The Glade

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

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Contents

The Corner: The Beautiful Changes

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Our world in Missouri is transformed by the change in seasons, so that we are now nearly to the bare bones, the quiet architecture, of things. After living much of my life in the south, in places where the snow seldom falls and the thermometer regrets drops below 80ºF, I have come to appreciate the four seasons of Missouri—the bright falls; the arrival of snow each and every winter; the lingering, rainy spring; and those humid, hot, and relatively brief summers. Our world, but especially at home in Missouri, experiences growth and renewal perpetually, and every year the change of seasons remind us of life's cycle of birth, death, and transformation. While nature offers us change and surprise at every turn, there are changes on our planet that many of us mourn; however, many people shape their lives to influence and understand these alterations in response to the political, social, and economic pressures that drive habitat destruction, pollution, and environmental homogenization. Global and local change motivates those of us affiliated with MOSCB, and our collective individual efforts will be magnified, we hope, to make a difference. Within MOSCB, there are many positive changes coinciding with the change in season: we recently elected new board members who have many ideas to help us build on the work of our past efforts and to expand our scope; and, Sara Storrs is taking on the enjoyable job of editing *The Glade*, bringing her talents and ideas to task. With new year's resolutions around the corner, we might all challenge ourselves to do something good for our planet either locally or globally. Nature, even with human influence abounding, promises us many gifts as fall crystallizes into winter. In "The Beautiful Changes" the poet Richard Wilbur takes a closer look at the world and finds the beauty about him transformed by the smaller parts making up the whole: a leaf is not entirely a leaf, but also a praying mantis that has become part leaf and "makes the leaf leafier." Wishing all of you many beautiful changes, with eyes to see the world about you anew and sights that touch you back to wonder.

Amphibians on Land: Habitat Edges Created by Forest Fragmentation Affect Amphibians Too

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Although amphibians have skin that must remain moist, most species spend the majority of their lives on land away from bodies of water. Conservation efforts that only focus on providing good quality breeding habitat, often small wetlands or creeks, will not succeed unless good quality non-breeding habitat is also available. Thus, understanding terrestrial habitat requirements is crucial to the conservation of amphibians. Historically, research efforts have focused on processes that occur in or near water (e.g. breeding, development, and metamorphosis), leaving many unanswered questions about the processes occurring in the non-breeding season (e.g. feeding and growth patterns, over-wintering, dispersal, migration, predation, and refuge requirements). Recent work has begun to answer these questions, but the research is often conducted in continuous, presumably good quality terrestrial habitats. As conservation biologists, we are not only interested in how these processes function in good quality habitat; we are concerned about how these processes function in habitats altered by humans.

Habitat loss and fragmentation is often labeled as the number one threat to biodiversity. In many cases, the habitat alteration has already occurred or is unavoidable. For example, harvesting trees occurs and will continue to occur to support the needs of humans. We are then faced with developing methods to mitigate the effects of these activities. However, to develop effective mitigation methods, we need to understand the mechanisms driving observed population level effects (e.g., decreased abundance of salamanders at habitat edges; deMaynadier & Hunter 1998). Potential mechanisms driving salamander abundance patterns could be decreased survival, decreased movement, or behavioral avoidance of the area. I conducted a series of behavioral experiments on salamanders to explore the possibility that salamander abundance decreases at habitat edges, because they behaviorally avoid the habitat edge (Rittenhouse 2002).

I studied a population of spotted salamanders (*Ambystoma maculatum*) that breed in a pond located on a distinct forest-grassland edge. The pond was completely encircled with a drift fence to monitor the direction salamanders migrated to and from the pond. Adult salamanders clearly entered and left the pond on the forested side. I radiotracked two groups of adult salamanders. One group was resident to this pond and I tracked them as they emigrated from the forested side of the pond. This group migrated away from the pond in a straight line, similar to movements reported by Madison (1997). A second group of salamanders, which I displaced from a pond surrounded by forest to the grassland side of the study pond, were also radiotracked as they emigrated. I expected these salamanders to migrate in a straight line perpendicular to the edge of the pond. The expected migration route would require them to cross a distinct forest-grassland edge, thus entering the grassland. Another patch of forest was located on the other side of the grassland within known migration distances (approximately 100 m). The displaced salamanders initially emigrated as expected. However, when they reached the habitat edge they stopped migrating, making small movements back and forth along the habitat edge or reversing direction and moving back into the small patch of forest on the grassland side of the pond. Thus, the salamanders were able to detect the habitat edge and chose not to enter the grassland. I then conducted a choice test in the laboratory to determine how the salamanders detected the habitat edge and found that salamanders can distinguish between substrate (soil, litter, or the combination of soil and litter) collected from a forest or grassland.

Although the salamanders that I studied behaviorally avoided the grassland when reaching the habitat edge, the strength of the avoidance behavior may be dependent on other factors, such as sex, age, or condition of the individual, as well as the type of habitat edge or the edge contrast. More research is

needed to fully understand this behavior. However, assuming that salamanders behaviorally avoid edges most of the time, how can we use this information to ensure the survival of salamander populations? Spotted salamanders clearly require two different habitats to survive: aquatic breeding habitat (e.g. small fishless pond) and terrestrial non-breeding habitat (e.g. mature hardwood forest). These two habitats must be adjacent. Salamanders are reluctant to cross a habitat edge and travel through non-forested areas to reach good quality habitat, even when the habitat is located within normal migration distances. In addition, behavioral information, such as avoiding habitat edges, may potentially be useful in some mitigation situations or when labor intensive actions are taken to protect an endangered species. For example, we may be able to create hard edges to prevent salamanders from entering areas known to be harmful (e.g. a wetland contaminated by an accidental spill, or a forest patch scheduled for development). Conserving biodiversity will require a detailed cause and effect understanding of biological processes, as well as the use of this information in the development of creative conservation solutions.

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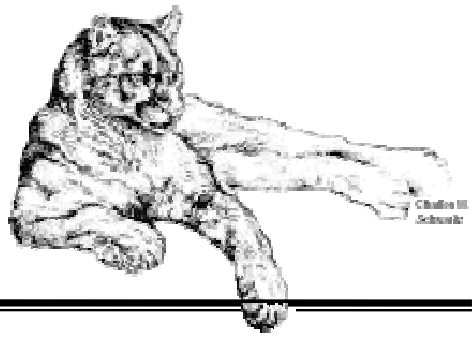
Nature is, above all, profligate. Don't believe them when they tell you how economical and thrifty nature is, whose leaves return to the soil. Wouldn't it be cheaper to leave them on the tree in the first place?
--Annie Dillard, from Pilgrim on Tinker Creek

When I would recreate myself, I seek the darkest wood, the thickest and most interminable, and to the citizen, most dismal swamp. I enter a swamp as a sacred place—a sanctum sanctorum. There is the strength, the marrow of Nature.
--Henry David Thoreau, from "Walking"

The Return of Apex Predators—
Ecological and Conservation Considerations



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When most ecologists think about large carnivores, the Midwest receives scant attention. Yellowstone? Absolutely. Alaska? Of course. Missouri? No. Yet over the past several years, the state of Missouri has briefly seen the reappearance of some interesting predators. Wolves, including one originally captured and tagged in Michigan, have surfaced in Missouri. Recent road-killed mountain lions suggest the possibility of transient pumas entering from western states. These sightings reflect the broad range expansions occurring for these species elsewhere in North America. As of yet, there is no evidence of a local breeding population for either of these species. There is, however, a slowly but steadily expanding black bear population in the Ozarks. One could, therefore, argue based on current trends that within the next decade we will see portions of the state where bears and mountain lions co-occur in an eastern deciduous forest landscape. Moreover, within the next several decades breeding populations of gray wolves could also conceivably enter this landscape.

The conservation of large carnivores, perhaps more than any other faunal guild, is fraught with politics (Clark et al. 2001). There is no doubt that these animals can sometimes cause economic losses, especially to livestock producers, and that these animals represent a perceived safety threat to some people. On the other hand, there are potential economic gains in the form of hunting and tourism, and for some, spiritual and esthetic benefits from having these carnivores in our midst. So, the pressures to augment or impede the return of these animals make predicting restoration timeframes problematic. But independent of one's love, hate, or apathetic relationship with this group of organisms, and independent of whether the end result of these range expansions is a management strategy designed to facilitate or limit these fledging populations, it benefits all to understand that the ecological impact of recolonizing top predator populations could be significant.

It is increasingly realized that just a few individual members of a population of top-predators holds the potential to disproportionately influence animal and plant communities. The importance of this phenomenon, known as a "top-down" effect, has been demonstrated by several recent studies. For example, as few as four individual killer whales may be responsible for a shift in Alaska's Aleutian Island near-shore community structure from one dominated by kelp forests with few herbivores to one of high sea urchin numbers and low kelp densities (Estes et al. 1998). Similarly, in Michigan's 544 km^2 Isle Royale National Park, just two or three wolf packs indirectly control tree community organization by regulating moose numbers (Post et al. 1999). Thus, in the context of understanding the possible impact of a return of top carnivores to the Midwest, the lesson is that it will not take a large number of animals to affect ecological change. Indeed, the question should not be whether ecological change will result from the return of top carnivores, but rather what types of change will occur.

Unfortunately, it is at this point that our predictive abilities weaken. The complexities of predicting change are exemplified by the Greater Yellowstone Ecosystem wolf restoration effort. Wolves were reintroduced to Yellowstone in 1995 and the population has expanded steadily since. Ecological impacts of this restoration are now becoming clear (Arjo et al. 2002, Ripple et al. 2001, Smith et al. 2003, Soulé et al. 2003). The most intriguing impacts have been the altered behavioral and foraging ecology of putative prey and competitors, and the direct and indirect impact of these changes. For instance, coyote numbers seem to have declined, but those that remain are using a novel resource—the carcasses of ungulates killed by wolves, which has resulted in coyotes living in bigger packs and themselves killing

more ungulates than before wolves returned. Altered behavior of ungulates, such as elk and moose, has reduced browsing pressures on vegetation such as aspen and willow. If wolf-based shifts in the foraging strategies of ungulates continue, one might expect broad changes to riparian vegetation structure and associated faunal richness—changes observed in cross-site comparisons that differed in moose browsing pressures (Berger et al. 2001). The strength of the effects of wolves on prey behavior, and its ensuing indirect importance for the surrounding community was unforeseen.

Would the variety of changes that occurred in Yellowstone also occur in an eastern deciduous forest? At a very basic level—a shift in prey and mid-sized predator behavior resulting in altered direct effects on the biotic and abiotic systems—the answer is undoubtedly yes. What these shifts and the associated indirect effects are likely to be, however, is unclear. Underlying our lack of insight is the inherent complexity of areas like the Ozarks, which are far more diverse than western ecosystems. In thinking about potential changes, however, conservationists and natural resource managers might start by asking how habitat use by potential prey such as deer or raccoon would change, and how interactions within the broader carnivore guild, from coyotes to weasels, might shift. The dynamics of the latter group has been shown time and again to be strongly influenced by the arrival of novel top carnivores (e.g. Crooks & Soulé 1999, Johnson et al. 1996). What might a shift in the numbers and distribution of animals like raccoons, foxes, or skunks mean for an organism or community of conservation concern?

The return of apex predators to eastern deciduous forests is a natural experiment that is likely to happen within the next few decades. From a conservation perspective, regional managers are faced with two options: ignore these animals until their return and then respond to the impact (a default option) or plan for the return based on the insights, albeit limited, gained from elsewhere in the world, and then modify the plan as necessary. Although the second strategy is likely safer, in either scenario the clock is ticking.

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Local Society for Conservation Biology Chapters Share Ideas in Duluth, Minnesota

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Representatives of several local chapters joined in a roundtable discussion held during SCB's 17th Annual Meeting in Duluth, Minnesota in June 2003. As the representative of the Missouri chapter, I gave a brief summary of our chapter's history, membership, and major activities. Other chapters did the same, providing an opportunity to share ideas and solutions to common challenges. For example, the UC-Davis chapter, which is an official student organization, has conducted environmental education programs in schools and completed ecological restoration projects. Every year they co-sponsor (with the UC-Berkeley chapter) a Bay Area Conservation Biology Symposium, which features student talks and raises funds for their other activities. On the opposite side of the country, the New England chapter is a nonprofit organization with a membership comprising about half students and half conservation professionals, university faculty, and others. They sponsor an online conservation journal, hold workshops, and provide support and expertise to government and non-government organizations and legislators dealing with conservation issues.

Paul Beier, SCB's local chapter liaison, introduced the idea of a "sister chapters" program, in which chapters in developed and developing nations could partner on specific activities. For example, the partner in the more developed country could facilitate publication of research results by providing peer-editing services or helping conservation biologists in the developing nation gain access to the scientific literature. A representative of the Bolivian chapter who attended the roundtable expressed support for such a program, noting that access to good libraries is a major problem for scientists working in Latin America. Exchange programs could also form between sister chapters, with representatives visiting each other in alternate years.

Hearing the breadth of activities undertaken by other local chapters was helpful as MOSCB continues to define its niche with respect to other statewide conservation organizations and societies. The roundtable affirmed that local chapters are free to choose their own focus, relying on committees that form around specific issues or projects to accomplish their mission. Of the 27 chartered chapters of SCB, Beier could confirm only 11 that were currently active, including 10 local chapters in North America and one in Bolivia. Up to four additional chapters may form in the upcoming year in Minnesota, Maine, Wisconsin and Tennessee.

Visit http://conbio.net/SCB/Activities/Chapters/ for additional information, including links to other Society for Conservation Biology chapters.

A solitary maple on a woodside flames in single scarlet, recalls nothing so much as the daughter of a noble house dressed for a fancy ball, with the whole family gathered around to admire her before she goes.
--Henry James

Meet Your New MOSCB Executive Board

President: Stacy James—Stacy is a Ph.D. candidate in Biological Sciences and the Conservation Biology Program at the University of Missouri-Columbia (UMC). She is interested in the impacts of contaminants on amphibian populations and the role of contaminants in the global decline of amphibians.

Past President: Betsie Rothermel—Betsie has recently moved to Aiken, SC to post-doc at the Savannah River Ecology Laboratory after finishing her Ph.D. in Biological Sciences at UMC.

Vice-President: Mundy Hackett—Mundy is a Ph.D. candidate in Fisheries & Wildlife at UMC. He is investigating the dynamics of Missouri's meso-carnivore assemblage at various spatial scales with special emphasis on the rare and endangered plains spotted skunk. Mundy received a M.S. in Biology from Virginia Commonwealth University. Mundy is also an award winning nature photographer.

Treasurer: Tracy A. Green Rittenhouse—Tracy is a Ph.D. candidate in Biological Sciences and the Conservation Biology Program at UMC, where she has recently finished her M.S. degree. She examines how changes in the terrestrial habitat influence terrestrial amphibian survival and the maintenance of amphibian populations in altered landscapes.

Secretary: Emily Coffey—Emily received a BS in Biology and Chemistry, as well as a Certificate of Conservation from the University of Missouri-St. Louis. She previously was employed and now volunteers at the Shaw Nature Reserve in Gray Summit, MO as an Environmental Educator. She also has studied rare and endangered plants in the Midwest.

Conservation Co-Chairs: Michelle D. Boone, Sara I. Storrs, and Neal H. Sullivan—Michelle is a post-doc with the USGS Columbia Environmental Research Center studying the effects of contaminants and invasive species on native amphibian communities. She has served as editor of *The Glade* since 1999. Sara is a Ph.D. candidate in Biological Sciences at UMC. She received her M.S. from Penn State examining the effects of atrazine on amphibians. Sara is the new editor for *The Glade*. Neal is a post-doc for the Forest Service in Columbia. He studies tree ecophysiology, as well as regional patterns of forest production. Neal has managed the website for MOSCB since 2000.

For more information about the board, visit http://www.snr.missouri.edu/moscb/exec_brd_pg.html.

Announcements

❖ MOSCB would like to thank and acknowledge the following people for their financial donations during the past year: Michelle Boone, Emily Coffey, John David, Chrissy Howell, Mundy Hackett, Stacy James, Kim McCue, Wayne Morton, Tracy Green Rittenhouse, Chad Rittenhouse, Betsie Rothermel, Sara Storrs, Neal Sullivan, Sage Research, Inc., and Bethany Williams.

❖ If you would like to help support MOSCB's activities and publication of *The Glade*, please send your contribution to MOSCB, care of Tracy A. Green Rittenhouse, 105 Tucker Hall, Division of Biological Science, Columbia, MO 65201. Suggested donations are $5 for students and $15 for other members. Thank you for your support!

❖ Our annual meeting will be held at the Missouri Natural Resources Conference at Tan-Tar-A during the Jan 28-30. Check out our web site for updates on the time and date of our meeting. Everyone is welcome and we encourage you to attend!

The Glade

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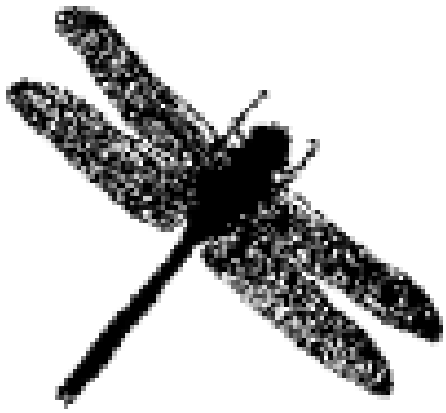

When one tugs at a single thing in nature, he finds it attached to the rest of the world. --John Muir

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. 6, No. 2 was edited by Michelle Boone. Special thanks to the authors in this issue for their time and thought in writing their articles. Special thanks to Missouri Botanical Garden for providing funds that helped support this edition of *The Glade*.