KONZA PRAIRIE
BIOLOGICAL STATION

Tallgrass Gazette Spring 2003

"The Newsletter for Docents and by Docents"

Konza Prairie Soil Research:

Improved Management Can Help Reduce Global Warming

Improved management of the tallgrass prairies of the Flint Hills may benefit more than just the rangeland grasses. It also could benefit the entire globe by helping reduce the level of greenhouse gases that can cause global warming, according to Charles W. Rice, professor of agronomy at Kansas State University. Two of the most important management factors for tallgrass prairie systems such as the Konza are prescribed burning and grazing management. **About 30 percent of the rangeland in Kansas is currently being burned too early in the spring, being overgrazed, or has poor grazing distribution.**

Each spring, thousands of acres of tallgrass prairie are burned to clear the mulch that inhibits the growth of tall grasses. Burning may also help reduce the level of carbon dioxide in the air, according to Rice, who has conducted both long- and short-term research on the soil properties at the Konza Prairie Biological Station. "Research is showing that prescribed burning of tallgrass prairie increases the conversion of harmful atmospheric carbon dioxide into beneficial stored soil organic carbon. This is a process called **carbon sequestration**," said Rice.

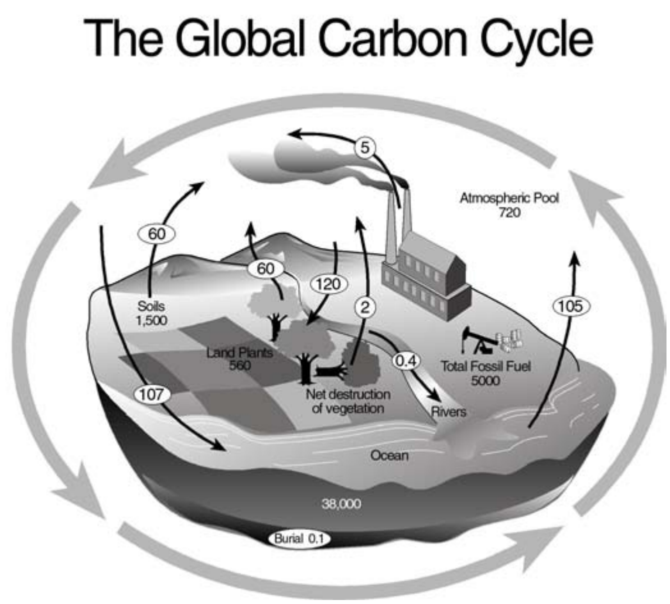
Burning at the proper time (late spring) increases plant growth, and this increases the amount of carbon dioxide absorbed by plants. Carbon dioxide is a "greenhouse gas," which contributes to global warming. Since much of the plant growth in tallgrass prairie occurs below ground, the carbon dioxide that is converted by plants into root material is processed by soil organisms into soil organic carbon, thus potentially reducing carbon dioxide. Biological production of nitrous oxide, another greenhouse gas, is also reduced in burned prairie.

Mycorrhizal fungi, an important soil microbe essential to the health of many prairie plants, also plays a role in stabilizing soil particles which protect carbon in the soil. Grazing pressure and distribution is the other key management practice. By reducing grazing pressure on land currently being overgrazed, and by improving distribution of livestock, grass production can be increased significantly over time. As with properly timed prescribed burning, this increase in forage production through grazing management will increase carbon sequestration rates, Rice says.

Much of his research takes place in the field, so plant and soil samples are indicative of the entire population. From that point, some work takes place in a laboratory where the soil organic matter is divided and examined how much carbon is tied up in microorganisms and how much is available," Rice said. Another research method that Rice has utilized is the addition of stable isotopes of both carbon and nitrogen. This allows researchers to find out exactly how and where carbon and nitrogen are changing in the soil and atmosphere after grassland is burned.

As concerns about global warming continue to grow, the increased carbon absorption capacity shown in Rice's research could become a tool to counteract the problem in the future. "Can we manage these ecosystems and the amounts of carbon dioxide in the air? That's the ultimate question we are trying to answer," Rice said.

Prepared by Steve Watson and Dr. Charles Rice, Dept. of Agronomy, Kansas State University



KSU research is studying ways of reducing "green house gases" with various methods of grassland management.

Prairie Patter

by Dr. Valerie Wright, Environmental Educator and Naturalist

Birds, Bugs, Butterflies and Books

Chod Hedinger, Doris Burnett and Earl Allen have been maintaining the bird feeders at Hokanson Homestead this winter. Any of you out on the Nature Trail are welcome to fill them with black sunflower seed from the cache in the barn. In December friends of Marilyn Tilghman, Docent Class of 1992, decided to honor her 50th wedding anniversary with a gift to the Hokanson Homestead of two squirrel-proof bird feeders and a sign for the observation lean-to. What a great idea! Giving to Konza Prairie something so useful in the name of someone so deserving.

This past year there were two professional publications through the KEEP program. The first is about the collection and recognition of a species of long-horn beetle on Konza not previously found in Kansas. "First Kansas Record for Tetraopes texanus (Coleoptera: Cerambycidae)" was published by Ron Huber and myself in the Journal of the Kansas Entomological Society. This beetle looks like the common long-horn beetle, red with black spots, found on milkweeds, but the antennae are different. A second publication already "in press" in the same journal is "Butterflies of Konza Prairie Biological Station: An Annotated Checklist", which will be out in June. Gene Towne has a new publication, "Vascular Plants of Konza Prairie Biological Station: An Annotated Checklist of Species in a Kansas Tallgrass Prairie". He put a list of KPBS plants by common name and another by scientific name, both in alphabetical, order on the Konza web site. You can find it from the KEEP web site by clicking on "Plant & Animal Checklists".

Painted Lady Butterfly (J.J.Audubon)

There are many new books in the Hulbert Center Library. A donation from Anna Gates of books, a bookcase and other items from the library of Professor Dell Gates was incorporated into our collection by Barbara Hilpman and Terrie Clark. I just finished reading one of Dell's books, "On the Road with John James Audubon" (1980) by Mary Durant and Michael Harwood, who followed the travels of Audubon across North America. There are many excerpts from his diaries, comparisons to how things are in the 20th Century and interesting plates and photos. The diary format makes the book easy to read in short sections. The Audubon drawing inserted here is Vanessa cardui, the Painted Lady. One of its host plants is Tall Thistle, a native thistle of the tallgrass prairie.

Tall Thistle with Monarch Butterfly

Page Twiss, Gordon Cunningham, Annie Clark (left to right) at January docent meeting.

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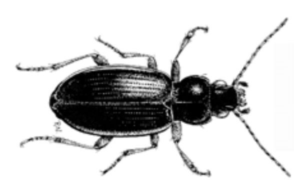


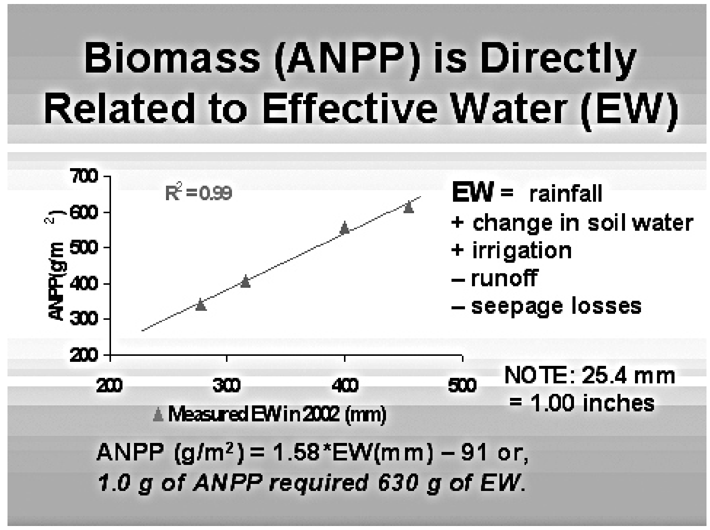
Konza Prairie — Irrigation Transect Study

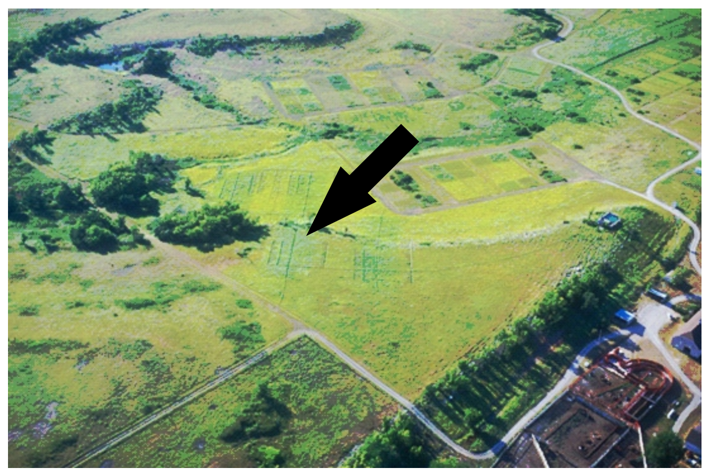
The planned minimum duration of this interdisciplinary study is 10 years (started in 1990). We have now completed 12 years. Water supplementation is scheduled to offset evapotranspiration losses and minimize moisture deficits during the growing season. Additions of about 28 mm are made at the fully-watered target area 2 meters either side of the of a single line of sprinklers when a combination of calculated evapotranspiration, from weather data at the Headquarters station, and measurement of soil water indicates that the top 1 meter of soil can hold up to 50 mm of additional water that can be used effectively by the plants. **Variables measured along irrigated and control (no water) transects include: soil moisture, plant water potential, net primary production (NPP), reproductive effort, plant species composition, soil organic C and N, microbial biomass, N mineralization, plant C and N content, and litter decomposition.**

Results show that on average 300 mm (12 inches) of additional water is needed annually (range from 150 to 400 mm). Additions have begun as early as mid-June and as late as mid-September. Most are done from mid-July to late August. Average increase in NPP during the first 8 years was 21% for the fully supplemented area. In 2002, a severe drought year because from May 28 to July 27, only 33 mm of rain fell at the site. **It was the driest in 113 years at Manhattan for this same period.** Preliminary data showed an 80% increase in NPP (by far the greatest difference in any year). The chart (right) shows the relationship between water and NPP for 2002. Total water added in 2002, however, was only 330 mm. **Rains returned in late July, 150 mm in 3 days, and the drought in the middle of the growing season was over.**

This study is done in collaboration with several scientists. Alan Knapp, in particular, has been involved from the beginning. Numerous scientists use the area as a part of their studies. Currently, Loretta Johnson has a water and nitrogen addition interaction study that has just completed its third year of operation. The plots create bands of brighter green areas and additional growth within the watered areas.

Dr. James Koelliker, Professor and Head of Biological and Agricultural Engineering, Kansas State University





Konza transects in August 2002 (bison corrals- lower right). The distinct lines (center) are irrigation system.

Water being applied.

Docent Book Reviews

This series will highlight reviews of literature found relevant to the world of the Konza Prairie.

Reviewed by Ann Foster
Beyond Global Warming: Ecology and Global Change: By Peter M. Vitousek
***Ecology*, Volume 75, Issue 7 (Oct., 1994), *Ecology* is published by The Ecological Society of America.**
This paper was presented in Wisconsin by Peter M. Vitousek as a MacArthur Award Recipient. Vitousek is with the Dept. of Biological Sciences at Stanford University, Stanford, California.

Vitousek tells us the global environment is changing and what he expects the consequences of those changes to be. He says ecologists are certain about at least three of those changes: carbon dioxide increase in the atmosphere, alterations in the nitrogen cycle and land use change. These changes, in turn, are changing our global environment.

Carbon dioxide, or CO2, increase in the atmosphere is the best documented global change. Measurements of CO2 have been taken since 1957. In addition air bubbles trapped within Greenland and Antarctic ice caps show stable concentrations for thousands of years before the 19th century. During the 19th century carbon dioxide concentrations began to increase rapidly.

Another ecologist, F.A. Bazazz, recognized that an increase in CO2 increases photosynthetic rates and increases efficiency of water and nutrient uptake. Plants that grow rapidly, C3, seem to gain more from this than plants that grow slowly, C4's. This may cause a shift in the boundaries of prairies and forests.

Vitousek writes extensively about the change in the nitrogen cycle and land use as well. These changes will lead to a loss of biological diversity, of that he is certain. He is from Hawaii, an island state that has seen the extinction of many native plants and animals. He says some major ecosystems, such as the tallgrass prairie, have been reduced to fragments or virtually disappeared.

He calls ecologists to action. Educate ourselves, then educate the public. Get involved.

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