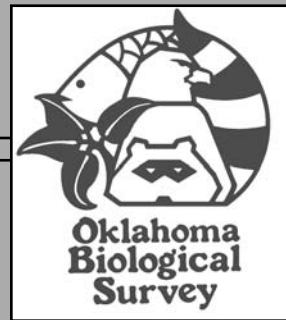


Biosurvey News



The Newsletter of the Oklahoma Biological Survey
Summer 2009

Is the Answer Blowing in the Wind?

In Oklahoma and other prairie states, wind is the front-runner in the development of alternative energy sources. Wind is renewable and can be harvested easily, so it only makes sense to farm it where the wind comes sweeping down the plain. Given what appear to be oceanic expanses of uninhabited prairie, wind energy development would seem to be a win-win solution to problems caused both by America's insatiable energy demand and the rapidly changing global climate.



Aerial view of a wind farm. Photo by Michael Patten.

However, in this case, going green comes with a potentially high cost to prairie wildlife. According to Ferrell (2009, *Oklahoma Bar Journal* 80:1015–1028), "A wind power project will only physically occupy three acres [1.21 ha] of land per megawatt [MW] of turbine capacity," although a wind farm on a ridgeline may require only two acres [0.81 ha] / MW. The U.S. Department of Energy's National Renewable Energy Laboratory (ver. 1.1.23, 13 Nov 2008) estimated Oklahoma's "wind electric potential" to be 384,560 MW, a figure that includes solely those lands classified as "developable." If full capacity were to be reached - and the southern plains are persistently windy enough to expect it - then 311,259–466,888 ha (769,120–1,153,680 acres) of land would have to be developed, almost all of it in the

western one-third of the state. This total footprint increases by more than an order of magnitude if we accept the American Wind Energy Association's estimate that "In open, flat terrain, a utility-scale wind plant will require about 60 acres [24 ha] per megawatt of installed capacity" (http://www.awea.org/faq/www_environment.html). A key question is from where will the >300,000 ha of land come? There is every reason to think that the >300,000 ha will come from what remains of pristine shortgrass prairie, nearly half of which has been lost already to development in the past century (Samson, Knopf, and Ostlie 2004, *Wildlife Society Bulletin* 32:6–15).



The Lesser Prairie-Chicken. Photo by Michael Patten.

If the proposed mass development of pristine shortgrass prairie comes to pass, then there will be many losers. Perhaps chief among them will be the Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*), a rare and declining grouse endemic to shortgrass prairie of the

south-central United States. The species' population has declined so much in the past decade that in its most recent review the U.S. Fish and Wildlife Service raised the "listing priority number" of the species to the highest candidate status short of actual listing under the Endangered Species Act (*Federal Register* 73:75179–75180, 10 December 2008). Our 11-year study of the Lesser Prairie-Chicken in western Oklahoma has shown the species to be tied strongly, especially when breeding, to relatively undisturbed shortgrass prairie, meaning any further loss of that habitat will lead to further depression of population size.

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BioBlitz! 2009

BioBlitz! 2009 will be held at Robbers Cave State Park and Wildlife Management Area near Wilburton. Nestled in the wooded hills of eastern Oklahoma, Robbers Cave was once the hideout for bandits. But this year, biologists of all ages and affinities will be scouring the hillsides, not to flush out criminals, but to find as many different organisms as possible. Join these dedicated scientists in our annual inventory of Oklahoma's biodiversity.

To learn more, call (405) 325-7658 or check out the web site at www.biosurvey.ou.edu and click on the BioBlitz! button.

Robbers Cave State Park is located five miles north of Wilburton in the scenic, hilly woodlands of the San Bois Mountains. The lobed spleenwort, in this year's logo, is found in the deciduous forests of the eastern United States, but Robbers Cave is the *only* place in Oklahoma where it can be found. Come look for it and other rare wildlife this September!



-Prsicilla Crawford

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NEW ON THE WEB

New page for National Vegetation Classification

Updated pages for the Flora of Oklahoma

Updated pages for BioBlitz! 2009

Updated publications pages

Updated Oklahoma Natural Heritage Inventory's plant tracking list of species of concern in Oklahoma

Biosurvey News, Fall 2008
Amy K. Buthod and Caryn C. Vaughn, editors

Biosurvey News is published twice each year and reports on activities, 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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The Lesser Prairie-Chicken hugs the ground during its bursts of rapid flight - the species seldom flies above 2 m (6 ft.). Thus, although collisions with wind turbines are highly unlikely, the birds are likely to collide with fences strung along new access roads (Wolfe et al. 2007, *Wildlife Biology* 13 [suppl. 1]:95–104). Moreover, our recent studies suggest that they will avoid areas where tall structures have been built (Pruett, Patten, and Wolfe 2009, *BioScience* 59:257–262; Pruett, Patten, and Wolfe 2009, *Conservation Biology* 23:in press). Like other inhabitants of shortgrass prairie, the Lesser Prairie-Chicken evolved in a relatively flat, treeless expanse in which any tree or other tall feature offered a perch for diurnal raptors, the key predator of adult prairie-chickens. It is easy to envision how birds that avoided such areas, and who carried genes for that avoidance, left more offspring than birds who did not. Our data suggest that, at a minimum, prairie chickens stay 100 m from tall structures, and avoidance distances are probably much greater, perhaps closer to 500 m.

Catastrophe for prairie chickens can be averted. Informed siting of new wind farms into areas of minimal biological impact, such as in existing grain fields, could mean few, if any, negative effects on grassland biodiversity. There is reason to believe that we can develop wind energy and preserve our natural heritage. Indeed, tools to accomplish this task are being made available by, for example, the Oklahoma Department of Wildlife Conservation (<http://www.wildlifedepartment.com/lepcdevelopmentplanning.htm>), where J. D. Strong and Russ Horton have been instrumental in attempts to guide potential developers in wise siting of turbines.

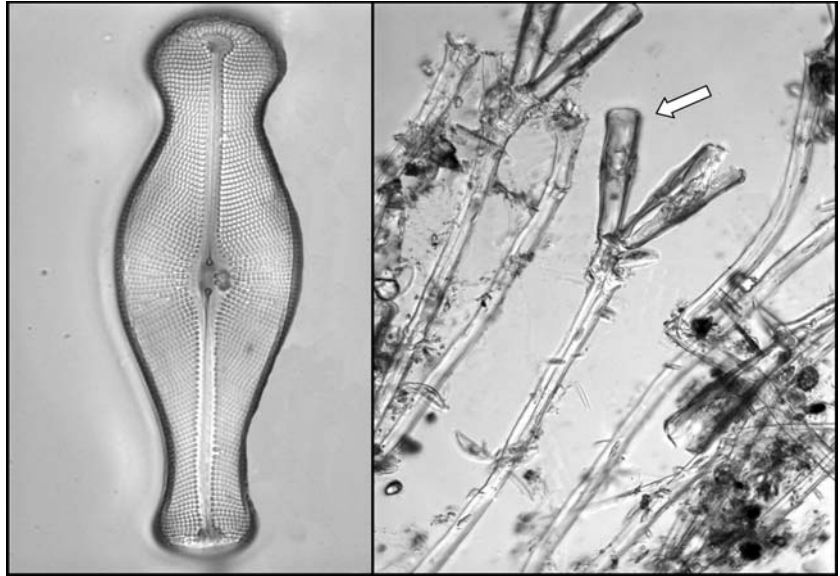
-Michael Patten

Didymo (Rock Snot): An Invasive Diatom Hits Oklahoma Waters

Whether you're a fisherman, hiker, playing with kids or just out for a stroll, crossing a stream with slippery rocks can be challenging. The slick coating on rocks is a biofilm produced largely by microscopic, single-celled algae - the diatoms. Diatoms have beautifully patterned glass cell walls and store energy as highly nutritious oil. Stream biofilms also include other types of algae, bacteria and fungi.

Although 50 or more species of diatoms may be present in a biofilm, a few species of diatoms typically dominate - though this isn't usually apparent in the field. A major exception is *Didymosphenia geminata* or "Didymo", whose colonies can overgrow the biofilm on rocks. During a bloom, colonies of Didymo look and feel like patches of wet, brown cotton that can coat individual rocks or even areas of the stream bed with a one to five centimeter (or thicker) "mat". This golden brown mat has been given the name "rock snot" because of how it looks during a bloom - although the texture is decidedly not snot-like.

Didymo was reported in the Mountain Fork below Broken Bow Reservoir in April 2009. First observed by fishermen and Oklahoma Department of Wildlife Conservation (ODWC) personnel, the identification was confirmed at the Oklahoma Biological Survey, where our lab has been doing research on Didymo blooms in Colorado for the past two years.



Didymosphenia geminata from the Mountain Fork. *Left:* face view of the glass cell wall with its distinctive patterning. *Right:* Didymo cells and stalks. Cells are in side view (one is indicated by an arrow) and are absent from some stalks. The chloroplast is visible within the Didymo cells. Note the numerous smaller diatoms and clumps of detritus, which are typical of Didymo colonies.

Didymo is a stalked diatom, meaning each cell is found on a stalk produced by the diatom. The visible mat is made up of stalks - the individual diatoms are too small to see. The stalks are resistant to decay and may persist after the cells are gone. Sediment may also accumulate among the stalks.

How did Didymo get here? Nobody knows for sure, but it is likely that Didymo was accidentally introduced by fishermen. Research elsewhere has shown that felt-bottomed waders can harbor live cells of Didymo for several days - and even longer if the felt isn't completely dry. Clothing, waders, shoes, wet dogs or anything else that gets wet can carry Didymo cells to new streams and rivers. Only a few live cells can start a new population because diatoms can reproduce by simple division, doubling every few days.

According to recent habitat models, Didymo shouldn't be in Oklahoma. Didymo grows in cool or cold waters and Oklahoma waters are too warm - except below bottom release dams, which release cold water. This is the situation in the lower Mountain Fork, which is cool enough to support a trout fishery. Because Didymo often is found in trout streams, we checked for Didymo in the fish tanks from the hatchery that stocks the trout in the Mountain Fork. No Didymo.

Where is Didymo from? Originally Didymo's range was circumboreal and alpine - that is, the high north and tops of high mountains. In North America, Didymo didn't form visible colonies, though colonies had been recorded in northern Europe. Nobody knows why Didymo started forming blooms and extending its range in the 1990s. Recently Didymo blooms have been reported from the Rocky Mountains, the Sierra Nevadas, the northern Appalachians and scattered areas in the northern Great Plains.

What does Didymo do? Extensive colonies of Didymo can have a multitude of effects. Habitat and stream bed water flow are altered by the thick mats. Algal composition changes. Smaller worms and midge larvae may replace many of the larger insects. For trout, this change in invertebrates may mean less food. In some sites, trout have fared poorly during Didymo blooms.

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Herbarium Mystery: Rare Volume of Bound Plant Specimens Archived in the Bebb Herbarium

A rare example of old herbarium specimens bound into book form, dated 1801 and labeled in French, is contained in the holdings of the Robert Bebb Herbarium. We have little information concerning the origins of this volume or how it came to be deposited in the herbarium of the University of Oklahoma.

During the 18th century and before Carolus Linnaeus (1707-1778) revolutionized scientific nomenclature, it was common to bind plant specimens into volumes. By the 19th century, few collectors or herbaria bound specimens into volumes, since it was easier to study and exchange specimens when they were mounted on individual sheets of paper. Our example of a bound herbarium is most likely from a collector in Switzerland and is one of several original volumes. It contains many specimens collected in northeastern Italy and southwestern Austria.

The volume deposited at Bebb (Tom VI) is labeled “Herbier du Frioul” on the leather spine. Although the Iles du Frioul are a group of four islands off the French Mediterranean coast near Marseilles, “Frioul” also represents the French spelling for the Italian province of “Friuli” (Friuli-Venezia-Giulia). We now know that most of the 195 specimens in the volume were collected near the towns of Tolmezzo and San Daniele del Friuli and the province of Corinthia in Austria. The “Frioul” indicated on the heading refers most likely to the Italian province of Friuli. The collector remains unknown, since there is no indication of the identity of the collector or where they were located. French botanists suggested that the collector was Swiss or at least based in Switzerland. Inquiries are continuing among French and Swiss institutions to determine the identity of the collector and where any of the other volumes are archived.



The bound herbarium.
Photo by Wayne Elisens.

Marcia Goodman, wife of George Goodman and History of Science emeritus librarian, and Marilyn Ogilvie, curator of the OU History of Science collection, have no information concerning how or when Bebb acquired this volume. Goodman stated that the volume was in the herbarium when George Goodman assumed his position as curator in 1933. Please feel free to contact the herbarium if you have any information concerning this rare book of bound herbarium specimens. In the meantime the volume is safe, since it is stored in the facilities of the Bebb Herbarium along with the type specimens.

-Wayne Elisens

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Effects of Didymo in the lower Mountain Fork are not known. Growths have not yet been extensive or very widespread, so we don't know yet whether trout or other species will be affected. We are currently working with ODWC to start a regular Didymo monitoring program in the Mountain Fork and other potential Oklahoma sites.

How can Didymo be controlled? Emphasis is placed on management of Didymo – for both reducing spread and reducing the extent of blooms. Reduced spread depends on public awareness and willingness to help. Cleaning and treating waders, clothes, boats and equipment before going to another water body are paramount. Treatment methods include timed submersion in very hot water, 5 percent dish detergent or 2 percent household bleach, or complete freezing. Oklahoma has other sites that Didymo could colonize, so care is needed when fishing among cooler Oklahoma waters.

Research is being conducted on the effects of high flow as a control measure. During May and June, large flood-related releases of water into the lower Mountain Fork eroded away Didymo and the rest of the biofilm in the reaches directly below the dam. Downstream, the former Didymo mats were not visible but we found live Didymo cells on rocks. It'll be interesting to watch whether Didymo blooms again this summer in the Mountain Fork – but whether or not it blooms again soon, Didymo is likely here to stay.

-Liz Bergery and Joshua Cooper

Survey Director Elected President

OBS director Caryn Vaughn has been elected president of the Freshwater Mollusk Conservation Society (FMCS). FMCS is an international society dedicated to the conservation of and advocacy of freshwater mollusks, one of the most imperiled faunas globally. Dr. Vaughn will serve as president elect from 2009-2011, president from 2011-2013, and past president from 2013-2015.

Biofuels and Biodiversity: Are They Compatible?

In October 2008, the USDA and the Department of Energy held a joint workshop on the sustainability of biofuels and what our future research opportunities were in this area. One of the topics explored was “Biodiversity and Ecosystem Services” (USDA DOE 2009). Alternative biofuel feedstock production techniques were discussed, including growing high diversity grassland systems (e.g. natural prairie or hay meadows) rather than focusing solely on one species monocultures (e.g. switchgrass or *Miscanthus*). Even among this diverse group of scientists, the myth that diverse systems will be necessarily of lower production than single species systems persisted. What we have seen in previous comparisons (e.g., Schmer et al. 2008) are monocultures that are fertilized and irrigated compared with native prairie systems that are not grown on comparable soil types nor comparably treated. This is the key comparison that is lacking. Anecdotal evidence given in a presentation by G. Phillip Robertson at the USDA DOE workshop showed that comparably treated mixed species systems were equally, if not more, productive than monocultures. Caldierra et al (2005) showed similar results. However, until we perform these experiments across the range of biofuel feedstock production areas, we will not know whether or not mixed species systems will produce enough feedstock to be economically viable.

Why is this of concern? The 2007 Energy Independence and Security Act has mandated that 16 billion gallons of cellulosic biofuels be produced by 2022. This will require the use of 16 - 19 million acres of energy crops (USDA DOE 2009). Where will these acres come from? It is accepted that we can not remove acres from food production given the impact that even a small diversion of corn from the U.S. food cycle (18 percent in 2007 – USDA DOE 2009) has caused on food prices and corn availability worldwide. Therefore, the land used for cellulosic biofuel production is going to be “marginal” land that is not useful for current food production. Some of this will be Conservation Reserve Program land that already is planted with mixtures of grass species to reduce soil erosion. A lot of these mixtures are non-native species. However, some of this may be prairie or grazing lands.

How will monoculture growth affect species diversity should that system end up being used for cellulosic biofuel production? Obviously, plant diversity will be vastly reduced. Studies already under way have suggested that grassland birds may be less affected as they respond more to the physical structure of the system rather than the specific grass species in a prairie (Roth et al. 2005, Semere and Slater 2007). However, insects are strongly affected by which species are present (Albrecht et al. 2007, Bascompte and Jordano 2007). The effects of potential trophic cascades on grassland birds have not been studied. Small mammals, like birds, respond more to system structure than to individual species. However, small mammals are extremely sensitive to human presence and different management protocols may affect their diversity in ways that have yet to be analyzed.

Wallace and Mitchell (in review) have suggested that planting switchgrass (*Panicum virgatum*) west of the 100th meridian would not be a sustainable use of that land because of the need for irrigation. Further, they have suggested that we develop a long-term agricultural research network, comparable to the LTER (Long-Term Ecological Research) network that already exists. This way, comparisons of growth of mixed species and monoculture systems can occur under tightly controlled conditions and we can get the critical answers we need.

Therefore, the overall potential impact of monocultural biofuel production plans on biodiversity and the ecosystem services provided by that biodiversity is not good. What we desperately need at this juncture is research to truly understand the true potential of growing diverse feedstocks and their use in the ethanol industry.

-Linda Wallace

Dr. Linda Wallace is a Samuel Roberts Noble Presidential Professor and the director of the Kessler Farm Field Laboratory in the Department of Botany and Microbiology at the University of Oklahoma

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Biodiversity: The Oklahoma Grasspink (*Calopogon oklahomensis*)

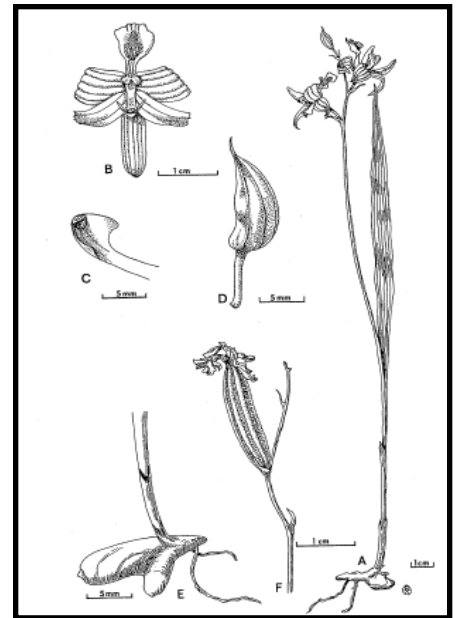
One might assume that the only new botanical discoveries are from some isolated mountaintop in the South American rainforest. This assumption is false, as new plants are described yearly - even from Oklahoma!

Such is the case with the Oklahoma grasspink. This terrestrial orchid was “discovered” only in 1994 when botanists noticed dramatic ecological and morphological differences among populations of a similar plant, the tuberous grasspink (*Calopogon tuberosus*).

The Oklahoma grasspink grows from a forked corm to a height of around 35.0 cm. The plant usually has only one linear-lanceolate leaf. The inflorescence is a terminal raceme with two to 11 blossoms. Flowers range in color from pale to deep pink and have three sepals, two clawed petals, and a modified third petal known as a lip or labelum. This lip is covered in yellow and pink hairs. A pinkish column (the structure in orchids comprising the unified style and anthers) is present. Flower scent is described as “citronella-like”.

The Oklahoma grasspink is known from the states of Arkansas, Kansas, Louisiana, Missouri, Oklahoma and

Texas and may also be found in Illinois and Iowa. The plant prefers a mesic prairie habitat with acidic sandy-loam soil. In Oklahoma, 25 historical sites are known from Adair, Bryan, Cherokee, Craig, Delaware, Haskell, Latimer, Le Flore, Mayes, McIntosh, Muskogee, Okfuskee, Ottawa, Rogers and Sequoyah counties. Many of these prairie hay meadow sites were converted to fescue over the years, and the last known sighting of the plant was back in 2004. The U. S. Fish and Wildlife Service is currently considering listing the Oklahoma grasspink as endangered or threatened.



The Oklahoma grasspink (*Flora of North America* 2002).

-Amy Buthod