

Center for Grassland Studies

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Nebraska's Wetlands

by Ted LaGrange, Nebraska Game and Parks Commission



The Center for Grassland Studies has been a leader in recognizing the important role that wetlands serve in providing for healthy grassland systems. This is due in large part to the intricate and highly integrated mosaic that grasslands and wetlands form across Nebraska's

landscape. Hillsides covered by dry-tolerant grasses and forbs descend into swales covered by wetland plants such as sedges, rushes, and cattails. Both grasslands and wetlands are dominated by plants that are well adapted to fire, grazing and the weather extremes of the Great Plains, including floods and droughts.

Of course the defining difference between upland grassland and wetlands is the presence of water. The State of Nebraska has adopted the federal definition of wetlands:

"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

Wetlands are delineated using three diagnostic environmental characteristics: (1) **vegetation** – defined by a prevalence of hydric (water loving) plants adapted to

growing in inundated or saturated conditions, (2) **hydric soils** – the presence of soils that developed under inundated or saturated conditions that limit oxygen (anaerobic conditions), and (3) **hydrology** – defined by inundation or saturation by water at some time during the growing season (the time when plants are actively growing).

Because of the presence of water, even if for only a brief period, wetlands can provide a variety of unique functions, including:

- **Improving Water Quality.** When most people consider wetlands the last thing they think about is clean water. Wetlands can produce foul-smelling gas (rotten egg odor) and contain numerous floating plants, algae, bacteria, bugs, and other animals that hardly make you want to drink the water. However, due to these plants and animals, and the chemical processes that produce the smelly gas, wetlands are a great natural cleanser of many common water pollutants. Wetlands act as a filter, slowing water down and allowing sediment and many pollutants to settle out. As the water slowly moves through the wetland, a series of chemical transformations takes place that tie-up or alter a variety of pollutants. The net result is that, as a general rule, the water leaving a wetland is of higher quality than the water entering the wetland. Studies have shown that up to 80% of the nitrate pollution entering wetlands is converted to harmless nitrogen gas by the time the water exits the wetland. Wetlands are increasingly being used for water pollution control and waste water treatment due to their water-cleansing functions.

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The Center for Grassland Studies is a unit within the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources. It receives guidance from a Policy Advisory Committee and a 50-member Citizens Advisory Council. This newsletter is published quarterly.

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FROM THE DIRECTOR

We hear and read much today about the research efforts of both public and private organizations.

Since we live and work in a world of high technology, that is to be expected. Research of some kind is being conducted on almost every aspect of our society.

Over the years, people have benefitted greatly by research and extension efforts on grasses and grasslands. This has been true whether the effort has been directed toward grasses grown for human food, livestock feed, recreation or aesthetic purposes.

At the University of Nebraska, research and outreach on grasses and grasslands have had a long history and tradition. Today, we are growing and using in Nebraska and other states numerous improved forages and turfgrasses developed by University and USDA-ARS scientists. With the advent of new techniques in plant breeding, we will see many more improved grasses in the years ahead.

Our understanding of biological processes has grown rapidly, and thus, it has become increasingly possible for us to use new techniques now available in plant breeding. At the University of Nebraska, Dr. Terry Riordan, turfgrass breeder, is using flow cytometry to determine ploidy levels in buffalograss and a "gene gun" in an attempt to incorporate the Roundup® herbicide-resistant gene into buffalograss. Dr. Ken Vogel, grass breeder with USDA-ARS and the Department of Agronomy, is using molecular markers for germplasm characterization. He is also using flow cytometry for determining ploidy levels in different grasses. Much of plant breeding today involves genetic engineering, and as we look to the future, biotechnology will be one of the primary means of producing new and improved food, feed, fiber, landscape and medicinal plants.

Scientists are now able to identify specific genes which improve yield, quality, cold and drought tolerance, pest and chemical resistance, and other important traits in plants. This kind of work is being conducted to identify genes that confer beneficial traits to plants while improving the environment. These procedures add significantly to the speed and precision with which improved plants can be developed, and these new techniques have enabled us to better manage and use the genetic diversity of plants. Also, they greatly improve the efficiency with which breeders can select their parents and progeny.

Our growing ability to transfer genes among plants of even different species has opened up possibilities that were not available previously. These new techniques provide us with much better opportunities for tailoring plants to meet our future needs and challenges. It is an exciting time to be involved in research relating to grasses and other biological organisms.

M. A. Massengale

Ashfall Fossil Beds: Record of an Ancient Grassland Ecosystem Preserved in Rock

by Michael Voorhies, University of Nebraska State Museum

Ten million years ago an enormous volcanic eruption in what is now southwestern Idaho sent hundreds of cubic kilometers of ash downwind into the central Great Plains. Herds of rhinos, camels, three-toed horses, and other animals around a water hole in northeastern Nebraska were suffocated and eventually buried by blowing dust over a period of several weeks. Their perfectly preserved skeletons can now be seen, lying in their death poses, at Ashfall Fossil Beds State Historical Park located in Antelope County. This Niobrara River valley area contains North America's most complete record of the 20-million history of grassland animals.

The 360-acre site is owned by the Nebraska Game and Parks Commission and operated as a research and educational facility by the University of Nebraska State Museum. Superintendent Rick Otto keeps the park open to the public seven months each year while paleontologists and students from the Museum participate in excavation and analysis of the fossil beds each summer between Memorial Day and Labor Day. Visitors are invited to watch ongoing excavations in the "Rhino Barn," a permanent structure covering part of the fossil bed. A nearby Visitors Center features interpretive exhibits and a working fossil preparation laboratory. Remarkable discoveries continue to be made in the basal one meter of the volcanic bed that measures up to three meters thick in the deepest part of the ancient water hole. Some skeletons are literally buried in their tracks. Female rhinos and horses with young at their sides, or in some cases, still unborn, have been uncovered. The abundant three-dimensional skeletons are the most complete representatives of their species known anywhere, and provide paleontologists with an unparalleled opportunity to study populations of prehistoric animals that demonstrably lived and died together.

Since opening to the public in 1991, Ashfall Park has attracted more than 300,000 visitors including people from all 50 states and 30 foreign countries. Many visitors especially appreciate the chance to see fossil skeletons as they actually occur in nature in contrast with their usual presentation as reassembled mounted specimens in traditional museum settings. At Ashfall we have made every effort to leave the evidence in the ground, undisturbed except for brushing away enough volcanic ash that the skeletons can be viewed in three dimensions.

Although the skeletons in the volcanic ash layer have received most of our attention, discoveries during

recent field seasons at Ashfall indicate that significant fossil beds also occur both above and below the ash layer. It has become clear that animals were using the water hole for hundreds or perhaps thousands of years before it catastrophically filled with ash. Sandstones directly beneath the ash bed contain fragmentary remains of at least 50 species of vertebrates including frogs, toads, salamanders, lizards, snakes, turtles, birds, insectivores, rodents, carnivores, rabbits, gomphotheres (primitive elephants), and a great variety of hoofed mammals. All species identified from the ash bed also occur in the underlying sand bed, but many of the latter have not yet been discovered in the ash bed. Just last year we discovered numerous fossils in the fluvial sandstone layers *above* the volcanic ash bed. Giving us a chance to identify the biota that repopulated the area following the disaster.

Fossil seeds collected from sandstones above and below the ash bed as well as from the mouths and body cavities of skeletons in the ash have been studied by Dr. Joseph Thomasson of Fort Hays University, who has identified numerous species of grasses in the assemblage. Relatives of today's needle and thread grass are especially common and were included in the "last meals" preserved inside several rhino and horse skeletons. The fossil plants clearly indicate that northeastern Nebraska was already a grassland ten million years ago. The lack of fish remains in any of the excavations at Ashfall suggests that the water hole, like many on the prairie today, was a temporary one – filling with water during the rainy season but drying up entirely in dry periods. The abundance of giant tortoise remains strongly suggests that the climate of the day was entirely frost-free – a far cry from the bone-chilling winters that force us to keep Ashfall closed five months of the year!



Wetlands (continued from page 1)

● **Providing Habitat for Wildlife, Fish, and Unusual**

Plants. Wetlands are one of the most productive biological systems known. They produce more plant and animal life per acre than cropland, prairies, or forests. This high level of productivity makes wetlands important habitat for an abundance of different kinds of wildlife and fish. Wetlands provide migration, breeding, nesting, and feeding habitat for millions of waterfowl, shorebirds, songbirds and other wildlife. Wetlands are home to thousands of different plant and animal species including many that are threatened or endangered. Nine of Nebraska's 11 federal endangered and threatened species use wetland areas. Wetlands also provide important winter cover for pheasants, deer and other resident wildlife.

● **Reducing Flooding and Soil Erosion.** Many wetlands act as a sponge, storing water temporarily, allowing it to percolate into the ground, evaporate, or be slowly released back into a stream or river. This temporary storage reduces flooding after a storm. Wetlands also

slow the overland flow of water, reducing downstream soil erosion.

● **Producing Food and Fiber.** Some of our most productive cropland is located on completely drained wetland soils. Many of the same factors that make drained wetlands productive for agriculture can be tapped to make existing wetland areas productive for food and fiber. These functions are already recognized by many in agriculture who tap the ability of existing wetlands to produce hay and forage for livestock. Less conventional uses are also possible such as raising fish, crayfish and frogs, or growing alternative crops like wild rice, new strains of crops adapted to wetlands, and wetland plants for biomass or ethanol production.

● **Supplying Water.** Wetlands store rainwater and runoff. Many wetlands slowly release water into the ground to recharge ground water. Some wetlands also slowly release water to streams and rivers, helping to maintain stream-flows. These water supply functions can benefit municipal and agricultural water users, and provide water for livestock.



Wetlands (continued from page 4)

● **Providing Recreation and Education.** Wetlands provide numerous recreation opportunities including hunting, trapping, wildlife watching and photography. Anglers also benefit from wetlands because many species of fish use these areas for spawning, hiding, or because the foods used by the fish are produced in the wetland. Wetlands provide an excellent setting for environmental education because of the many unusual life forms present and because they are unique features of the landscape. Wetlands also serve a heritage function because they represent a landscape as it once appeared in the past.

At the time of statehood in 1867, Nebraska contained an estimated 2,910,000 acres of wetlands. These wetland resources were very diverse and dynamic. They included Rainwater Basin marshes, Sandhills lakes, Platte River wet meadows, Missouri River sandbars and oxbows, salt marshes, playa wetlands in the southwest, and many more types. However, through much of the state's history wetlands were viewed as an impediment to transportation, agriculture and development. Wetlands were impacted directly by filling, ditching, tiling, digging concentration pits, channelization, and declining water tables, and indirectly by changes in the surrounding uplands that caused increased sedimentation or the diversion of surface runoff away from wetlands. The net result of all of these activities statewide was a reduction in wetlands by an estimated 35%, to 1,905,000 acres. The destruction of wetlands was much higher in some regions of the state (approaching 90% for the Rainwater Basin, Eastern Saline wetlands, and some reaches of the Missouri River), but the statewide figure is buffered by the large wetland resource still remaining in the Sandhills.

In recognition of these losses and the valuable functions that wetlands can provide, a wide variety of conservation programs has been put in place to help protect, restore and enhance Nebraska's wetlands. These programs include technical guidance on management, payment for wetland restoration and management practices, and purchase of easements or title on select areas. It is hoped that these programs will reverse the long history of wetland declines, and that wetlands will continue to serve their important role as part of Nebraska's grassland system.

Editor's Note: Ted LaGrange is the wetland program manager for the Nebraska Game and Parks Commission, and is also the author of a publication titled *GUIDE TO NEBRASKA'S WETLANDS and their conservation needs*. For more information on wetland programs in Nebraska, contact your district Game and Parks office, or LaGrange at the state office, 402-471-5436, lagran@ngpsun.ngpc.state.ne.us.

CGS Associate News

On July 1, 1998 **Terry Klopfenstein** became President of the American Society of Animal Science.

Earlier this year **Jim O'Rourke** received two honors at the Society of Range Management annual meeting: was conferred the title of fellow by SRM and presented the Outstanding Undergraduate Teaching Award.

The Association of American Geographers honored **Jim Merchant** by presenting him with the Outstanding Contributions Award, given annually to only one or two geographers in the country.



The following are selected comments from participants in grazing management education in northeast Nebraska, extracted from a list provided by extension educator Terry Gompert.

"Wildlife in our area has increased, especially deer and pheasants."

"On this pasture we are already beginning to see gullies and trailing begin to disappear."

"This has reduced both purchased and home raised harvested feed that is used for my cow herd and in retained ownership for the calves."

"Noxious weeds have gone from being a problem to being mostly controlled by nature."

"I have found that for a modest investment in materials and a moderated investment in time and management, I have been able to experience more than 100% increase in pasture output resulting in added profit."

"MIG (management intensive grazing) practices have allowed me to shift from a 'cattle storage' business to the production of pounds of beef per acre."

Wet Meadow Restoration at The Nature Conservancy's Speidell Tract

by Chris Helzer, The Nature Conservancy

The Nature Conservancy is restoring a wet meadow on the Platte River to benefit ecological targets including cranes and other migratory birds, lowland tallgrass prairie communities, and grassland breeding birds. Located near Kearney, Nebraska, the Speidell tract was purchased in 1997 because of its prime location – adjacent to two channels of the Platte, including one that harbors high density of roosting sandhill cranes during the spring migration. At the time of acquisition, the property consisted of 220 acres of crop fields, 300 acres of dense eastern redcedar/cottonwood woodland, and about 130 acres of scattered prairie fragments. The Conservancy's goal is to restore the woodland and crop fields to high-diversity prairie and wetlands.

To restore a large open wet meadow at the Speidell Tract, critical habitat for both migratory cranes and breeding grassland birds, prairie and wetland restoration must take place on both the crop field and woodland areas. In the crop field, the topography is being reshaped and seeded with a diversity of locally-collected seeds at a rate of about 50 acres a year (25 acres were completed in early 1998). To recreate the sloughs and ridges that have been nearly leveled over time, the Conservancy is working with Shawn Harders of Cairo, Nebraska, who has created wetlands for the Conservancy and others. Harders is deepening (with a bulldozer) the historic sloughs and rebuilding the adjacent sandy ridges, mimicking the landscape just north of the crop field where the topography is still intact. Groundwater is typically only a few feet below the surface of the crop field, so the reshaping is creating sloughs that will have standing water much of the year in their deeper portions. The sloughs and the associated dry ridges will support a wide variety of plant species and communities typical of Platte River wet meadows.

Following Harders' work, the Conservancy is seeding the reshaped areas with about 120 species of prairie and wetland seeds collected locally in cooperation with the Prairie Plains Resource Institute (PPRI) of Aurora, Nebraska – partner in Conservancy restorations since 1994. Bill Whitney of PPRI has had 20 years of prairie restoration experience and has refined techniques of collecting, processing, and planting seeds. The seeds of forbs, sedges, and some grasses are hand-collected by staff and volunteers throughout the growing season, and warm-season grass seeds are harvested by combine in the fall. The seeds are stored over the winter and some are scarified, fan-milled, or otherwise processed. The seeds are then hand-broadcast in the spring by staff and volunteers and left to be packed by rain. Typically, it takes two to three years for

the prairie plants to become well established and to displace the abundant annual weeds that dominate that early period. Whitney's experiments over the years with other techniques, including drilling seeds, harrowing and packing seedings, and mowing weeds, have not measurably improved establishment results, so they have been eliminated from the process.

In the woodland area at Speidell, the densely packed eastern redcedar trees, some of which are more than 50 years old, and the mature cottonwoods have displaced the prairie that once covered the property. Therefore, the restoration strategy is to clear the trees and lightly re-seed the area (primarily with forbs, assuming that many of the grasses will reestablish themselves) to jumpstart the prairie recovery process. The 300 acres of trees are being cleared by Great Plains Red Cedar, a family-owned logging company from Brady, Nebraska. They are clearing the entire property at no cost for the right to sell any timber that is marketable. Many of the large cedars are being sold for wood shavings to the American Wood Fiber mill in Clarks, Nebraska, and many others are being sold as fence posts. The cottonwoods removed from the site are being made into pallets. At the present time (July 1998) much of the property has been cleared, and about 20 acres have been seeded. The remaining woodland area will be seeded in the spring of 1999. The logging slash (which is considerable) is being left where it falls or in small piles throughout the property, where it will be burned up in future prescribed burns. This reduces the cost for the loggers and the disturbance to the soil that would result from pushing together and burning large woodpiles.

Future management of the property, in addition to prescribed burning, will entail rotations of grazing, haying, and rest periods, with grazing and haying rights being leased to neighbors. Special challenges will include controlling the regrowth of deciduous trees like mulberry and elm, as well as other weeds that will come into the disturbed area. The Conservancy estimates that the planting of the property will be completed by the spring of 2002, and most of the restorations should be fairly well established by 2006. Funding for the acquisition and restoration of the Speidell Tract is being provided by the Nebraska Environmental Trust, the North American Wetlands Conservation Act, and the Fish and Wildlife Foundation, as well as by members of The Nature Conservancy.

Editor's Note: For more information about this project, contact the Nebraska Field Office of The Nature Conservancy, 1722 St. Mary's Ave., Suite 403, Omaha, NE 68102, 402-342-0282.

Info Tufts



The National Audubon Society and Audubon Nebraska recently purchased 610 acres of the O'Brien ranch near Lincoln to be used as an educational center and research facility. All but 53 acres of what is now called Audubon Spring Creek Prairie has never been plowed. The property contains most types of habitat found in eastern Nebraska: tallgrass prairie, wetlands, springs, ponds, bogs, and old-growth and undisturbed woodlands. It even has deep wagon wheel ruts from the historic Oregon Trail. Audubon Nebraska plans to relocate its headquarters to the ranch's main house.



In the U.S. 5-6% of the land is in wetlands.



On June 19 a federal appeals court sided with builders and real estate developers and rejected stricter federal rules for dredging in wetlands areas. The president of the National Wildlife Federation said the ruling could have devastating impacts on wetlands and streams, wildlife and people across the U.S. Environmental groups are expected to appeal.



There is a Visitors' Center dedicated to national grasslands education and information in Wall, SD. The center is open seven days a week.



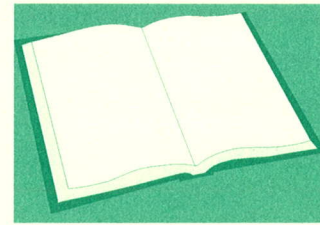
In a 1940s experiment, Cornell Professor Johnstone-Wallace observed that cows never exceeded eight hours of grazing in a day, prompting *Grass Productivity* author Andre Voisin to comment that "cows refuse to work any hours of overtime."



Pioneers Golf Course in Lincoln, Nebraska is one of the oldest courses west of the Mississippi River.



The PGA sanctions four pro golf management programs in the country: Mississippi State, Penn State, Ferris State, and New Mexico State Universities. To graduate from the MSU program, students must shoot no more than 15 over par for 36 holes, and have just one chance each semester to do so.



Resources

Wetlands: Understanding a Resource. This free 16-page tabloid carries an abundance of information about Nebraska's wetlands, plus contact information for 31 wetland agencies in the state and several wetland-related Web sites. Order from the Water Center, University of Nebraska, PO Box 830844, Lincoln, NE 6858-0844, 402-472-3305, sress@unlinfo.unl.edu. The publication is also available at <http://www.ianr.unl.edu/ianr/waterctr/wetlands.html>.

Academy 2000: Distance Learning in the Watershed Approach. Internet-based set of training modules and materials based on EPA watershed approach courses and technical references. <http://www.epa.gov/OWOW/watershed/wacademy/acad2000.html>

The Prairie Reader. \$18/yr for individual; \$25/yr for business, library or agency. Quarterly 12-page newsletter devoted to prairie restoration, preservation and gardening. Summer 1998 issue includes articles on prairies of Nebraska Sandhills, the endangered blowout penstemon plant, controlling reed canary grass, Iowa's Eddyville Dunes, prairie dogs, Missouri's grassland initiative, and more. There are book reviews and an "ask the experts" section. Specialists from many states throughout the Midwest and Plains contribute to this well-designed and informative publication (two articles in this summer's issue are by CGS Associates Paul Johnsgard and Jim Stubbendieck). The Prairie Reader, PO Box 8227, St. Paul, MN, 55108, 651-646-2098, <http://www.theprairiereader.com/>.

Discussion papers from the "Achieving Wildlife Objectives of the 1996 Farm Bill" workshop held April 13-15, 1998 and other related information can be found at <http://www.fb-net.org/fb-papers.htm>.

Federal and university scientists conducted long-term field experiments to evaluate the interactive effects of grazing, nitrogen enrichment, and fire frequency on plant species diversity in native tallgrass prairie. Results were reported in an article in *Science* magazine earlier this year, 280:745-747.

CGS Advisory Committee Tours Golf Course, Burned Grasslands, Fossil Beds and Ranch

On July 21 the CGS Citizens Advisory Committee visited northeastern Nebraska. The biggest treat of the day was the weather! After several days of blistering heat and high humidity, the weather broke overnight and we couldn't have asked for a better day for the tour – in the 70s and overcast but no rain. How fortunate we all felt! We were equally fortunate to visit interesting sites and people who enlightened us on many things about turf, grassland management, the history of Nebraska's grasslands, and rangeland management.

We learned about some of the benefits and challenges of small community golf courses from Dave Roder at the Summerland Golf Course outside of Ewing.

Next we stopped at three sites near Grove Lake and Ashfall State Historical Park where we heard from Nebraska Game & Parks Commission personnel about wildlife habitat management (Jim Douglas) and controlled burning of grasslands (Marvin Forbes, Bruce Trindle and Tom Welstead).

At Ashfall Park Mike Voorhies with the University of Nebraska State Museum explained what fossils of grassland mammals tell us about the history of Nebraska grasslands (see page 3).

In the afternoon we visited the Brush Creek Ranch north of O'Neill where owner Lon Keim and manager Mike Douglass described management of the operation and demonstrated how they use holistic resource management concepts on the ranch. We were each provided with an excellent report detailing the goals and operation of the ranch. We toured the land and witnessed a large herd (about 1,500 head) being moved to the next pasture, an almost daily occurrence for the management-intensive ranch. Extension educator Terry Gompert, who has worked with Keim and

Douglass as they strive to achieve their goals, assisted with this part of the program.

We thank all of our presenters for sharing their time and expertise as well as for their enthusiasm and hospitality. We also want to express our appreciation to the Advisory Committee members who take time from their busy schedules, and in some cases travel great distances, to provide valuable input at these semiannual gatherings and who act as ambassadors for the Center for Grassland Studies year-round.

For more information about the above sites and topics, contact the CGS office.

Calendar

Contact CGS for more information on these upcoming events:

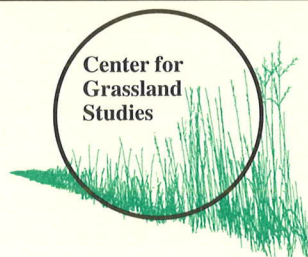
1998

- Sep. 12: Festival of Color, displays of colorful water-conserving flowers, children's activities and landscaping demonstrations, Ithaca, NE
- Sep. 28-
Oct. 2: Monocots II and 3rd International Symposium on Grass Systematics and Evolution, Sydney, Australia
(e-mail: karen@rbgsyd.gov.au)
- Oct. 18-22: ASA, CSSA, SSSA annual meetings, Baltimore, MD

1999

- Feb. 21-26: Society for Range Management/American Forage and Grassland Council joint meeting, Omaha, NE
(<http://srm.org/meetings.html>)
- Feb. 24-25: Great Plains Grasslands at the Millennium, Omaha, NE
(<http://esa.sdsc.edu/grasslands.htm>)
- Apr. 11-16: International Symposium on Nutrition of Herbivores, San Antonio, TX
- Jul. 19-23: VI International Rangeland Congress, *People & Rangelands: Building the Future*, Townsville, Australia
(<http://irc.web.unsw.edu.au>)

If you have articles, events, resources, CGS Associate News, or other items you would like to submit for inclusion in future issues of this newsletter, please contact the editor, Pam Murray, at the CGS office.



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