Biosurvey News

The Newsletter of the Oklahoma Biological Survey
Fall 2004

Biological Survey Research: Short Term Response of Annual Cicadas to Wildfire in Riparian Forests

By Max Smith & Jeff Kelly

Natural disturbances such as flood and wildfire are important aspects of many ecosystems. Accordingly, many plant and animal communities are adapted to cope with, or take advantage of, regular disturbance events. Organisms adapted to a specific disturbance regime could suffer serious consequences if that regime is altered or replaced by another. The diverse riparian ecosystems of the southwestern U.S. evolved with regular flooding disturbances that provided germination sites for native vegetation such as cottonwood (*Populus spp*.) trees and willow (*Salix spp*.) shrubs. In recent decades, however, humans have prevented flooding within many riparian forests. In the absence of flooding, combustible, exotic vegetation, such as saltcedar (*Tamarix ramosissima*) and Russian olive (*Eleganus angustifolia*) often

Unburned (above) and burned (below) sites. Photos by Max Smith.

Tibicen dealbata-the cicada. Photo by Max Smith

invades native riparian communities, and wildfire has become an increasingly frequent occurrence. A shift in the primary disturbance process from flooding to wildfire may have profound consequences for native plants and animals found in riparian forests.

Adult cicadas (*Tibicen dealbata)* emerge from the ground to reproduce each year in the Middle Rio Grande riparian forests of central New Mexico. Riparian cicadas have been identified as keystone species because they are consumed by numerous wildlife species and make below-ground nutrients available to above-ground communities. Cicadas are especially important to birds that nest during cicada emergence and feed cicadas to their nestlings. Alteration of timing and density of cicada emergence by wildfire could therefore impact numerous organisms in the riparian forest. To determine how emergence is altered by wildfire, we installed emergence traps in recently burned wildfire sites and in unburned sites. The emergence traps, which resemble small tents without a floor, capture cicada nymphs as they crawl out of the ground to become adults. We checked the cicada traps every three days to record timing and density of emergence at each site.

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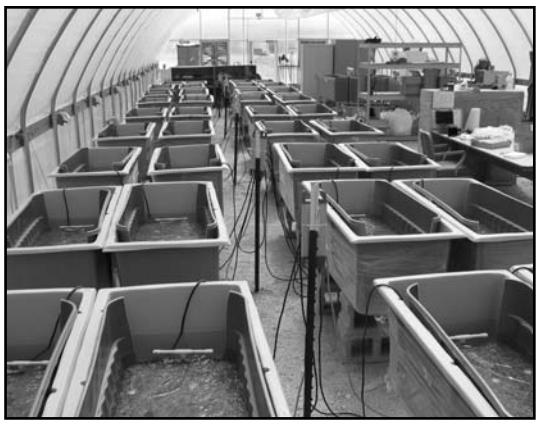
University of Oklahoma Aquatic Research Facility Supports Research on Oklahoma's Aquatic Organisms

The University of Oklahoma recently allocated a substantial piece of land on south campus for the establishment of an Aquatic Research Facility (ARF). This area contains 32 ponds originally used by the Peace Corps for training fishery biologists and two 3,000 ft^2 climate-controlled greenhouses. New greenhouses and additional facilities currently are under construction. The ARF is managed by the Department of Zoology and used by faculty and students in multiple departments. Two Survey faculty, Caryn Vaughn and Liz Bergey, share space in one greenhouse whose construction in 2002 was funded by the Biological Survey with matching funds from the vice president for research.

ARF greenhouse. Photo by Caryn Vaughn.



Mesocosms for mussel experimentation. Photo by Caryn Vaughn.

Dr. Vaughn has constructed a set of 36 replicated stream mesocosms that are housed in the greenhouse. She is using these stream mesocosms to perform experiments examining the functions that freshwater mussels perform in rivers.

Tub for algae experiments. Photo by Liz Bergey.

Dr. Liz Bergey uses sets of tubs in a recirculating water system to run experiments on the dynamics of algal persistence and growth in streams, where bottom-dwelling algae are an important food source for other organisms.

NEW ON THE WEB

Updated pages for 2004 BioBlitz
New pages featuring the wetland and aquatic plants of Oklahoma
Updated pages for the Robert Bebb Herbarium
New pages for the Flora of Oklahoma project

VISIT US AT WWW.BIOSURVEY.OU.EDU!

Graduate Student Research: Mussel Communities, Ecosystem Services, and Changing Environments

By Daniel Spooner

Freshwater mussels (bivalve mollusks in the family Unionidae) are sessile filter feeders dominating the streambed biomass of many lakes and rivers throughout North America. They also are one of the most taxa-rich groups, represented by over 300 species. In southeastern Oklahoma, mussels occur in dense aggregations called 'mussel beds' composed of as many as 21 different species at densities as high as 50 individuals per square meter. Despite their high species richness and abundance, their unique biology makes them one of the most threatened groups of organisms in North America, and both rare and common species are in a state of dramatic decline.

Freshwater mussel beds provide ecological services by filtering out algae and particles from the water column (biofiltration), stabilizing the streambed, and providing important nutrients and habitat to surrounding invertebrates. Mussels also are thermo-conformers, passively changing their body temperature to match the surrounding environment. Elevating body temperature increases activity and thus increases the effect mussels may have on the surrounding ecosystem. However, excessive temperatures, often associated with low-flow drought events, can be lethal. To counter the effects of temperature, mussels may shut down activity and use stored energy reserves until a manageable stream temperature is restored. The temperature at which an organism begins shutting down and the duration a mussel can withstand this is variable among species. This period of suspended activity will result in little to no interaction with the surrounding ecosystem and thus no ecosystem services rendered. Mussels also may have different optimal temperatures for which they maximize filter feeding and provide ecosystem services.

Daniel Spooner measures a mussel's respiration. Photo by Caryn Vaughn.

Our laboratory is interested in how freshwater mussel communities influence their surrounding ecosystem under a variety of temperatures, and which species within these communities are important. Using replicated artificial streams to simulate mussel beds, we are manipulating streamflow, water temperature and mussel species composition. We are determining how individual species of mussels respond to changes in temperature by measuring their physiological condition. In addition, we are determining their contribution to ecosystem services by measuring filtration rate and nutrient excretion. We use this information in predictive models to determine what time of year freshwater mussels are important and which particular species may be relevant to the health of stream ecosystems. Our results to date suggest that mussels are most important during months of low flow and warm water temperature. The warm temperature increases mussel activity while low flow over the mussel bed increases the residence time of water, allowing a longer period of time for mussels to interact with the water column.

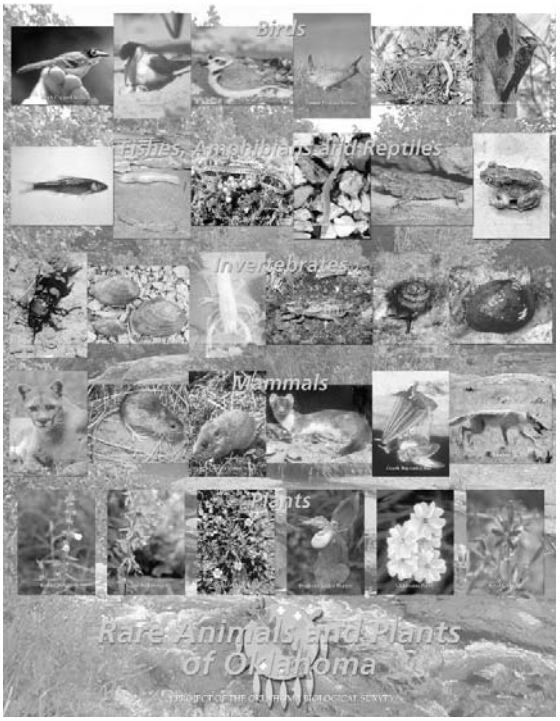
From a conservation perspective, we can use freshwater mussels as surrogate indicators of stream health. Larger-scale climatic disturbances such as global warming threaten to change the magnitude and periodicity of flood and drought events. Given that mussels are intimately linked to the dynamic nature of stream characteristics and fish communities, we can predict how mussel communities may be influenced by such long-term disturbances and how the services they provide may influence the health and function of our beautiful streams.

Daniel Spooner is currently a PhD student in zoology under the direction of Dr. Caryn Vaughn. His dissertation research is focused on the physiological ecology underlying mussel community responses to environmental change.

Fourth Annual BioBlitz Reveals Diverse Life in Okmulgee County

The 24-hour, rapid biological inventory at the Fourth Annual BioBlitz unveiled 1,160 different species of plant and animal life present at Dripping Springs/Okmulgee State Park and the Wildlife Department's Okmulgee Wildlife Management Area. Included in the tally were the presence of five mammal species and 159 plant species previously unreported for Okmulgee County. The Oklahoma Biological Survey hosted the event, which had 186 volunteer biologists, students and educators stirring up life hidden in crevices, under leaves, in the dirt and around trees. The event fosters awareness about the diverse number of living things in Oklahoma and adds to the general scientific knowledge of what species occur in an area. In addition to visitors dropping by the event, the BioBlitz education team taught more than 300 fourth and fifth grade students about local plants and animals. Lizabeth Ogle, a naturalist at the Oklahoma City Zoo, found the kids' energy contagious. "The kids were so excited it made the learning and teaching fun," Ogle said. "The BioBlitz is a great way to help adults and kids discover what's in their own backyard. It creates a tangible excitement about the living diversity in Oklahoma."

An elementary student examines insect collections. Photo by Sheila Strawn.



Coming Soon From the Oklahoma Biological Survey: "Rare Animals and Plants of Oklahoma"

"Rare Animals and Plants of Oklahoma" is the second in a series of posters highlighting the biological diversity of the state of Oklahoma. The poster will be available in December of 2004. Please check our web site at www.biosurvey.ou.edu for updates and ordering information!

Biosurvey News
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Amy K. Buthod and
Caryn C. Vaughn, editors

Biosurvey News is published twice each year and reports on the activites, programs, and news related to the Oklahoma Biological Survey. We welcome readers' comments and suggestions.

The Oklahoma Biological Survey is proud to be a unit in the College of Arts and Sciences at the University of Oklahoma.

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Survey and Fisheries Lab Team Up for Online Tournament Fishing Reports

The Biological Survey and the Oklahoma Fisheries Research Laboratory of the Oklahoma Department of Wildlife Conservation have a long-standing cooperative agreement to assist with fisheries graduate student education. Recently we have been cooperating in other ways. Personnel from the OBS were instrumental in assisting the OFRL with its annual bass tournament reporting system. Previously, all tournament fishing reporting was done by mail-in postcards. However during 2002 and continuing in 2003, a web site was established through the OBS server and a program was initiated to evaluate the feasibility of using the Internet as an alternative to mailed results. "Historically, the Tournament Report Program has been extremely useful in tracking success and conflict with regard to Oklahoma competitive fishing events", said Greg Summers, laboratory director. In addition, the data also provides reservoir managers with an "angling index" of relative bass fishing success and bass population health. "Of the 1,201 bass tournaments permitted in Oklahoma in 2003, 727 (61%) were voluntarily reported as part of this program", stated Summers. There was an increase in tournament reporting compared to previous years, and this was attributed to online reporting. "Over half the 2003 reports were taken over the Internet and tournament directors now have an easier way to provide us with the information we need," said Summers. The reported results from 2003 represented 33,368 bass weighing 68,972 pounds caught by 39,124 anglers.

Biological Survey Research *(CONTINUED FROM PAGE 1)*

We found that cicadas continue to emerge in recently burned sites. Density of emergence is not significantly different between wildfire and unburned sites (figure 1). Timing of cicada emergence, however, was altered in wildfire sites (figure 2). Cicadas initiated and ceased emergence earlier in wildfire sites than in unburned sites and peak densities of emergence occurred nearly one month earlier in wildfire sites than in sites that were unburned. Previous research has shown that cicadas use cues from soil temperatures and host tree chemicals to determine when to emerge. The earlier emergence we observed may therefore be caused by elevated soil temperatures in wildfire sites or abnormal chemical signals from fire-stressed trees.

While our results show that wildfire sites remain adequate foraging areas for animals that eat cicadas, the temporal availability of this resource is altered. This change in the timing of emergence may benefit bird species that nest early in the summer, but may negatively affect species that nest later in the season, such as the locally threatened yellow-billed cuckoo (*Coccyzus americanus*). We are conducting additional research to evaluate long-term effects of wildfire on cicada emergence, interactions between wildfire, exotic vegetation and cicada emergence, and effects of cicada emergence on nest success of riparian birds.

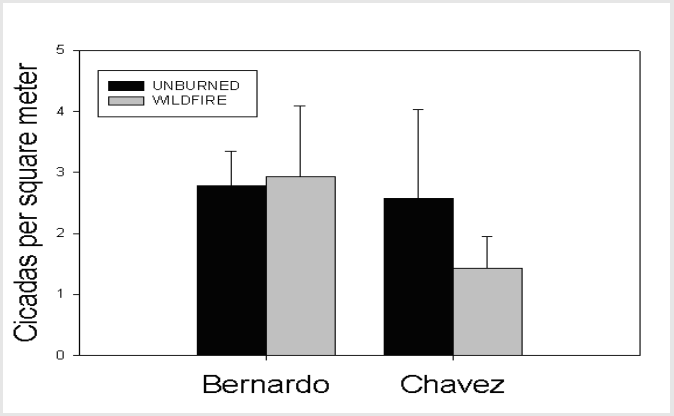

Figure 1. Emergence densities at two pairs of wildfire and unburned sites.

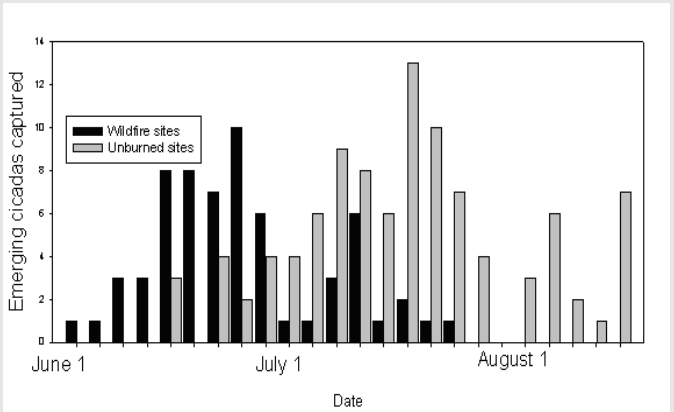

Figure 2. The number of cicadas captured in emergence traps every three days in recently burned and unburned control sites.

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Biodiversity: The Common Nighthawk

By Dan L. Reinking

The Common Nighthawk (*Chordeiles minor*) is one of many species of birds with a less than accurate common name. Not related to hawks, it belongs to a group called the nightjars and is a *crepuscular* species, being most active at dusk and dawn rather than at night. The prefix *Common* is true enough, given that this species breeds from central Canada south through virtually all of the U.S., and well into Central America. It is a long-distance migrant, wintering widely throughout South America. Its time is equally divided between its summer and winter homes, with its presence in Oklahoma spanning late April through late October.

Familiar to both urban and rural residents of Oklahoma, the Common Nighthawk is at home in tallgrass, mixed-grass, and shortgrass prairies of Oklahoma, and less common in forested regions of the state. The rancher or naturalist out early or late in the day will likely see nighthawks on the wing, their erratic flight in pursuit of aerial insects lending credence to their *bullbat* nickname. Even more enjoyable is the visual and auditory display performed by males during the breeding season. Working his way up, higher and higher, a male suddenly plunges downward at a 70 degree angle to the ground, flexing his wings and causing a distinctive booming sound as air rushes through his primary feathers. This sound, together with the nasal sounding, vocal *peent* given by both males and females, is an integral part of a summer morning or evening on the Oklahoma prairie. During the long daylight hours in between these times, careful inspection of the tops of fenceposts may reveal the brown, horizontal form of a perched nighthawk, lazily peering at your approach through half closed eyes, but ready to spring into the air should you trespass too closely.

Most nesting activity here in Oklahoma takes place in May and June, although no nest is actually built. Rather, the female simply lays her two heavily speckled and creamy eggs on a flat rock or bare ground. If severe weather and predators don't take their toll, the eggs will hatch after 19 days of incubation. The female then continues to brood the young, while the male feeds them twice-daily rations of regurgitated insects both before sunrise and again after sunset. The young take their first flights at about three weeks of age, and become independent about a week later.

City dwellers, too, can enjoy Common Nighthawks; it is a species that has adapted well to habitats created by humans. Street lights attract insects at dawn and dusk, and these in turn attract the insectivorous and opportunistic nighthawks. Flat, gravel-topped roofs are apparently viewed as acceptable substitutes for bare ground or a flat prairie rock, and are used by females as nest substrates. Both these city slicker birds and their country cousins offer Oklahomans a chance to easily observe and enjoy bird behavior; even so, many aspects of their biology are poorly studied and could provide opportunities for future research.

The common nighthawk. Photo by Dan Reinking.