May 8-31) with less than 0.10 inches of rain. In the southeast, Perryville and Poplar Bluff experienced the least amount of rain, 0.40" and 0.30", respectively for the entire month of May. Only a handful of counties reported more than 5 inches for May, which is near average.

Sunny days in May and June, coupled with above normal temperatures and below normal relative humidity, led to unusually high moisture loss from soils, water surfaces and vegetation. The high evaporative losses, in combination with the lack of rainfall, resulted in a "flash drought" across the state and impacts emerged rapidly. Reports of deteriorating pastures, declining soil moisture reserves, limited stock water supplies and crop stress increased.

By the end of June, the drought became one of the worst to impact Missouri in 25 years. Statewide average June rainfall was less than 2 inches, or nearly 3 inches below normal. Extreme heat exacerbated the stressful conditions with record triple-digit temperatures. The last time Missouri experienced 100-plus degree heat in June was 1988. On June 28, several communities reached all-time high temperature records for June including St. Louis, Columbia, Rolla and West Plains with 108, 107, 106 and 106°F, respectively. Grass fires increased during June and burn bans were imposed across the state. A forest fire in the Mark Twain National Forest burned 600 acres in Iron County.

According to the Missouri Agricultural Statistics Service, by the end of June, 97 percent and 93 percent of the topsoil and subsoil moisture supplies, respectively, were in short to very short condition. And pasture conditions had declined to

Figure 1: Drought Conditions



Kendra Graham, University of Missouri Extension Service

By July, the National Agricultural Statistics Service declared that Missouri had the worst pasture conditions in the US. (Madison Co.)

76 percent from poor to very poor.

The average statewide temperature in July was 83.7°F, or 6.4°F above normal. July rainfall was paltry, with a statewide average of 1.67 inches, or 2.57 inches below normal. Generally, west-central and southwestern Missouri received the least amount of rain, with less than 0.50 inches reported in many locations. Several counties in far southwestern Missouri reported less than 0.25 inches for the month.

By the end of July, the National Agricultural Statistics Service said that Missouri had the worst corn, soybean and pasture conditions in the United States. Soil moisture reserves were abysmal with 99 percent of the topsoil and subsoil reported in short to very short condition. Water supplies were dwindling with river and stream flow levels bottoming out.

Finally, the remnants of Hurricane Isaac spiraled into southern Missouri on the last day of August bringing relief and steady rain for many hours. The tropical depression lingered for the Labor Day weekend. Even with the remnants of Isaac, it was the third-warmest and third-driest May through August period on record. Only May-August 1934 and 1936 were warmer and May-August 1901 and 1936 were drier.

Cooler September temperatures with rain mitigated the drought conditions, but by no means eliminated them. Preliminary temperature data indicate a statewide average temperature of 66.7°F, or slightly less than 1 degree F below normal for September. The cooler-than-normal month broke a string of 11 consecutive months with above-normal temperatures. Preliminary rainfall data for September indicated an average statewide total of 5.23 inches, nearly 1 inch above normal. The heaviest rain fell across southern Missouri with typically 5-7 inches. Drier conditions remained in far northern and northwestern sections, where 1-2 inches was common.

Vegetative growth and the green-up of lawns and pastures continued through October, because of varying periods of warm and cool weather and the lack of a killing freeze. Topsoil moisture conditions improved across southwestern, south-central and northeastern sections, where above-normal rainfall totals of 4-6 inches were common. Below normal October rainfall occurred over northwestern, west-central and a few southeastern counties, with less than 2 inches reported for the month. Long-term severe and extreme drought conditions continued to impact northwestern, central and far southeastern Missouri through October, where year-to-date deficits were 8-12 inches. Significant surface water recovery was especially notable over southwestern sections, where more than 10 inches of rain fell between September and October.

Even though drought conditions generally improved as autumn progressed, precipitation deficits were more than 10 inches in many Missouri locations near year end. Winter is typically the dry season in Missouri and it is unlikely surface and ground water supplies will fully recover for the start of next year's growing season, especially across the northern and central sections. The highest likelihood for hydrological drought to carry into next year exists across northwestern Missouri, where year-end precipitation deficits exceed a foot and only 3-4 inches generally falls between December and February. Better chances for drought recovery will exist over southern sections, where 7-12 inches typically fall from December to February.

No one anticipated the severity and magnitude of the 2012 drought and, similarly, we do not know what 2013 will bring. Extended dry and wet patterns can change abruptly and there are numerous occasions, both in temperature and precipitation, where Missouri transitioned from one extreme to another in a short period of time. Historical climate data provides a valuable baseline in showing these extremes and abrupt changes, in addition to trends ranging from weekly to multi-decadal.

Recent trends for Missouri indicate an unprecedented multi-decadal wet period beginning in the early 1980s and continuing for more than 30 years. Alternatively, there have been decadal and multi-decadal dry periods, i.e. the 1930s and 1950s through the 1960s. Climate records provide a story of what can happen. If it's happened before, it can happen again. Drought has been and always will be a part of our climate system. Developing proactive drought mitigation strategies is the best way to prepare for these droughty periods when they return.

Patrick Guinan works for the University of Missouri's Extension Commercial Agriculture Program as the state climatologist, director of the Missouri Climate Center and as an assistant professor in climatology. He holds a Ph.D. in soil, environmental and atmospheric sciences. Guinan also maintains and operates the Extension Commercial Agriculture Automated Weather Station Network, which consists of 30 automated weather stations in Missouri that monitor several environmental variables on a 5-minute, hourly and daily basis. Information on this can be found at: http://agebb.missouri.edu/weather/stations/index.htm.

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A Framework for Responding to Climate Change

Impacts on vulnerable communities

By Leslie Brandt

Over thousands of years, shifts in climate have shaped the vegetation across the Missouri landscape. Post-glacial boreal forests gave way to woodlands, savannas and prairies as temperatures warmed and precipitation patterns changed. Even as vegetation transformed to what we recognize today, it endured large periods of warming, cooling and extended drought.

Missouri's Climate: Recent Past and Future

Historical records of climate are available from around the turn of the last century. These records show that the average annual temperature of Missouri fluctuates by several degrees from year to year, and that Missourians have experienced warm periods in the 1930s and early 1950s and cooler years during the 1960s and 1970s. While there has been a slight warming trend since the 1970s, temperatures today are still not as high as some years earlier in the twentieth century.

Just looking at average annual temperatures only tells us part of the story, however. Summer low temperatures have been increasing this past century, while summer highs have been decreasing. Precipitation changes can also be observed. The southwestern part of the state has become considerably drier in the summer. Other parts of the state have received more precipitation, especially in the fall.

Projections from climate models indicate that more dramatic changes in climate are likely in store for the next century (see map). If global emissions of greenhouse gases continue on the trajectory they are on today, we could see dramatic increases in temperature by the end of the 21st century, reaching up to an average of about eight degrees Fahrenheit above the 1971-2000 average. Even if dramatic actions are taken to reduce greenhouse gas emissions, temperatures will still increase by a degree or more on average.

Changes in climate over the next century will most likely vary by season. Winter low temperatures are projected to increase the most, while summer and fall temperatures may experience the least amount of change. The majority of models indicate a substantial increase in spring precipitation, followed by a reduction in precipitation in either the summer or fall (depending on the particular model used).

Less is known about how these broad shifts in temperature and precipitation will affect extreme weather events in Missouri such as tornadoes, floods and droughts, but evidence is beginning to accumulate that suggests all of these events are likely to become more common during the coming decades. While this may not be the first time the Missouri landscape has seen dramatic shifts in climate, the rate of change, coupled with other stressors such as invasive species, landscape fragmentation and novel disease outbreaks, could put an unprecedented stress on our natural communities.

Open woodlands may be among the most resilient to projected changes in climate.

Photo courtesy of Mark Twain National Forest

Vulnerable Communities

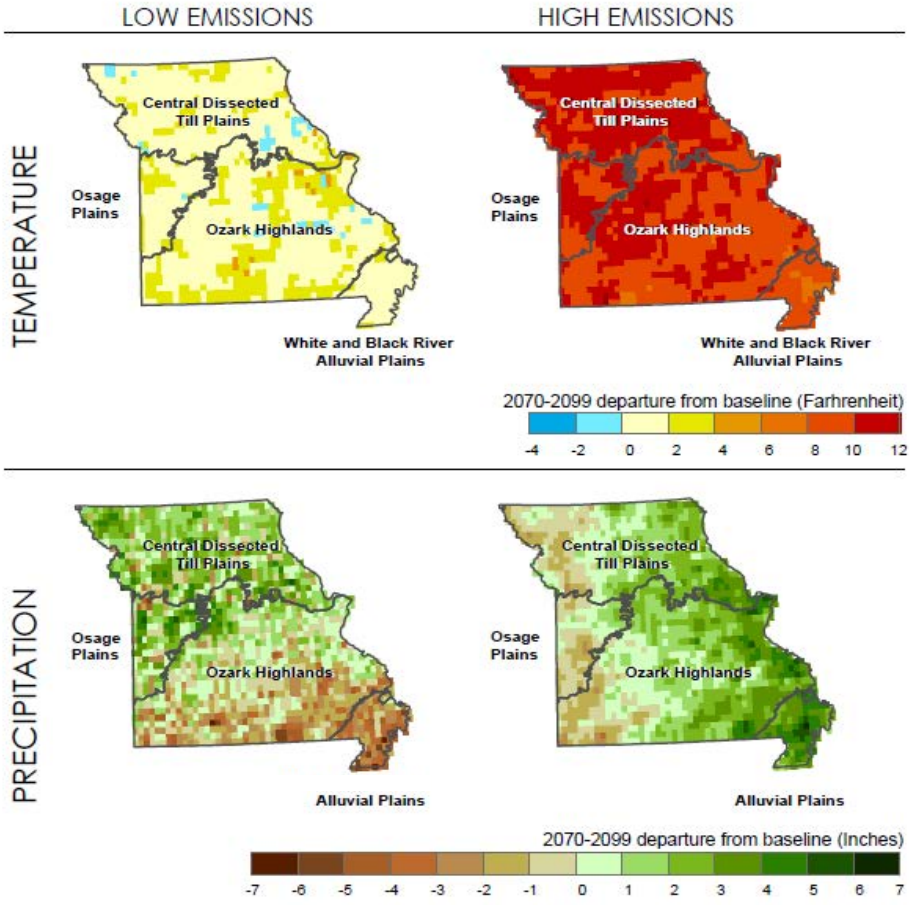
How might the natural communities of Missouri respond to these projected changes? Researchers and land managers from universities, state and federal agencies and other organizations are working together to find out. The Missouri Ozarks is the focus of an effort called the Central Hardwoods Climate Change Response Framework, an integrated set of tools, partnerships and actions to support climate-smart conservation and forest management.

As part of the broader framework project, we are working to assess the vulnerability of forests and other natural communities in the Missouri Ozarks to projected climate change over the next century. Results from our assessment indicate that some natural communities may be more vulnerable to changes in climate than others.

Mesic hardwood forests, for example, may be among the most vulnerable. They are dominated by a number of species at the southern extent of their range, such as sugar maple, beech and basswood, that are projected to decline under warmer conditions. These systems are also not adapted to frequent disturbance and may not be able to withstand a late-season reduction in precipitation.

Other systems may be less vulnerable. Climate projections indicate that conditions for wildfire may be more favorable

Maps show projected changes in annual temperature and precipitation for the state of Missouri compared to the 1971-2000 average. Low emissions indicates projected changes from a scenario where dramatic reductions in global greenhouse gas emissions are made. High emissions indicates projected changes from a scenario where greenhouse gas emissions continue to increase at a rate similar to what we are experiencing today.



Map provided by USFS

by the end of the century. Fire-adapted systems that are also relatively drought-tolerant, such as savannas, open woodlands and prairies, may be more resilient to climate change. However, even these systems may experience negative impacts, such as declines in some dominant species and increases in pests and diseases.

Conserving our Natural Areas Now and into the Future

Understanding the vulnerabilities of our natural communities to climate change can help us make important decisions about the conservation of our natural areas into the future. As part of the Climate Change Response Framework, we have developed an approach to incorporating information about climate change impacts and vulnerability into natural resource management.

A variety of strategies are possible to adapt to climate change, which can depend on local values and management objectives. In some cases, an effort to resist climate change and maintain communities as they are for as long as possible may be desired. In others, managers may choose to enhance a systems' resilience to change, returning to a previous state following disturbances. There may be other instances where the best option may be to allow a community to transition to something new, perhaps providing some help to soften the landing.

By working together across organizations using the best available science, we can begin to develop on-the-ground approaches that will ensure we conserve the important benefits the natural communities of Missouri provide.

Leslie Brandt is a climate change specialist with the Northern Institute of Applied Climate Science and the U.S. Forest Service. Her work focuses on climate change adaptation and outreach for natural resource managers in the Midwest and Northeast. She currently coordinates the Central Hardwoods Climate Change Response Framework project. She earned a doctorate in ecology from the University of Minnesota.

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Additional resources:

Climate Change Response Framework project, www.climateframework.org, Central Hardwoods Climate Change Response Framework, www.climateframework.org/central-hardwoods. For more information or to get involved, contact Leslie Brandt, lbrandt@fs.fed.us.

Tools and information on responding to climate change for land managers: www.fs.fed.us/ccrc/

Bringing City Kids to Natural Areas

A 35-year reflection

By Jim Wilson

Thirty-five years ago, getting kids into the outdoors wasn't much of a problem—at least in the little town of Jefferson City where my family lived. Our kids were outside a lot; bicycling on the dirt path, having adventures in the "death jungle" (no adults allowed) and even taking an occasional (and unauthorized) foray to the Missouri River.

When I thought about this, I realized it might be different in the big city. So I called my friend Jan Phillips, legendary teacher, author and principal of the nationally recognized College School in Webster Groves. She said that back then, things were much the same in her world. It was a much simpler time, when it was okay to let kids roam. It was also a time of environmental awareness. Design for Conservation, the sales tax in Missouri, had just been approved and natural history, nature centers and education were the new direction of conservation and natural resource agencies. Notably, the natural areas system was born.

But things happened. Our generation got older and perhaps preoccupied. Personal computers came along in the 1980s and computer games improved dramatically and hyperlinks changed the way we thought and the way we looked at the world. In St. Louis, open spaces shrank, the streets got rougher and, more often, all the best places seemed to be found online.

Forest Park, once the rally ground of the St. Louis community, fell into disrepair. Conflicts arose over competing uses, some of which were unsavory. The park was deemed unsafe by many and use and interest dropped.

Catching tadpoles a quarter mile from Barnes Hospital in Forest Park.

Photo provided by Jim Wilson

Photo provided by Jim Wilson

Kids explore pond life in the summer program at Forest Park.

But across the country, urban park management philosophy was evolving. The idea of a park as open space, often a mowed field, was slowly moving to include an interest in natural communities, native species and the restoration of ecological processes. Against this backdrop, a group of concerned citizens formed a nonprofit organization, Forest Park Forever, to raise money and serve as the private arm of park management in cooperation with the St. Louis City agency responsible for the park. During the next 25 years, Forest Park Forever raised some $50 million to match a similar amount appropriated by the city. The resulting renovation of Forest Park was nothing short of spectacular. Beauty, safety and civic pride were restored to the park.

As this renaissance was happening, and perhaps partly because of it, rumbles of concern began to be felt about childhood obesity, lack of outdoor interest and activity, increasing time spent with television, computer games and other video devices. Forest Park Forever and other private organizations began to provide outdoor experiences for children to augment those programs traditionally offered by state and local government and park agencies. Eloquent journalist Richard Louv captured this concern in his popular book, *Last Child in the Woods: Saving our Children from Nature Deficit Disorder*.

At least partly because of this book, attention seemed to galvanize around the problem and multiple organizations joined one collaboration or another to provide increased outdoor experiences for urban youth. Today, some 30-plus organizations and agencies self-identify as being involved in this effort in the greater St. Louis area. Many of these utilize Forest Park at least part of the time. Whether this represents a sea change or just another wave in a continuing cycle of outdoor programming remains to be seen.

How does this relate to the management of natural areas, nature reserves and the like? The protection of special natural features relies in part on the development of at least three groups of constituents, and the development of

those constituents is as much a responsibility of those who care about natural areas as exotic species removal or the maintenance of natural processes.

One of these constituent groups includes landowners and management agency administrators who can change the character of an area forever with just one poor decision. Cutting a forest, overgrazing a prairie or dredging a stream can have irreparable effects. The education and cooperation of this group is essential to management in an immediate and ongoing sense.

A second group includes all those adult lay persons and professionals who care about natural areas. They need cultivation, validation and collaborative attention as a part of natural area management. These are the civic decision makers who control public support for the Natural Areas Program.

The third group are arguably the most important—the kids. These are the people who will determine the future of natural areas. Finding ways to instill awareness, appreciation and an ethic of stewardship for natural areas and natural features may determine whether or not there even IS a natural areas program a generation or two down the road.

If you have been entrusted with the protection of these special areas, you cannot afford to ignore this group. And, considering the demographics of the state, this is not just a white middle-class issue. Ethnic balance is changing and will continue to change. Most of these groups are suburban or urban, and many of them will never leave those areas—even to visit. If you want their support in the future, you must find them where they are today. As Phillips put it, "you have to involve and engage them if you want to make a difference."

Urban parks and the experiences of youngsters within them may have a lot to do with the future of natural areas. We ignore these opportunities at our peril.

Jim Wilson is a former employee of the Missouri Department of Conservation and a former member of the Missouri Natural Areas Committee. He is currently the E. Desmond Lee Endowed Professor of Experiential and Family Education, University of Missouri—St. Louis, in collaboration with Forest Park Forever.

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Leaving no child inside can improve the health of kids and natural areas

By Paul McKenzie and Jennifer Gorman

In the book *Last Child in the Woods-Saving our Children from Nature-Deficit Disorder*, author Richard Louv sparked a national campaign: *Leave No Child Inside* as well as conversations about the correlation between children's health and time spent in nature. Louv also co-founded Children & Nature Network, an organization dedicated to connecting all children, their families and communities to nature through innovative ideas, evidence-based resources and tools, broad-based collaboration and support of grassroots leadership.

According to C&NN and Louv, numerous studies have been published supporting the benefits of connecting children with nature and outdoor activity. These include:

- Reduction in stress
- Decreases in obesity, body mass index and vitamin D deficiencies
- Improved cardiovascular health and core strength
- Improved ability to focus and subsequent improvement in cognitive abilities, academic achievement, attitudes and behavior
- Improvements in ability to cope with attention-deficit hyperactivity disorder
- Increased measured mastery of science concepts
- Enhanced abilities in cooperation and conflict resolution
- Gains in self-esteem and attitudes regarding self-efficacy as well as in positive environmental behavior and improvements in problem-solving ability, motivation to learn and classroom behavior.

It is important to teach children about their natural world. Every action – blowing dandelion seeds, pursuing fireflies or gazing at the stars – opens a door into the natural world for a child. It is imperative for us, as advocates and stewards of natural communities, to throw the door wide open and welcome children with organized excursions for families, school field trips and education opportunities. Children who spend time in nature establish a greater awareness and appreciation for it and are more likely to consider a career as a naturalist, scientist, conservationist or outdoor educator... as the future stewards of our natural communities.

Our efforts will be measured by the flourishing natural communities we protect AND how well we prepare the next generation to continue our quest.

The future maintenance and management of Missouri's natural areas will depend upon the recruitment of the next generation into the field of conservation. Such a transition will not be possible unless the initiative to connect children to nature is successful.

Paul M. McKenzie has been an endangered species coordinator and biologist for the U.S. Fish and Wildlife Service's Columbia Ecological Services Field office for more than 20 years. He earned a bachelor's degree in wildlife management from West Virginia University, a master's degree in wildlife and a doctorate in wildlife and fisheries science from Louisiana State University.

Jennifer Gorman is working at the Columbia Ecological Services Field office after having earned a bachelor's degree in biology from Truman State. She is a devoted advocate for connecting children to nature. For upcoming youth events, contact her at columbiaes@fws.gov, with the subject line: Kids2Nature.

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Pine Woodland Restoration in the Interior Highlands

A vision becoming a reality

By Jane Fitzgerald

Prior to widespread European settlement, woodland systems dominated or co-dominated by shortleaf pine once occupied more than 6 million acres of the Missouri Ozarks. After settlement, these shortleaf pine woodlands were largely decimated by widespread logging, free-range grazing and subsequent suppression of the fires critical to their persistence.

Little attention was paid to this sorry state of Missouri's once-great pineries, or even to the ecological effects of widespread fire suppression in the Ozarks, until the Mark Twain National Forest's Jody Eberly, wildlife biologist, and Mike Schanta, silviculturist, noticed very positive grass and forb effects following a wildfire in pine woodlands in the early 1980s. Both excited and curious about the effects of the fire and its implications for the ecosystem, the forest service staff selected both DD Savanna (118 acres) and Grassy Pond Savanna (139 acres) as early pine woodland demonstration areas. They burned DD Savanna in the spring of 1987, 1989 and 1992, following pine thinning with horses in 1986. They went on to burn Grassy Pond Savanna in spring of 1988, 1989 and 1992, following understory thinning.

But it wasn't until ecologists Doug Ladd and Blane Heumann from The Nature Conservancy, Paul Nelson and Ken McCarty from the Missouri Department of Natural Resources and Rick Thom and Tim Nigh from the Missouri Department of Conservation began a holistic assessment of Missouri's natural heritage and associated conservation needs in the late 1980s that the idea of restoring shortleaf pine ecosystems in Missouri began to be more widely discussed among the conservation community at large.

The listing of the red-cockaded woodpecker as federally endangered played a key role in terms of stirring interest in pineland restoration projects around that time. Development of its recovery plan helped identify the scale at which restoration would be needed, as well as the structural characteristics that managers needed to reach.

The ecologists then began to identify sites and landscapes with the best restoration potential in the Missouri Ozarks. Although some MDC and MoDNR lands offered great promise, with the successful restoration of the pine-bluestem woodlands at Hawn State Park being a prime example, it was determined that the only opportunities to recover Missouri's historic pineries at a large or "landscape" scale were in the Mark Twain National Forest.

The Conservancy developed and implemented a rapid ecological assessment technique to identify those sites in the forest with the best restoration potential based upon their current condition, remnant vegetation and floristic quality.

MDC

Northern bobwhite are among the species that will benefit from the restoration of shortleaf pine woodland systems.

This assessment led to the selection of the Pineknot project area in Carter County, Missouri, initially targeting a tract of more than 12,000 acres. The thinning and burning needed to restore the woodlands at Pineknot wasn't fully implemented until 2006.

Thinning and burning opens the tree canopy to allow enough sunlight to reach the ground for the herbaceous layer to recover. Fire kills back the hardwoods and allows pine to grow. Bird species of conservation concern that benefit from this restored habitat include the northern bobwhite, the whip-poor-will and chuck-wills-widow, the red-headed woodpecker and the prairie warbler. The red-cockaded woodpecker was extirpated in Missouri, as was the brown-headed nuthatch, but they could be reintroduced if enough suitable habitat becomes available. The woodpeckers and nuthatches need big widely-spaced pines with cavities for nesting, and the bobwhite and prairie warbler like the more open canopy and herbaceous groundcover.

By the early 2000s, pine-bluestem and pine-oak restoration gained traction among conservationists in both the Missouri and Arkansas Ozarks and restoration efforts were underway on both state and national forest lands. The number of acres that could be treated, however, was limited by the amount of management that agencies on both sides of the state line could fund in addition to their traditional responsibilities.

By 2005, both states had completed their first State Wildlife Action Plans, which emphasized natural community restoration of glade-woodland complexes, oak woodlands and pine and oak-pine woodlands. Under the leadership of Tim Nigh, a cross-border partnership came together and successfully applied for a Doris Duke Foundation grant to

not only accelerate the habitat work, but also to foster better regional communication and coordination. Once those funds were expended, however, the work slowed again.

Fortunately, in 2009, an opportunity to secure significant funding for woodland restoration work was made available through passage of Title IV of the Omnibus Public Land Management Act, and establishment of the Collaborative Forest Landscape Restoration Program (CFLRP). The CFLRP, administered by the U.S. Forest Service, was intended to encourage collaborative, science-based ecosystem restoration of priority forest landscapes on and around national forest lands across the United States. Re-establishing natural fire regimes to reduce the negative consequences of uncharacteristic wildfire is also part of the goal.

As a result, up to $40 million can be appropriated annually from 2009-2019, with up to $4 million a year available for any particular project. The Mark Twain National Forest was encouraged by its regional office, as well as other conservation agencies and organizations in Missouri, to submit a proposal for at least 50,000 acres of pine restoration work. This later was expanded to more than 100,000 acres, which included Pineknot and another project area, Cane Ridge, also under management for pine-bluestem restoration.

The CFLRP's emphasis on partnerships and collaboration was known to be a key component of the proposal selection process. Planning meetings were held in 2009 and 2010, with the Central Hardwoods Joint Venture taking a leadership role in bringing together key partners with federal, state and non-governmental organizations and agencies. Unfortunately, the initial proposal was not funded.

Word got out that the Ozark-St. Francis and Ouachita National Forests in Arkansas also had submitted proposals focused on pine-oak and pine-bluestem woodlands, respectively, and it was thought that expanding communication and collaboration among partners across

Paul Nelson

In the Pineknot/Cane Ridge landscape, fire kills back the hardwoods and allows the pine trees to grow. The bobwhite and the prairie warbler like the more open canopy and herbaceous groundcover and generally will thrive given these conditions.

MDC

Prairie warblers benefit from the restoration in the interior highlands.

the interior highlands would be worthwhile, even if it didn't result in CFLRP funding when the proposals were re-submitted the following year. The first meeting of the new Interior Highlands Shortleaf Pine Restoration Initiative took place in January 2011. From this, a subcommittee – consisting of community ecologists from multiple agencies and in both states – developed a set of "desired future conditions" for pine-bluestem and pine-oak communities and then presented it in April 2012.

By the time of the April meeting, all three national forests in the region collectively had been awarded more than $2 million in funding, via the CFLRP or related programs, for restoration work in 2012, with the potential for that amount or more each year through 2019. If Congress continues to support and fund the CFLRP, more than 500,000 acres of pine and pine-oak woodlands should be well on their way toward the restoration goals within the next decade on national forest lands alone.

While "well on their way" is not the end point envisioned by the community ecologists devoted to the restoration of functioning pine ecosystems in the interior highlands, we certainly are much closer to the dreams of those pioneering ecologists of the 1980s than we were 35 years ago. Perhaps, with continued funding and public support, the Missouri Natural Areas Program will be able to designate a large portion of the Pineknot/Cane Ridge landscapes as its first pine-bluestem state natural area within the next 35 years!

Jane Fitzgerald, an employee of American Bird Conservancy, has served as the Central Hardwoods Joint Venture coordinator, a regional partnership for bird conservation focused on the central hardwoods region, for more than ten years. Prior to her work with the Joint Venture, Fitzgerald was the Midwest coordinator for Partners in Flight, an international landbird conservation initiative, for more than five years. Fitzgerald earned a Ph.D. in zoology from the University of Arkansas, Fayetteville.

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Additional resources:

For more information on Collaborative Forest Landscape Restoration Program (CFLRP) funding administered by the US Forest Service: http://www.fs.fed.us/restoration/CFLRP/

Ecological Sites for Missouri

Past, present and future

By Fred Young, Doug Wallace, Tim Nigh and Dennis Meinert

From the prairies of the loess bluffs in the northwest to the mixed-oak woodlands of the limestone-dolomite uplands in the Ozarks, the political boundary of Missouri encompasses portions of four major ecological regions. In the 20th century, great strides were made in describing and cataloging the terrestrial diversity of Missouri. The identification and designation of the natural areas was one result. Detailed mapping, however, remained elusive. A landowner or agency land manager had access to excellent community descriptions but in considering the appropriate management, there was no guide. That is what the ecological site project seeks to provide for every acre in Missouri.

The Past

In 1977, when Missouri's natural areas program was established, knowledge of Missouri's terrestrial ecology was general, not specific. For example, we knew the characteristics of Ozark soils, but many counties did not have soil surveys and the relationships between specific soils and their vegetation potential was not always clear. The landowner could see what the current vegetation was on that hillslope, but without good soils information it was difficult to know the ecological potential of the site.

Missouri's soil-survey program accelerated in the late 1980s, and thanks in part to the parks and soils sales tax, initial soil mapping for Missouri was completed in 2002. At about the same time, Tim Nigh and his MDC colleagues were developing the Ecological Classification System (ECS). Defining and mapping the lowest level of this hierarchical system, the Ecological Land Type (ELT), proved to be a daunting proposition for the small staff. To borrow a phrase, necessity is the mother of collaboration. MDC joined with the Natural Resources Conservation Service (NRCS) and the DNR to develop the ELT level of the ECS, using the soil survey as a base. This solved the mapping problem and brought the authors together on the task of grouping soil map units into ELTs. The NRCS has a similar system called ecological sites; a full description of an ecological site constitutes an Ecological Site Description (ESD).

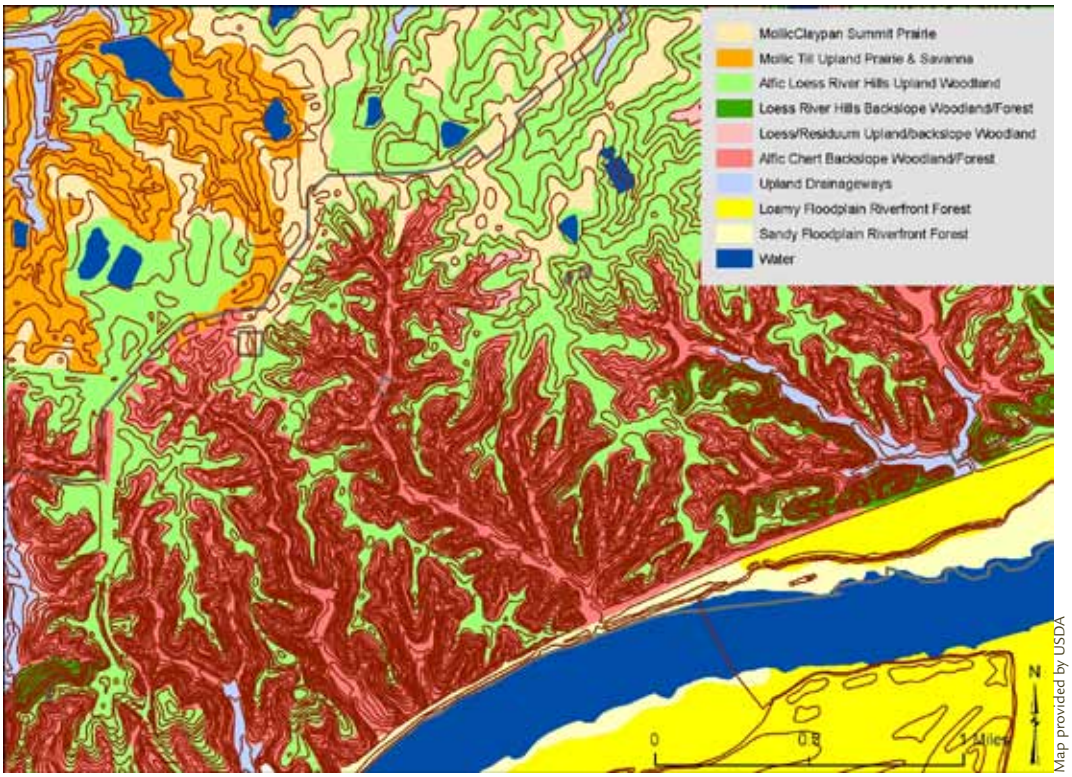
During the past 10 years or so, a statewide system of ESDs has been developed built on the soil mapping base, soil properties and landscape position features of the soil survey. Relating potential natural vegetation to the soil-landform ecological site groups is accomplished by field investigations and GIS correlations with historic vegetation databases developed from the original land survey. Missouri's natural areas provide invaluable reference sites to document the ecological potential of ecological sites.

The Present

An initial, statewide legend of Missouri ecological sites is now complete. There are 155 unique names currently in use. Because the ESD system is organized around Major Land Resource Areas, some names are used in multiple MLRAs; e.g., there are five Alfic Chert Upland Woodland ecological sites, separated regionally, with slightly different reference vegetation communities and ecological dynamics. Including these regional duplicates, there are 295 ecological sites in Missouri as of this writing. The naming system consists of terms for soil/substrate + landscape position + reference community type (Table 1).

Development of ESDs is occurring in phases. As of 2013,

Figure 1: Ecological Sites for a portion of Weldon Spring Conservation Area, including Weldon Spring Hollow Natural Area.



Map provided by USDA

Table 1: Explanation of the Alfic Chert Upland Woodland ESD name, with reference to other terms used in the current ESD naming system.

Designation	Explanation
Alfic	Soils formed under woodland or forest vegetation and have thin, light-colored surface horizons.
	These soils have argillic horizons (subsoils that are enriched with translocated clay), and although they may be acidic, they are not low in bases such as calcium. Contrasts with *Mollic* (thick dark surfaces; prairie soils) and *Ultic* (forest/woodland soils, low in bases).
Chert	Soils with an abundance, at least in the upper horizons, of rock fragments (gravel, cobbles) that are dominantly chert.
Upland	Convex summits, shoulders and backslopes with slopes of less than 15 percent. Contrast with Backslope (>15 percent slopes), Footslope, Terrace, Floodplain, etc.
Woodland	Vegetation community dominated by trees, with an understory historically dominated by grasses and forbs adapted to fire. Contrasts with forest, prairie, flatwoods, etc.

Provisional ESDs will be available for use in conservation planning and land management. These include:

- general notes on the region (MLRA) and the location of the ecological site
- physiography
- soils
- ecological dynamics
- species lists of typical plants in a reference community for the ecological site.

Provisional ESDs can be accessed by anyone via Section II of the Missouri NRCS electronic Field Office Technical Guide: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg. Ecological site maps can be created for anywhere in Missouri via the Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/, although limited ESD information is currently available on this site.

An example of ecological site mapping on a natural area is shown (Fig. 1) for Weldon Spring Conservation Area in St Charles County.

The Future

ESD development will continue on a regional basis in 2013 and beyond. The "draft" phase of ESDs will include more detail on ecological dynamics and vegetation communities that occur on each site, including state and transition models. The final, "certified" phase of ESD development will produce comprehensive documents for each site, available via WSS. Studies being initiated from the Missouri Soil Health Laboratory at the University of Missouri will document soil property values in selected reference communities, such as natural areas.

What can we envision for the next 35 years of Missouri Natural Areas? By 2047, our ability to detect and map the ecologically significant factors of landscapes will no doubt be significantly greater than today. Site-specific models of ecological parameters will enable naturalists to predict site conditions with a precision we can only imagine now. Our understanding of the relationships between site, soil properties and vegetative response will be much more quantitative.

Precision ecological restoration will be here by 2047. Much of the baseline data and relationships for this will be developed in natural areas, thanks to the vision of those who founded the Missouri natural areas system in 1977.

Fred Young has been working in Missouri for the past 25 years on the soil survey program. He is a soil scientist with USDA-Natural Resources Conservation Service.

Doug Wallace is a forester, who recently retired from NRCS as the national agroforester at the National Agroforestry Center in Lincoln, Nebraska. He previously served as Missouri NRCS state forester for more than 20 years. He is currently contracted with NRCS to work on the Missouri Ecological Site project.

Tim Nigh is a long-time MDC terrestrial ecologist and originator of the Missouri Ecological Site project. He recently retired and is still working on Ecological Site development.

Dennis Meinert has been a soil scientist with the Missouri Department of Natural Resources for more than 30 years. Formerly a mapper on the soil survey program, he is currently conducting detailed soil mapping on Missouri State Parks as well as supervising field correlation of soils and vegetation for the Missouri Ecological Site project.

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For more information on Ecological Site concepts:

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Natural Community Restoration on Private Land

Engaging landowners with the CCPI program in the Southeast Ozarks

By Joe Tousignant

The Missouri Department of Conservation has been engaging private landowners in the management of their lands since its inception in 1936. However, in 2000, the Conservation Commission advanced conservation on private land by creating the Private Land Services division and partnering with the Natural Resources Conservation Service (NRCS) to engage private landowners in land management.

In this first decade, Private Land Conservationists (PLCs) assisted landowners with hundreds, if not thousands, of projects in Southeast Missouri, many of which aimed to restore natural communities like glades and woodlands. Numerous projects, in Conservation Opportunity Areas (COAs) in Ste. Genevieve, St. Francois and Iron Counties, were designed to restore these natural communities and were sometimes funded with NRCS cost-share programs. However, funding was spotty at best, and couldn't be relied on from year to year.

In December 2010, the U.S. Department of Agriculture released a request for proposals for the Cooperative Conservation Partnership Initiative (CCPI), which coordinates NRCS financial assistance with MDC financial and technical resources. It is a five-year program that provides cost-share funds for private landowners to install conservation practices in a priority area. Local NRCS and MDC staff didn't start from scratch to build a proposal for Southeast Missouri. Resources were previously targeted by a successful National Fish and Wildlife Foundation grant: the St. Francois Glade and Woodland Restoration Project spearheaded by PLC David Hasenbeck.

Prescribed burns control cedar and hardwood regeneration.

PLC Jan Dellamano

PLC Jan Dellamano

The Bowman's sandstone pine woodland during woody cover control.

MDC decided to target eight priority COAs in this new proposal. These COAs, located in a three-county area in the Missouri Ozarks, each emphasized fire-dependent natural communities such as glades, oak woodlands, oak-pine hills and igneous knobs.

Glades are characterized by thin droughty soils and exposed bedrock. They are dominated by native wildflowers, grasses and scattered fire-tolerant trees and shrubs and are typically surrounded by woodlands. Usually glades are found on ridge tops and south- and west-facing slopes.

Woodlands, unlike forest habitats, are characterized by smaller, poor-timber-quality trees, an open canopy and a diverse herbaceous plant understory. Most of Missouri's glade-woodland complex habitat is degraded through a combination of lack of fire, grazing and inappropriate logging practices. In this absence of management, glades become overgrown with invasive species such as eastern red cedar. In woodlands, the tree canopy closes and shades the desirable understory herbaceous vegetation. Glade and woodland species, including rare species such as the eastern collared lizard and Mead's milkweed, disappeared from unmanaged glade-woodland complexes.

MDC public land managers are well versed in the challenges of managing glade-woodland habitats. Several Missouri natural areas are being restored and managed on public land within the project area, including the St. Francois Mountains, Elephant Rocks, Royal Gorge, Pickle Springs and LaMotte Sandstone Barrens Natural Areas. Fortunately, public land managers typically have some resources available to them to manage glades and woodlands. Work crews can

install firebreaks and apply prescribed fire on the landscape. Thinning of invading cedars or of overstory trees can be done by employees or private contractors.

The situation is much different on private land. Private landowners often lack the technical, financial or labor resources to complete natural community restoration. With costs to thin severely degraded sites easily exceeding $100 per acre, and prescribed fire not logistically possible, landowners often look to MDC and NRCS for assistance.

This is where the CCPI comes in. It was recently approved and funding started in the summer of 2011. NRCS has allocated $500,000 in financial assistance to CCPI for its five-year lifespan. MDC has promised more than $325,000 in matching funds and technical assistance in the form of conservation plan development, prescribed burn plan writing, forest plan development and project coordination, checkout and certification.

The $500,000 in federal cost-share funds are provided through the Environmental Quality Incentives Program (EQIP), a NRCS program utilized for conservation work since1997. As with most cost-share programs, funds are often in short supply. Normally, this requires spreading the funds throughout the state in a competitive fashion. However, the beauty of this CCPI is that the funds are dedicated to only a few conservation practices in a targeted area. While EQIP as a whole can be a complicated program, covering everything from irrigation pipelines in the Bootheel to terraces in Northwest Missouri, CCPI offers four cost-share components. These include woody thinning (called woody cover control), prescribed burning, forest-stand improvement and an extra incentive payment called restoration and management of declining habitats.

The best way to illustrate this is to use a real example:

Gary and Joe Bowman have a property in Ste. Genevieve County near Hawn State Park and Pickle Springs Natural Area. They contacted PLC Jan Dellamano for information and assistance on forest and wildlife management. Dellamano knew that the Bowman's property was in an area with sandstone glades and woodlands and was on the lookout for opportunities to restore these habitat types.

While on a site visit, he found restoration potential on the ridges, characterized by tall rocky outcrops and a remnant herbaceous plant community including wild indigo, goats rue, poverty grass, little bluestem, lowbush blueberry and farkleberry under a dominant oak and pine canopy. Dellamano consulted with Nelson's *The Terrestrial Natural Communities of Missouri* to confirm the restoration potential of the site.

Shortly thereafter, Dellamano presented the Bowmans with a comprehensive management plan for their property. During that visit, the Bowmans signed an application for the CCPI program to complete 14 acres of pine woodland restoration. Once the project was selected for funding, the Bowmans went to work on the thinning for the restoration. Dellamano assisted the Bowmans with firebreak location and burn planning. When the Bowmans were unsuccessful in finding a contractor to do the prescribed burn, Dellamano conducted a landowner-training burn with assistance from the landowners and other MDC staff. The burn went off without a hitch and was effective in controlling the excessive hardwood regeneration.

PLC Jan Dellamano

Firebreak trails on land managed by a private landowner.

Dellamano received a report from Gary Bowman that spring:

Hey guys, just wanted to give a little feedback from the burn projects. AMAZING RESULTS!!! The deer & turkeys were in the units right after the smoke quit. I see them almost every time I'm there. Forbs & grasses are popping up now. Also I killed a turkey in the firebreak of each of the units! I can't believe the difference it has made! Thanks again for the info & the help. –Gary

Public land managers do not have a monopoly on natural community restoration. With targeted projects such as the glades and woodlands CCPI, private landowners now have more tools to accomplish their land-management goals. Private landowners have moved "beyond the food plot," and are increasingly managing their properties in ways consistent with our natural areas, and which can enhance our natural areas...especially if they are just down the road.

Joe Tousignant is an area biologist for MDC and has been working with the Natural Resources Conservation Service area staff in Jackson, Missouri, since 1996. His role is to integrate fish, forest, and wildlife considerations into the daily operation of NRCS, including programs available to private landowners such as the Environmental Quality Incentives Program.

Contact: Joe Tousignant, joe.tousignant@mdc.mo.gov, 573-243-1467 ext. 111.

Western Prairie Fringed Orchid Endures

By Steve Buback

As the sun sets on a Northwest Missouri prairie, the sweet smell drifting on the breeze might distract you from the firefly displays. It could be from an orchid attracting sphinx moths for a drink of nectar – a means to accomplish vital pollination. This showy and fragrant orchid, the federally threatened western prairie fringed orchid (*Platanthera praeclara*), was first documented in Northwest Missouri in 1976, only a year before the Natural Areas Program began, and is ineluctably tied with the fate of natural areas.

Historically, the western prairie fringed orchid was collected more frequently in the unglaciated plains of Southwest Missouri. In the 19th century, it was collected as far north as Kansas City. Today, only three populations are known to exist in Missouri, all located in the northwest quarter in mesic deep loess prairies. All of the known sites were maintained as hay prairies or periodically grazed, but never plowed. This benign use allowed a species that once was a common prairie sight to persist in small pockets. These three populations fluctuate dramatically over time, not only in terms of individuals within the population but also in terms of their geographic footprint.

The western prairie fringed orchid is a short-lived perennial, with individuals in South Dakota surviving as long as 7 years. Here in Missouri, we may have documented plants surviving up to 15 years, but the plants are difficult to relocate year after year. The extravagant flowers require a lot of resources to produce and an individual plant will seldom flower two years in a row. In the off years, the plant will send up only a strap-shaped leaf no longer than 6 inches, which can easily get "lost in the weeds."

Even when using state-of-the-art GPS systems and physical tagging, tracking individual orchids and assessing populations can be difficult. Dr. David Ashley of Missouri Western State University has been attempting just that for the last 16 years. Over this time period, he has seen orchid populations march up and down hills and swales, disappear from known locations and pop up in new sites. This unpredictability makes it important to maintain large, contiguous tracts of native prairie in the vicinity of known populations to allow the plants room to roam with changing temperature and rainfall patterns.

All of the known populations of the western prairie fringed orchid are located on Missouri Department of Conservation land and all are currently located within designated natural areas. While this designation recognizes the scarcity of deep loess prairies in Missouri, it also ensures that these prairies are managed for diversity and ecological integrity, including the orchid. Many of the sites were initially acquired because they supported the western prairie fringed orchid. By protecting the western prairie fringed orchid and the large tracts of prairie the orchid requires for continuing its existence, these natural areas ensure that the diversity they were enacted to protect will continue for another 35 years.

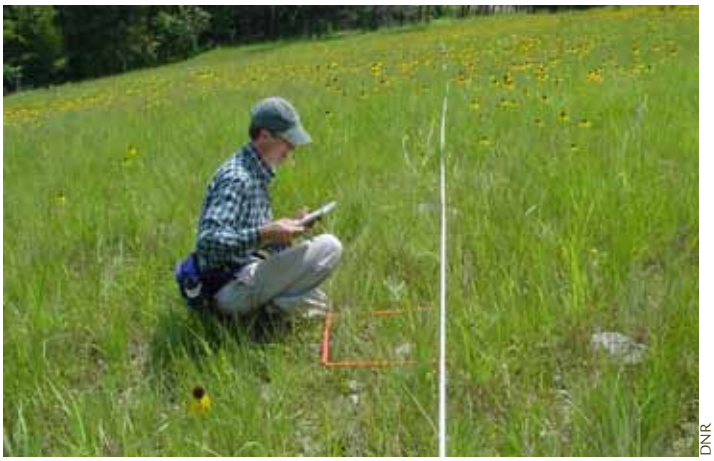
MDC

Western Prairie Fringed Orchid

The eastern prairie fringed orchid and the western prairie fringed orchid were at one time considered a single species and they are difficult to tell apart. Both are federally threatened. In 2009, eastern prairie fringed orchids were discovered on a private cemetery prairie, the first observation in more than 51 years in Missouri. Within the year, more than 38 healthy and flowering eastern prairie fringed orchids were found scattered throughout a swale on nearby private property being monitored for Wolf's spikerush in Grundy County.

Steve Buback is a natural history biologist for the Missouri Department of Conservation in the Northwest region, and currently serves as state recovery leader for the eastern and western prairie fringed orchids.

Contact: Steve Buback, steve.buback@mdc.mo.gov, 816-271-3111 ext. 1448.



DNR

Mike Currier

By Mike Leahy

This fall Mike Currier retired from the Missouri Department of Natural Resources, Division of State Parks. He served on the Missouri Natural Areas Committee (MoNAC) as their natural areas coordinator for the past 20 years.

Currier initially worked for the Missouri Natural Heritage Program and then served as a natural features inventory biologist for MDC from 1985-1991. He was directly responsible for the inventory of high-quality natural communities, rare and endangered plant and animal species and outstanding geologic features of 15 counties. This invaluable Natural Heritage information continues to assist biologists with conservation planning and management.

During his tenure with MoNAC, Currier developed successful natural area nominations, including Vilander Bluff, Elk River Breaks, Chariton River Hills, St. Francois Mountains, Meramec Mosaic, Regal Tallgrass Prairie, Lincoln Hills, Oumessourit, Ha Ha Tonka Oak Woodland and Tucker Prairie. He lobbied for the development of the Missouri Natural Areas Newsletter, becoming its first editor. He developed the Natural Areas Stewardship Award within the State Parks to recognize staff who contributed to the preservation of State Park natural areas through ecological management, research, administration and advocacy. The success of the 2000 and 2010 Natural Areas Association conferences in Missouri can be attributed to Currier's efforts.

"My best accomplishment was serving as a reliable assistant behind the scenes to maintain the Missouri Natural Areas Program," said Currier. "I was very comfortable serving in a support role and growing within the program to become a technical specialist on a range of natural area issues. I am honored to have had the opportunity to work with so many members of the Missouri Natural Areas Committee. It is the individuals and their commitment and cumulative knowledge that make the Missouri Natural Areas Program one of the best in the nation."

Gene Gardner

By Mike Leahy

MDC

In September, Gene Gardner retired from the Missouri Department of Conservation after 17 years. Gardner was the chairperson of the Missouri Natural Areas Committee (MoNAC) for the past three years and the chairperson of the MDC natural areas committee since 2007. During Gardner's tenure with MoNAC, he was involved with the designation of 13 Missouri natural areas and seven additions, adding 12,674 acres to the system. Gardner also assisted with de-listing seven natural areas nominated in the early years, which helped strengthen the integrity of the program.

Gardner started with MDC in 1978 by conducting an inventory of cave resources on public lands. He visited hundreds of caves and discovered 26 species of invertebrates new to science, including one named "Gardner's cave amphipod." His work was published by MDC, in the *Invertebrate Fauna from Missouri Caves and Springs*, Natural History Series No. 3.

Gardner left MDC and worked for the Illinois Natural History Survey from 1985 to 1993, where he conducted research on Indiana bats and supervised environmental impact assessments for the Illinois Department of Transportation. In 1993, he returned to Missouri and worked for the environmental section at the Missouri Department of Transportation. While there, he secured funding for the Missouri Resource Assessment Partnership. In 2001, Gardner returned to MDC in policy coordination. He transferred to the Wildlife Division and in 2007 was promoted to wildlife diversity chief.

In that position, Gardner provided leadership for the Missouri Bird Conservation Initiative, the Missouri Teaming with Wildlife Coalition and the Missouri Comprehensive Wildlife Strategy. He worked tirelessly to increase funding for fish and wildlife conservation as part of Missouri's Teaming with Wildlife Coalition. Gardner supervised a team of MDC Wildlife Division staff to ensure the conservation of high-priority species, management of invasive species and implementation of the Missouri Comprehensive Wildlife Strategy. Thousands of dollars in grant funds went toward natural community management and restoration projects on Missouri natural areas during Gardner's administration.

CALENDAR OF EVENTS

January 30 - February 1, 2013

Missouri Natural Resources Conference

Tan-Tar-A Resort, Lake of the Ozarks, Missouri

www.mnrc.org

Conservation Pays: Exploring the social and economic impacts

February 22 - 24, 2013

Conservation Federation of Missouri Convention

Jefferson City, Missouri

www.confedmo.org

August 4 - 9, 2013

Ecological Society of America 98th Annual Meeting

Minneapolis, Minnesota

www.esa.org/minneapolis

Sustainable Pathways: Learning from the past and shaping the future

October 1-4, 2013

The 40th Annual Natural Areas Conference

Chicago, Illinois

www.naturalarea.org

October 5 - 9, 2013

The Wildlife Society 20th Annual Conference

Milwaukee, Wisconsin

www.wildlife.org

January 26 - 29, 2014

75th Midwest Fish & Wildlife Conference

Kansas City, Missouri

www.midwestfw.org

WELCOME

Brian Davidson is the newest member of the Missouri Natural Areas Committee. He is filling in behind Paul Nelson as the Forest Service representative on the committee.

Brian Davidson is the botany, non-native invasive species and rangeland program leader for the Mark Twain National Forest. He has worked for the Forest Service for 20 years, spending 12 years in Arizona and New Mexico and two years with the Bureau of Land Management. Davidson has worked as a forester, rangeland management specialist and resource staff officer. He spent six years at the Ava/Willow Springs/Cassville Ranger District of the Mark Twain NF as the district environmental coordinator. Davidson is a native Missourian, from the Jefferson City area. He earned a bachelor's degree in natural resource management at Lincoln University in Jefferson City.

The MTNF has 17 designated State Natural Areas in Missouri totaling approximately 7,115 acres. The State Natural Areas within the MTNF represents some of the highest quality bottomland forest, chert forest, dry-mesic limestone/dolomite woodlands, fens and dolomite and sandstone glades.

CONGRATULATIONS

Brian Miller, Regal Tallgrass Prairie Natural Area Manager at Prairie State Park, received the Missouri Parks Association Employee of the Year Award for taking on extra duties during the park's busiest season in 2011. In addition to his role managing bison and elk roundups and vaccinations, overseeing prescribed burns and eradicating exotic and invasive species on the nearly 4,000 acres in the state park, Miller ran a state park youth corps to restore city parks in Joplin after the devastating tornado in May. The team of seven cleaned up and replanted, from May to November. This included hauling debris, removing uprooted trees, moving tons of topsoil and replanting trees, shrubs and sod. Miller organized, trained, equipped and supervised the corps as they worked.

For his exemplary service, Miller also received Missouri State Employee of the Month for May and MoDNR Employee of the Month for April.

The Regal Tallgrass Prairie Natural Area includes 19 rare or endangered species and five endangered terrestrial natural communities. Some plant and animal species documented at the park reach the eastern (or northern) edge of their North American range, like the southern prairie skink, the only population found in Missouri, and the fulvous harvest mouse.