

Center for Grassland Studies

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Grasslands, Horses, and Tractors

At the beginning of the 20th century, with the exception of trains and water transportation, the transportation and agriculture industries of the U.S. were powered largely by forages from grasslands and hayfields. The forages were converted to usable energy by draft animals, primarily horses and mules. After 1900, automobiles, trucks and tractors began to be used in transportation and agriculture. However, in 1920 there were still 25 million horses and mules on farms and ranches and two million draft animals in the cities of the U.S. (Census of Agriculture, 1920). The energy requirements of these animals were considerable. In the Midwest, the feed requirements for a work horse during the six-month crop growing season were 5000 lbs. of forages and more than 3000 lbs. of grains, usually oats, plus pasture. Horses and mules had to be fed and maintained even when they were not working, requiring additional forages. Horses were still an important source of power during and immediately after World War II. By 1954, U.S. agriculture and industry were largely powered by gasoline, diesel, or electrical motors, and there were only five million horses and mules in the U.S. (Census of Agriculture, 1954).

The massive shift from horse power to tractor power changed the agricultural landscape. At the beginning of this century, the agricultural landscape of the U.S. was different than what exists today. Because of the need to have forage for horses and mules, each farm had pastures and hayland. In 1900, there were 185 million acres of cropland in the U.S. and 61 million acres of hay and pastureland (Census of Agriculture, 1900). The pastureland was typically on the poorer parts of the farms, including some of the fields with the greatest slopes. The hayland was farmed in rotation with other crops. Often, one-fourth or more of a farm was in hayland or pasture that was required to feed the farm's

horses and mules. The decrease in the numbers of draft animals released approximately 80 million acres of land for other purposes (Census of Agriculture, 1954). The haylands and pasturelands that were released from forage production due to the decrease in draft animals were used for other agricultural purposes. In many cases, the land was converted to grain crop production.

Recently the U.S. Department of Energy (DOE) has been investigating the possibility of using forages or herbaceous biomass for energy production. A native prairie grass, switchgrass, has been identified as one of the most promising species. Utilizing fermentation technology that is currently under development, it may be feasible to break the forage plant cell walls down into simple sugars that could be converted into ethanol. Switchgrass can produce high forage yields on lands with high erosion potential such as the land currently enrolled in the Conservation Reserve Program. With current high yielding switchgrass cultivars and a conversion efficiency of 75%, ethanol yields of up to 500 gal./acre could be achieved. DOE expects that new conversion technology can reduce the cost of producing ethanol from biomass from the current \$1.35/gal. to about \$0.60/gal. If the conversion technology can be developed to turn forages into ethanol, it is expected that about 40 million acres of land in the U.S. could be converted back to its previous role as a producer of energy crops.

Source: Extracted from: Vogel, K.P. 1996. Energy Production from Forages for American Agriculture - Back to the Future. *Journal of Soil and Water Conservation*. 51:137-139.

"I believe a leaf of grass is no less than the journey work of the stars."

Walt Whitman, from *Song of Myself*



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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

The fall harvest season is a beautiful time in Nebraska. In addition to the brilliant colors of our trees and shrubs, we see the golden fields of corn and the various hues of red and gold in sorghum plants. It is another reminder of just how important grass plants are to humankind as both corn and sorghum are cultivated grasses. (Incidentally, as I write this article we are expecting record corn yields in Nebraska this year following a most favorable growing season.)

There are other grass plants that are of great importance but perhaps less conspicuous. Those are the grasses that grow in our home lawns, parks and golf courses, along roadsides, utility right-of-ways, wetlands, and forage and rangelands which help to control erosion while providing food and shelter for domestic animals as well as many species of wildlife.

Fall is also the time of year when numerous species of wildlife are harvested (hunted). This activity provides a great number of hours of both pleasure and leisure for many of our citizens. Grasses provide the primary source of food and are the principal cover for many of these animals. Sometimes, we fail to realize the number of useful purposes that our grass plants have and how important they are. A former United States senator from Kansas, John J. Ingalls, once wrote that "grass is next in importance to the life givers of water, light, and air." Ingalls further wrote that "grass bears no blazonry of bloom to charm the senses with fragrance or splendor, but its homely hue is more enchanting than the lily or rose. It yields no fruit in earth or air, yet should its harvest fail for a single year, famine would depopulate the world."

Ingalls made a rather compelling statement for grasses, but stop and reflect for a moment on all the places you see grasses growing and the important functions that they are performing in that particular space. Whether it is purifying the air by removing carbon dioxide or converting it along with water into carbohydrates and releasing oxygen in the process, providing food and forage for humans and animals or simply holding the soil in place, the functions of grass permeate our lives. Imagine for a moment what Nebraska, the Great Plains, or this planet would be like without grass. Yes, indeed, it would be a different place for us to live and work!

M. A. Massengale

Advisory Council Meets In Lincoln

On November 8 more than 40 CGS Citizens Advisory Council members and Associates gathered on the UNL East Campus. After learning about grain price trends from agricultural economist Jim Kendrick, the group heard from Brad Schmidt about Landscapes Unlimited, Inc.'s initiative, "Golf and the Environment," and about the National Arbor Day Golf Course that LUI is building in Nebraska City. CGS Associate Anthony Joern addressed work the CGS has been doing in the area of assessing grassland ecosystem health. The brief presentations served as the basis for two small group discussions, summaries of which follow (names in parentheses are group chair, recorder and reporter):

Turf and Landscape Plants/Wildlife/Environmental Impacts (Dave Stock, Fred Baxendale, Wayne Thorson)

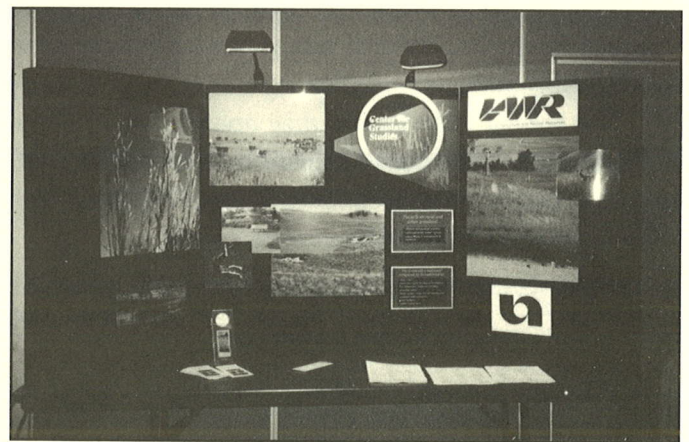
Discussions primarily focused on the new 300-acre Arbor Day Foundation Golf Course Project in Nebraska City. Roch Gaussoin reported that protocols are currently being developed to obtain baseline information on factors such as soil microbes, plant and animal (vertebrate and invertebrate) diversity, micro-climatic conditions and the presence of pesticides. He noted that several national environmental groups (e.g., National Wildlife Federation) are being included in the planning and implementation of the project. Site monitoring could commence as early as December 1996 and will continue for five years or more. A project goal is to leave the site as natural as possible, yet construct an environmentally responsible course that is both affordable and playable. All agreed that the project has great potential. Other items that were very briefly discussed included the concept of a grassland health project presented by Anthony Joern (which the group thought was an excellent idea), and development of an enhanced CGS Web page that would facilitate information exchange among private sector professionals and University staff.

Grassland Health/Livestock/Wildlife Habitats (Vince Shay, Jim Stubbendieck, Sid Salzman)

General Comments: John Ward reported that he had completed a project titled "Forage Utilization by Beef Cattle" in which he listed more than 300 references on research conducted in Nebraska during the past 35 years. John expected to find gaps in the research but few surfaced. He feels that the information gathered should be used as a basis for a plant/animal systems project. The systems approach should include people from many departments, and the work should be cooperative rather than many

individuals working on individual projects. One rancher said that we must look at all of the interacting parts of grasslands and still maintain the system. In addition to animal production, he said we must understand and be concerned with wildlife, soils, forage quality, and erosion. He commented that he looks upon grasslands differently now than he did 30 years ago when cattle production was his main concern. Another individual commented that it will be important to include soil scientists in grassland studies because of the relationship of soils and the mineral content of forages.

Grassland Health: Grassland or rangeland health is a relatively new concept, but it is not fully understood nor is there an accepted way to measure or quantify it. Measurement must be simple if it is going to be successful. Not everyone is convinced that it is necessary. Questions included: (1) Who has determined that the succession model does not work and that it must be replaced with grassland health? (2) What are the relationships between health and livestock production? (3) Will it be helpful to the producers? (4) Is this being driven by politics? (Managers of the public lands would rather say that the lands are "healthy" rather than having to say that 85% are in fair or poor condition.) (5) Is it necessary or are people just trying to reinvent the wheel? Grassland health may be one way to measure if grassland improvement practices are successful. It may better apply to eastern Nebraska seeded land than to the western rangelands. We should be able to demonstrate to producers (at least in the eastern third of Nebraska) that grasslands can furnish income. All of this land should not be converted from CRP acres to crop production.



CGS Display Available

CGS Associates are welcome to use the CGS display to showcase their work in the Center's focus areas: range/forage/livestock, turf/landscape grasses, wildlife/wetlands/natural habitats. Simply call our office to make arrangements to borrow the display.

Grazingland Words to Know

by Bruce Anderson, Department of Agronomy, UNL
and Terry Gompert, Extension Educator, UNL

Stocking Rate—number of animals on the entire grazing unit for the entire grazing season; usually expressed as animal unit months (AUMs) per acre per year.

Examples: Upland Sandhills with 112 cows grazing for 5 months on an 800-acre pasture equals 0.7 AUMs per acre.

Intensively managed brome/alfalfa rotationally grazed with 40 yearlings (0.75 animal units/yearling equals 30 animal units) for 6 months on 40 acres.

Determining and then applying the proper stocking rate is the most important factor affecting the success of any grazing program. At low stocking rates, individual animal performance is high because animals have much forage to selectively graze. However, gain/acre is low because number of animals is low. As stocking rate increases, individual performance declines because less forage is available to eat, and the average quality of what is consumed becomes lower as animals compete for the best forage. Gain/acre increases as stocking rate increases because more animals are present. However, once stocking rate becomes too high, both gain/animal and gain/acre decline very rapidly due to very restricted intake levels. The stocking rate at which maximum gain/acre occurs is near that at which individual gain is one-half of maximum average daily gain.

Stock Density—number of animals on a specific unit of land at a specific moment in time; usually expressed as animal units (AUs) per acre.

Examples: 112 cows on 800-acre range pasture equals 0.14 AUs per acre.

40 yearlings (equal to 30 animal units) on a 4-acre paddock that is part of a 10-paddock rotational grazing system equals 7.5 AUs per acre, or 10 yearlings per acre.

Stock density can be used to improve uniformity of grazing and manure distribution, especially on smaller

paddocks (where maximum distance to water is no more than one-quarter mile; a square, 80-acre pasture with water in the center is the largest size pasture where all points are within one-quarter mile of the water). When stock density is low, animals graze very selectively. As regrowth develops from previously grazed plants, animals prefer to graze this regrowth rather than adjacent ungrazed forage that is taller and more mature. As a result, spot grazing or patchiness develops. As livestock become increasingly crowded within a paddock (increased stock density), their grazing behavior changes. When they enter a new paddock, they often appear to eat more aggressively and with less selectivity, as if they want to get the good forage before the other animals get it. They graze as a herd, moving slowly over the entire area, but they walk around less. This causes less trampling loss. They go to water more as individuals or small groups rather than as one large herd if they have learned that there is always water available. As pastures get larger, stock density is less able to affect uniformity of grazing because distance to water becomes a more important factor to the animal.



Grazing Evaluation of Cool-season Grasses in the Nebraska Sandhills in Replicated Ranch Trials

by Dennis Bauer, Extension Educator, UNL

Cool-season grasses have the potential to provide early spring and fall pastures for grazing in the Nebraska Sandhills, a region of two million acres of warm-season rangeland with interspersed cropland. Four cool-season grass species were evaluated for establishment, beef production per acre, and persistence in replicated grazing trials in the Nebraska Sandhills, with ranches used as replicates. Two cultivars each of smooth brome grass, intermediate wheatgrass, western wheat, and crested

wheatgrass were fall-seeded, no-till into killed sod or stubble in 1990 on three different ranches. Pasture size was six or eight acres. Excellent stands were obtained by the following summer for all grasses except western wheatgrass and one cultivar of crested wheatgrass (bad seed lot). Western wheatgrass lacked the establishment vigor of the other grasses. The pastures were hayed in 1991 and 1992 and grazed in 1993 and 1994. The brome, intermediate wheatgrasses, and crested wheatgrass produced more than 1.7 tons/acre of hay in a June cut (Table 1) and additional regrowth for fall grazing. A short duration spring grazing program was used. When stocked with three yearling heifers per acre, average daily gain ranged from 1.78 to 2.09 lbs/day, and beef production ranged from 118 to 166 lbs/acre (Table 2). Assuming a stand life of 10 years, the cost of one pound of gain was \$0.23 to \$0.32. Results indicate that using cool-season grasses on go-back land or previously farmed land in the Nebraska Sandhills has the potential to be profitable.


Table 1: Hay Yields* 1992-1994 3 years
(Harvested 3rd week of June)

Hycrest Crested Wheatgrass	3,820	a ¹
Oahe Intermediate Wheatgrass	3,780	a b
Slate Intermediate Wheatgrass	3,640	a b c
Lincoln Smooth Bromegrass	3,480	b c
Rebound Smooth Bromegrass	3,400	c

¹Numbers with same letters are not significantly different at .10 probability.

Table 2:

Cultivar	Ave. Daily Gain (lbs)	Gain Per Acre (lbs)
Hycrest Crested Wheatgrass	1.93	152
Oahe Intermediate Wheatgrass	2.01	159
Slate Intermediate Wheatgrass	1.78	141
Lincoln Smooth Bromegrass	2.09	166
Rebound Smooth Bromegrass	1.80	140
Barton Western Wheatgrass	1.89	119
Flintlock Western Wheatgrass	1.86	118
LSD (0.05)	0.11	18

 The CGS congratulates Kenny and Elaine Frasier, recipients of the Nebraska Section Society for Range Management *Range Manager of the Year* award. Selection is based on land management, livestock management, innovative practices, and involvement in community activities. Kenny is a CGS Citizens Advisory Council member.

Value of Wetlands

The November 1995 issue of *Wetlands - Values and Trends*, published by NRCS, tells us:

- Wetlands are called the “kidneys of the landscape” since they filter out harmful materials.
- U.S. wetlands support about 5,000 plant species, 190 amphibian species, and one-third of all bird species.
- Of the U.S. threatened and endangered species, wetlands provide habitat for about one-half of the fish, one-third of the birds, one-fourth of the plants, and one-sixth of the mammals.
- From 1982 to 1992, wetland loss occurred at a higher rate in the East and Southeast than in the Midwest and West, mainly because of development.
- The conversion of wetlands to agricultural uses has slowed dramatically since the 1970s. Wetlands improve water quality by keeping nutrients, sediments and other materials from entering lakes, streams and reservoirs. Scientists estimate that the least-cost substitute for these wetlands benefits would be a water treatment plant costing millions of dollars to construct and operate.

EPA 1997 Science Research Grants

The Environmental Protection Agency is requesting applications for its first round of 1997 research grants. Two categories of potential interest to readers of this newsletter are Exploratory Research (includes environmental biology and chemistry) due January 15, and Ecosystem Indicators due January 22. During the coming months, EPA will be requesting applications for additional research grants to be awarded in conjunction with several other federal and private organizations. More information and application forms are available electronically at

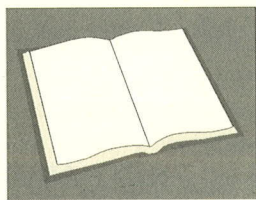
<http://www.epa.gov/ncercq>

or by calling the EPA Grants and Fellowship Hotline at 1-800-490-9194.

“Whoever could make...two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together.”

Johathan Swift, from *Gulliver's Travels*

Resources



Prairie Conservation: Preserving North America's Most Endangered Ecosystem. \$50 hardcover, \$28 paperback + \$4.75 s&h. Comprehensive examination of the history, ecology, and current status of North American grasslands.

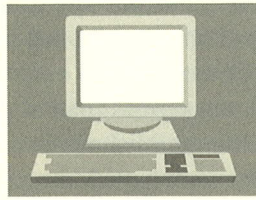
Chapters cover environmental history of the Great Plains, the economic value of prairie, prairie types and the ecological processes that sustain each type, prairie fauna, and conservation programs. Several of the contributing authors are CGS Associates, and Foreword is by Nebraska Governor Ben Nelson. Island Press, Box 7, Dept. 2AU, Covelo, CA 95428, 1-800-828-1302.

An Atlas of the Sand Hills. \$15 + \$1.50 s&h. This 1990 publication contains many color photos, maps and charts of the Nebraska Sand Hills. Chapters cover climate, geology, soils, groundwater, streams, lakes and wetlands, plants, fishes, amphibians and reptiles, birds, mammals, anthropology, land development and use, range management, and mineral resources. Several of the contributing authors are CGS Associates. Conservation and Survey Division, Maps & Publications, University of Nebraska-Lincoln, 113 NH, Lincoln, NE 68588-0517, 402-472-3471.

Grazingland Hydrology Issues: Perspectives for the 21st Century. \$12 + \$4 s&h. Chapter titles include: Rangeland Watersheds — Indicators of Healthy Ecosystems; Rangeland Policies — Past, Present and Future; Rangeland Watershed Research and Technological Needs for the Future. Society for Range Management, 1839 York St., Denver, CO 80206, 303-355-7070.

Pasture Talk. \$24/first year. Monthly newsletter on intensive rotational grazing written for farmers in Upper Plains and Great Lakes regions. The Greenbull Press, P.O. Box 620732, Middleton, WI 53562-0732, 1-800-831-3782.

Land and Water. \$14.40/1 year. Bimonthly for those working in the field of natural resource management and restoration. Land and Water, Inc., 900 Central Ave., Suite 21, P.O. Box 1197, Fort Dodge, IA 50501-9925, 515-576-3191, e-mail: landandwater@dodgenet.com, Web site: <http://www.landandwater.com>



We have added some new links in our CGS Web page, including the NRCS Grazing Lands Technology Institute. Our home page address is:

<http://ianrwww.unl.edu/ianr/cgs>

You can find fact sheets and question/answer sheets on the Environmental Quality Incentive Program (EQIP) and Wetlands Reserve Program at:

<http://www.nhq.nrcs.usda.gov/OPA/FB96OPA/FBillLnk.html>

The beef-forage selective grazing research model, "GRAZE for Windows," is now available for downloading at:

<http://www.gen.ufl.edu/graze.html>

GRAZE can be used directly to predict values such as body weight, daily weight gain, amount of forage consumed, forage availability, etc. within a given beef-forage grazing scenario. It can be used to compare various performance measures of several different scenarios, or to generate a predicted response to a change in inputs that may influence research or management understanding (e.g. how will animal performance change if a plant input parameter is altered or if a different fertilizer schedule is used).

The Nebraska Statistical Handbook is now available via Internet. It contains 200 tables and graphs related to Nebraska's economy, and is divided by categories, one of which is agriculture. The URL address is:

<http://www.ded.state.ne.us/economy/stathand/contents.htm>

☎ If you call the Wetlands Hotline, 1-800-832-7828, Monday through Friday between 9:00 and 5:30 EST, you can request information from U.S. Environmental Protection Agency specialists and/or order publications.










The following contains the missing text from our Summer 1996 newsletter as you go from page 3 to page 8:

This results in a shift in plant biomass favoring rhizomatous grasses and/or forbs, depending on whether it was a spring or summer fire, respectively. Bison selection for a burned area declines with time, and as it does, plant composition again shifts. Plant community composition and diversity at the landscape scale will be a product of these complex spatial and temporal mosaics.

Our apologies to author Al Steuter and to our confused readers!

Info Tufts

-  The UNL Center for Great Plains Studies, which celebrated its 20th year in September, is the oldest and largest interdisciplinary regional research and teaching institute in North America.
-  The United States Golf Association is one of ten companies/associations to join the EPA's Pesticide Environmental Stewardship Program, created to encourage pesticide users in agricultural and non-agricultural settings to develop approaches to pest control that are safer than traditional chemical methods.
-  80% of the Ogallala Aquifer is in Nebraska.
-  Sandhills, which cover one-fourth of Nebraska, were formed within the last 10,000 years. Streams originating in the Sandhills are among the most constant flowing streams in the world; in many instances more than 95% of the flow of these streams comes from Sandhills discharge.
-  Nebraska's livestock industry accounts for approximately 65% of the state's total agricultural receipts each year. Production agriculture contributes nearly \$9 billion annually to Nebraska's economy.
-  Approximately 60% of the world's landmass is rangeland. The figure is a little over one-half for the U.S. (1.2 billion acres), and a little under one-half for Nebraska (nearly 23 million acres). After Alaska, Texas has the greatest amount of rangeland (92 million acres).
-  It is estimated that 15 million acres worldwide are shifting annually from grassland to desert or wasteland (see *Feeding a hungry planet* by J. Iggers, 1989).

CGS Associate News

Blowout penstemon is the only Nebraska native wildflower on the federal endangered species list. With funding from the Nebraska Environmental Trust Fund, secured with the help of the CGS, **Jim Stubbendieck** is attempting to restore the species by transplanting 20,000 seedlings from the greenhouse to western Nebraska.

Several faculty associated with the CGS were recognized for their work at the joint annual meetings of the American Society of Agronomy, Crop Science Society of America and Soil Science Society of America in November:

CGS Director Martin Massengale — DEKALB Crop Science Distinguished Career Award, given for at least 25 years of significant contributions to basic and applied research.

Terrance Riordan — Fred V. Grau Turfgrass Science Award recognizing career contributions to turfgrass science.

Gary Hergert — cited for research on soil fertility and management, including improving fertilizer use efficiency.

Jeffrey Pedersen — honored for his work on genetic improvement of crops.

Golf and the Environment

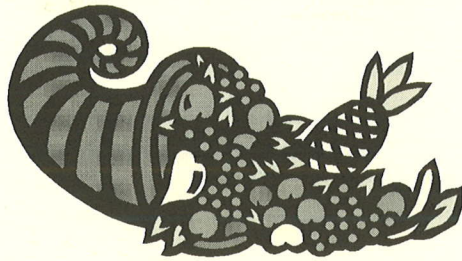


For 18 months Landscapes Unlimited has committed a substantial amount of time and effort to organize a proactive program to address the issues facing golf and the environment today. The purpose of this program is to take the principles established by members of both golf and environmental communities, and support these principles with research and factual data.

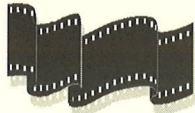
The National Arbor Day Foundation and the University of Nebraska joined with Landscapes Unlimited to create the initial organizing group. As this program evolved, others have joined in — USGA, GCSAA, ASGCA and many others. Palmer-Seay Design Company will work with Jeff Brauer's GolfScapes to co-design the living classroom course at Arbor Day Farm.

Source: *Links*, Summer 1996, published by Landscapes Unlimited, Inc.

Editor's Note: Bill Kubly, LUI President, is a member of the CGS Citizens Advisory Council. CGS Director Martin Massengale and Associates Terry Riordan and Roch Gaussoin are working with Bill and others on the Arbor Day Farm Golf Course in Nebraska City, Nebraska.



CGS Seminars Available on Video



The following list of selected sessions from this fall's CGS Seminar Series were videotaped and may be checked out from the CGS reference center:

- ◆ Mr. Michael Kenna, Director, Green Section Research, USGA, "USGA Interest in the Environment"
- ◆ Dr. John Ward, Professor Emeritus, UNL Animal Science Dept., "Grasslands of the World"
- ◆ Mr. Pete Jensen, State Conservationist (retired), USDA-NRCS, "Dr. John Weaver—The Man"
- ◆ Dr. Fritz Knopf, Vertebrate Ecologist, Biological Resources Div., USGS, "Conservation of Vertebrate Diversity on the Great Plains"
- ◆ Dr. Tom Bragg, Professor, UNO Biology Dept., "Fire in the Nebraska Sandhills Prairie Ecosystem: Necessity or Nuisance?"
- ◆ Dr. Dan Uresk, Program Leader, Center for Great Plains Ecosystem Research, USDA Forest Service, "Interrelationships of Plants, Prairie Dogs and Cattle"
- ◆ Dr. Tony Joern, Professor, UNL School of Biological Sciences, "Conserving Invertebrate Resources: Invisible Movers and Shakers in Grassland Ecology"

International Grassland Congress

To receive information about this event to be held June 8-19, 1997 in Saskatchewan, Canada, contact XVIII International Grassland Congress, PO Box 4520, Station C, Calgary, Alberta, Canada, T2T 5N3; phone 403-244-4487; e-mail amc@supernet.ab.ca. Deadline for the early registration fee is February 1.

Calendar

Contact CGS for more information on these upcoming events:

- Dec. 8-11** 58th Midwest Fish and Wildlife Conference, Omaha, NE
- Dec. 9-10** National Alfalfa Symposium, San Diego, CA

1997

- Jan. 9** Nebraska Forage and Grassland Council Annual Meeting, Lincoln, NE
- Jan. 13-15** Nebraska Turfgrass Conference, Omaha, NE
- Feb. 16-21** 50th Annual Meeting of Society for Range Management, Rapid City, SD
- Feb. 18-19** 1997 Platte River Basin Ecosystem Symposium, Kearney, NE
- June 8-19** XVIII International Grassland Congress, Saskatchewan, Canada
- July 8-12** Private Grazing Lands in the 21st Century: Integrating Pastures, Environment, & People, Logan, UT
- July 23-26** Soil and Water Conservation Society Annual Conference (focusing on ecosystem management within watersheds), Toronto, Ontario

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.

Center for
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