

# The Glade

*The Newsletter of the Missouri Chapter of the Society  
for Conservation Biology*

Volume 7, Number 1

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## News and Notes

### ☞ Poster winner at the Missouri Natural Resources Conference

Jeffery Ray of Saint Louis University won the MOSCB-sponsored poster contest at the MNRC in January. His poster was entitled "Genetic identification of pallid sturgeon (*Scaphirhynchus albus*), shovelnose sturgeon (*S. platyrhynchus*) and their hybrids." We thank all those who participated this year and hope to see many new entries next year.

### ☞ Hummingbird Photos for Sale

A beautiful photo of a hummingbird (by Mundy Hackett, vice president) is being sold on the MOSCB website. Proceeds benefit MOSCB's publication of *The Glade*. See our web site for details and a glimpse of the picture. <http://www.snr.missouri.edu/moscb/donate.html>

### ☞ Earth Day is Thurs., April 22

This year is the 34<sup>th</sup> anniversary of Earth Day. Get outside and enjoy yourself!

### ☞ River Relief

All along the Missouri River, a wonderful organization called River Relief has organized clean-up events. Check out the map on their web-site ([www.riverrelief.org](http://www.riverrelief.org)) for an event near you. They run from April 30 in St. Louis to June 19 in Kansas City.

### ☞ Questions or Comments?

Email Sara Storrs at [sisk95@mizzou.edu](mailto:sisk95@mizzou.edu)

# Monitoring Global Climate Change: The Missouri AmeriFlux Site

Neal H. Sullivan, North Central Research Station, USDA Forest Service, Columbia, MO: [sullivan@missouri.edu](mailto:sullivan@missouri.edu);

The carbon dioxide concentration in Earth's atmosphere has risen by about 19 percent in the past 45 years and by about 30 percent since the beginning of the Industrial Revolution. As a "greenhouse gas," increasing CO<sub>2</sub> is thought to be contributing to warmer temperatures globally and altered rainfall patterns as a consequence. While global climate change might be viewed as detrimental, CO<sub>2</sub> is the substrate upon which photosynthesis acts to capture solar energy for net primary production. Increasing CO<sub>2</sub> can lead to increased growth rates and yields for natural ecosystems and for agricultural crops. Predicting the outcomes both negative and positive as a result of changes in climate and changes in atmospheric gas concentrations has become a goal for scientists. In 1996, researchers began to form a coordinated network of sites throughout the Americas for monitoring and studying the influence of increasing CO<sub>2</sub> on ecosystems.

This North and South American network, *AmeriFlux*, is part of a global network (*FluxNet*) with 257 member sites. (see <http://www.daac.ornl.gov/FLUXNET/fluxnet.html>).

Study sites have been established in ecosystems ranging from boreal tundra to rainforests to croplands in the American Midwest. The distribution of network sites for the lower 48 states is shown in Figure 1. A team of scientists from the University of Missouri and the Oak Ridge National Laboratory (see below) have been funded by the Department of Energy to establish an AmeriFlux site in Central Missouri at the T.S. Baskett Research and Education Area near Ashland. Although there are sites located elsewhere in the eastern U.S., as shown in Figure 1, this new site is located at the western edge of the eastern deciduous forests. Since this forest edge is thought to be largely determined by moisture limitations, this area may be particularly sensitive to changes in patterns of rainfall and temperature regimes.

All phases of carbon and water cycles are open for study at these sites. The most prominent features of the sites are the flux towers (Figure 2). Instrumentation on the tower system measures and records data used

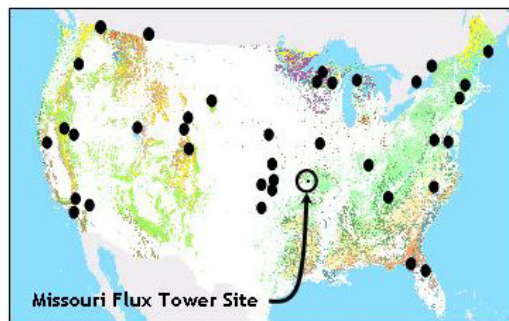


Figure 1. AmeriFlux sites in the lower 48 states with the location of the future Missouri Flux site in Ashland highlighted. Shading indicates forested areas.

in models for predicting exchange of CO<sub>2</sub> and water vapor from a forest area of about 1 km<sup>2</sup>. Some of the instruments are located on a tower that extends above the vegetation. At the Missouri site, the walk-up type tower will extend about 12 meters above the 28 meter canopy. While one instrument measures the concentration of CO<sub>2</sub> and humidity, another instrument simultaneously measures the direction and rate of air movement. The data is continuously monitored, recorded, and integrated using onsite computers. This measurement of air movement direction and air quality is termed "Eddy Flux Covariance." For example, during growing season daylight hours, air moving from the canopy would be expected to have lower concentrations of CO<sub>2</sub> and higher concentrations of H<sub>2</sub>O than air moving into the forest canopy. This would be due to carbon fixation and transpiration, respectively. Conversely, at night, the concentration of CO<sub>2</sub> would be higher in the air moving

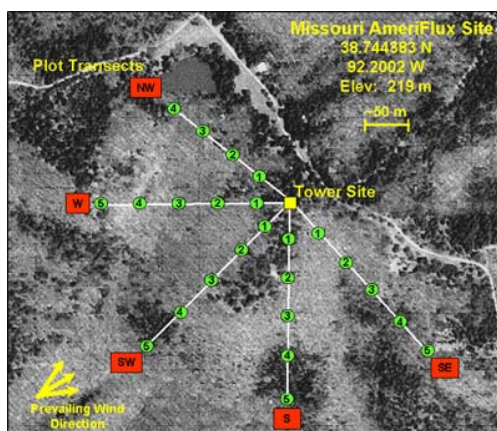


Figure 2. The Missouri AmeriFlux Tower site monitors gas exchange for a 1 km area in an oak-hickory forest. Plots are arrayed upwind of the tower. This leaf-off photo shows the presence of red cedar and plot locations arrayed with consideration for prevailing wind directions.



away from the forest due to the lack of photosynthesis and ongoing respiration of vegetation and soil microbes. The within canopy CO<sub>2</sub> profile will be recorded using separate instruments and a manifold system. Separate eddy covariance instrumentation will be installed near the forest floor to monitor carbon exchange dynamics in the understory.

Other measurements related to carbon exchange incorporated in the initial site establishment include: vegetation growth and phenology, litter production, leaf level photosynthesis and respiration, stem respiration and soil respiration. Climate measurements above the canopy and profiling systems within the canopy include: temperature, short and longwave direct and indirect solar radiation, photosynthetically active radiation, rainfall, and throughfall. Physiological measurements for evaluating plant water relations include: continuously measured sap flow velocity and stand-level sap flow area for estimating stand water use, soil water content and soil water potential, leaf level transpiration and plant segment hydraulic conductivity. In addition to the flux tower, there are plans to move several other canopy access towers to the flux tower site. These towers will be located to increase the number of trees and species that can be sampled.

As of this writing: the site data management building has been constructed, the foundation of the flux tower has been installed and the flux tower is slated to be assembled soon, vegetation plots have been located and inventoried, litterfall traps have been installed and monthly collections began in the fall of 2003, a team of scientists from Oak Ridge have begun installing soil respiration and sap flow sensors. The flux tower is scheduled to be running and collecting data by the beginning of summer of 2004.

The data from this installation will become part of the coordinated global network of sites established for modeling the role of terrestrial systems in the area of global climate change. The data collected will be used for predicting the carbon balance at local, regional, continental, and global scales. The Missouri site will not only provide information for a forest type and ecosystem not previously represented in the network, but it will provide an opportunity for long-term monitoring of dynamics at the site itself. Located at the western edge of the eastern deciduous forests, this forest may be more sensitive to climate change resulting in observable changes in ecosystem function and dynamics.

Other research efforts at or near the Missouri flux site are encouraged. Although carbon flux and plant-water relations are the research emphasis for the initial site establishment, other ecological research efforts could benefit from the intensive climatological and physiological data that will be collected continuously over the next several years. Anyone who would like to explore the possibility of conducting research at the Missouri Flux site should contact Dr. Stephen Pallardy at the address listed below.

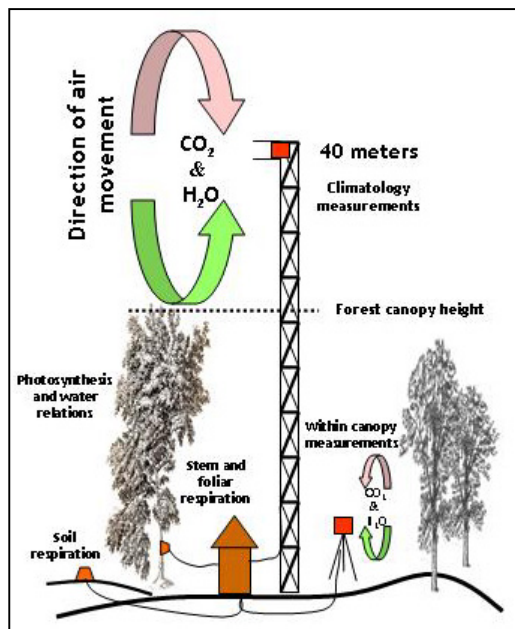


Figure 3. The basic measurements using eddy covariance flux technology at a FluxNet site

**Missouri  
Flux Site  
Researchers**

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Lianhong Gu, Paul Hanson, Stan Wullschleger, Nelson Edwards, and Tilden Meyers from the Environmental Sciences Division of the Oak Ridge National Laboratory, Oak Ridge, TN.

## Where the Coyote is King

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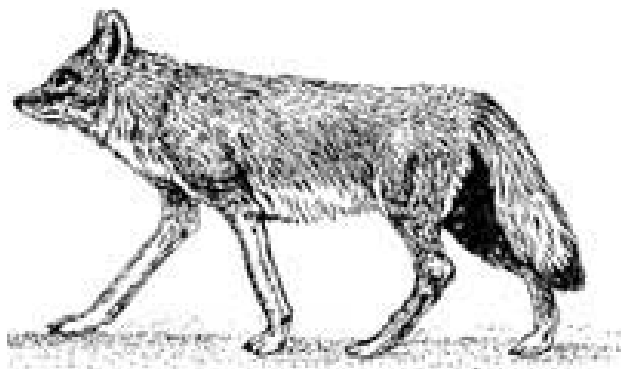
**Why am I here?** A question we all find ourselves asking at one time or another. I'll try to answer that through some circular discussion.

For now, I want to talk about the status of carnivores in Missouri and the Midwest in general. Carnivores are competitive predators, characterized by a pure existence of survival. They sit at the apex of food webs and dramatically influence the structure of their communities and ecosystems at all levels. The argument can be made that as the system goes, so goes the carnivore, and vice versa. Their impacts affect everything from behavior modification of prey to the alteration of ecosystem-wide processes.

Carnivore community dynamics in the Midwest have changed drastically in the last 125-150 years due to persistent persecution, over-consumptive over-harvest, misguided displacement, and ultimate extirpation of the largest and least ecologically elastic species. In many circles to embrace carnivores is tantamount to declaring war on all of conservative America. Large carnivores are gone forever from Missouri's prairies save for the occasional,

transient wolves, mountain lions, and fledgling black bear populations. Today, only 19 species represent the order Carnivora in the Midwest with fewer than half considered common or locally abundant. In Missouri, harvest trend data suggests only coyote, river otter and raccoon are to be considered common.

The majority of scientific studies to date on carnivores in North America have focused on the charismatic species like the wolf and grizzly bear, and usually as individual species, not as fully functional ecological guilds. Very little data is available to determine carnivore population trends and regional spatial arrangements across the landscape, and the few pieces of this puzzle that are available are taken from difficult to interpret historical harvest records. Without question the need exists to better understand the community structure and distribution patterns of modified carnivore communities in the Midwest and throughout the world. And that brings me back to why I moved to Missouri.



*The coyote is the current king of the Midwestern carnivore guild, but not for reasons of superior size...or strength...or stealth...*

I am beginning my PhD research, and through my findings I hope to lend some insight into the fundamental mechanisms underlying carnivore community structure in the Midwest, focusing my efforts on Missouri. My work attempts to address the importance of both scale-specific habitat preferences and intra-guild segregation patterns. I will use this information to create predictive models for carnivore species distributions (and resulting community structure) across the state.



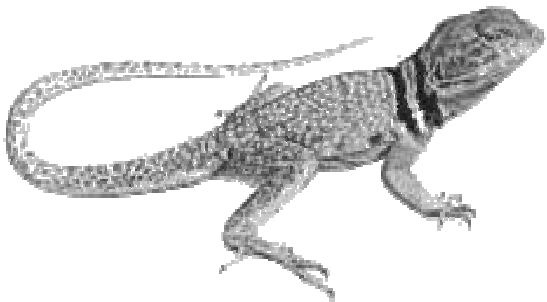
To date, few published studies have simultaneously incorporated an approach that combines habitat preferences and segregation patterns in discerning patterns of carnivore community assembly. I hope that by systematically surveying the carnivore guild throughout the various eco-regions of Missouri, focusing on dynamics and patterns of abundance at varying temporal and spatial scales, it will help determine what are the carnivore responses to alteration of habitat structural dynamics in Missouri, and to what degree choices and resulting patterns made by carnivores are driven by intra-guild competition and predation.

Additionally, I hope to help ascertain what is happening with the Eastern spotted skunk in Missouri (a collaborative effort with Missouri Dept. of Conservation biologists). In 1991, this species was officially listed as endangered in Missouri following a precipitous downward trend in harvest numbers from a high of 55,000 skins in 1940-41 to one in 1989-1990. Throughout the Midwest, historical harvest data indicates a decline of 97% over the period 1934-35 (242,230 skins harvested) to 1989-90 (875 skins harvested). Numerous theories abound as to what has caused the disappearance of this “little stinker”, but to date none of these have been examined in depth.

Without question the need exists to better understand the community structure and distribution patterns of these modified carnivore communities in the Midwest. The coyote is the current king of the Midwestern carnivore guild, but not for reasons of superior size (the wolf is larger), or strength (the grizzly is stronger), or stealth (the one they call ghost cat or cougar takes this prize). No, the coyote is the monarch of Missouri’s mammal kingdom simply because it was the only one to survive the push of man. Nevertheless, even today the coyote is persecuted and punished for doing what comes naturally; after all it is a carnivore.

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## **Creature Feature: Eastern Collared-lizard (*Crotaphytus collaris collaris*)**



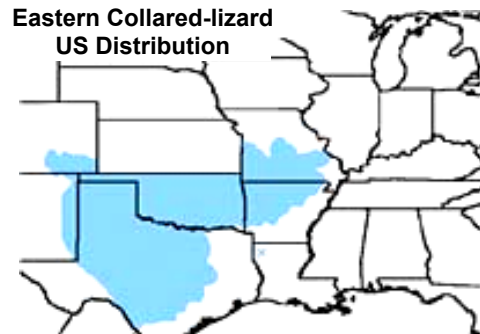
**DESCRIPTION:** relatively large lizards; males often have bright yellow or orange bodies; 2 black collars run arms to neck; usually have 6 dark, cross bands along back

**HABITAT:** from arid regions (with rocks for basking) to hardwood forests

**BEHAVIOR:** in retreat, will lift its body and tail to run on hind legs; their skiddish nature makes them a tough find (although they are well distributed)

**FOOD:** grasshoppers, spiders, moths, beetles, small lizards

**FUN FACT:** unlike most lizards, they cannot regenerate their tails



# Spring Bird Migration in Missouri

*Andrew Forbes, Ornithologist, MDC/Audubon Missouri; email: AndrewForbes@mdc.mo.gov*

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Spring is the time of year we all look forward to. The weather is pleasantly warmer. The trees are all either budding or have small leaves unfurled. Wildflowers bloom on the soggy earth, and grasses are once again green. All of this new plant growth is heartily eaten by white-tailed deer, as bucks regrow their antlers and pregnant does nourish the fawns that they carrying. The water is open and warmer, and angling enthusiasts are out testing their luck. The stark silence of winter is no longer. At night, choruses of frogs and toads fill the air, as males advertise their fitness to females and competing males. During the daytime hours, we are treated to another symphony of natural sound--birdsong.

Many of the birds that we hear singing on these warm days are year-round residents of Missouri; such as Black-capped Chickadees, Northern Cardinals, and American Robins, that are “awakened” by the changing day length and warmer temperatures. However, there are also many species of birds that migrate through Missouri on their way to points north. During the months of February and March, we often see flocks of waterfowl flying overhead or resting and feeding on lakes, ponds, or rivers. In shallower portions of are dotted with scurrying along in soup of invertebrates substrate and the same time, wooded or within urban areas sanctuaries for “fallouts” thousands of migrating warblers, tanagers, vireos, and other passerines, who single-mindedly feed on insects and any berries or fruits that they can find as they try to replenish energy stores depleted by their long and often arduous journey.



April and May, the shorelines and some of those same bodies of water shorebirds, walking and the mud, feeding on the present within the shallow water. At the areas along riparian zones can suddenly become of hundreds or even

There are a multitude of places in Missouri that provide excellent opportunities to view birds as they stop in Missouri on their way north. Listed below are a just few of the highest profile sites in the state. To find out more about places that you can go to view the spectacle of spring migration in your area, contact your local chapter of the National Audubon Society. You can also visit the Audubon Society of Missouri website at [www.mobirds.org](http://www.mobirds.org) to find out more about birding hotspots in Missouri.

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## HOT SPOTS IN MISSOURI

**Forest Park- St. Louis Area.** Forest Park is comprised of approximately 1,300 acres of predominantly open space within the St. Louis Metropolitan area, lying along US40/I-64. The main attraction in Forest Park is the 80-acre John F. Kennedy Memorial Forest. The Kennedy Forest contains a patch of mature forest, and over 160 species of birds have been seen here during spring migration. The peak time to visit for maximum diversity and numbers of birds is early May. (<http://stlouis.missouri.org/citygov/parks/forestpark/>)

**Eagle Bluffs Conservation Area- Columbia Area.** Located south of Columbia off of Rte. K,



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Eagle Bluffs is approximately 4,300 acres of predominantly wetland habitats in the floodplain of the Missouri River. Migrating waterfowl and shorebirds are abundant in many of the pools on the area, and sandbars on the adjacent Missouri River also provide good habitat for resting migrants. South of the river view parking lot, there is a trail that weaves through bottomland forest that is outstanding for migrant warblers, vireos, tanagers, and other migratory songbirds. (<http://www.conservation.state.mo.us/nathis/viewguide/index21.htm#eagle>)

**Weston Bend State Park- Kansas City Area.**

Located approximately 3 miles south of Weston off of MO 45/273. There are approximately 1,133 acres of forested habitat adjacent to the Missouri River. The network of trails within the park is excellent for migrating warblers, vireos, and other migratory songbirds. A Great Blue Heron rookery is visible across the river from the Overlook, as well as a beautiful view of the forested landscape. (<http://www.mostateparks.com/westonbend.htm>)

**Squaw Creek National Wildlife Refuge- Northwest MO.**

Located south of Mound City, this 6,900 acre complex of predominantly wetland habitats is one of the best places in the Midwest to view large numbers of migrating shorebirds and waterfowl. Squaw Creek is also one of the best places in the state to see rare species with a more western distribution, such as Cinnamon Teal, Eared Grebe, and Snowy Plover. Large numbers of Black Terns are easily found over open bodies of water, and look for Peregrine Falcons as they cut through the shorebird flocks, looking for a meal. To get to Squaw Creek, take I-29 to exit 79, and follow US 159 approximately two miles to the refuge headquarters. (<http://midwest.fws.gov/SquawCreek/>)

**Schell-Osage Conservation Area, Southwest MO.**

Approximately 6 miles west of El Dorado Springs, Schell-Osage Conservation Area can be reached by taking Route AA north for 12 miles off of US Hwy. 54, until you reach Route RA. Take RA east for about 1 mile to reach the area. The 8,633-acre area has an abundance of lakes, ponds, and marshes, as well as a variety of terrestrial habitats. Waterfowl, wading birds, and shorebirds are found in abundance in the marshes and on the margins of the ponds and lakes, and small patches of trees may yield surprising numbers of migratory songbirds. Rarities observed here include Cinnamon Teal, Glossy Ibis, and Ruff. (<http://www.conservation.state.mo.us/nathis/viewguide/index24.htm>)

**Mingo National Wildlife Refuge, Southeast MO.**

Just north of Puxico on MO Rte. 50, Mingo National Wildlife Refuge is approximately 21,000 acres of predominantly bottomland hardwood forest, in addition to marshes, moist soil units, and interspersed grassland and upland forest habitats. This refuge is the best and largest remaining example of the 2.5 million acres of habitat that once covered the “Bootheel” of Missouri. 281 species are listed on the refuge checklist, making Mingo one of the best birding locations in the region. Wintering waterfowl can number in the hundreds of thousands, and the sheer numbers and diversity of migrant songbirds on a good day is a sight to behold. The adjacent Duck Creek Conservation Area also provides excellent viewing opportunities for shorebirds and waterfowl. (<http://midwest.fws.gov/Mingo/>)

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*When one tugs at a single thing in nature,  
he finds it attached to the rest of the world. --John Muir*

### **Membership Information**

The goal of MOSCB is to promote communication among conservation biologists throughout the state of Missouri. Membership in MOSCB is free. Please visit our MOSCB web page for more detailed information (<http://www.snr.missouri.edu/moscb>).

The Glade Vol. 7, No. 1 was edited by Sara Storrs. Special thanks to the authors in this issue for their time and thought in writing their articles. Funding for this issue of *The Glade* was provided by the Division of Biological Sciences, University of Missouri-Columbia.

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#### **Annual Membership Renewal Form**

**Name** \_\_\_\_\_ **Email** \_\_\_\_\_

**Street** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**I would prefer to receive future issues of the Glade:**

**Via email** \_\_\_\_\_ **OR** **In the mail** \_\_\_\_\_

**Suggested annual dues are \$15 for non-students, \$5 for students.**

**I have included a donation** \_\_\_\_\_ **At this time I cannot include a donation** \_\_\_\_\_

Please mail this information to Tracy Rittenhouse, 105 Tucker Hall, Columbia, MO 65211.