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Center for Grassland Studies

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Study Shows Importance of Biodiversity to Grasslands

Editor's Note: This article, written by Tom Simons, appeared in the November 8, 2001 issue of *Scarlet*, a weekly newspaper for UNL employees, and is reprinted here with permission. It features the work of CGS Associates Jean Knops (in hat) and David Wedin.

More evidence for the importance of biodiversity to ecosystems has been shown in the results of a recently completed grasslands study that was published in the Oct. 25 edition of *Science*, the weekly journal of the American Association for the Advancement of Science.

Photo by Richard Wright

In the seven-year experiment, a team of scientists that included Johannes "Jean" Knops and David Wedin of the University of Nebraska-Lincoln, found that on average plots planted to 16 grassland plant species attained 2.7 times greater biomass than plots planted with one species. Moreover, the importance of biodiversity increased over time.

The scientists planted 168 plots at the University of Minnesota's Cedar Creek Natural History Area north of Minneapolis in 1994 with either one, two, four, eight or 16 species chosen randomly from a pool of 18 native grassland perennials.

Knops, an assistant professor of biological sciences, said the team documented what happened in each of the plots, recording how the plots functioned, how much above-ground and below-ground biomass was created, what happened with nutrient uptake, water relationships and insect herbivory, all with an eye to answering the basic question of what biodiversity means to the health of an ecosystem.

"We wanted to know, does the species number really matter?" Knops said. "We published papers in 1996 and 1997 on earlier experiments that basically showed that it does, but that raised a huge controversy."

Critics of the earlier studies said results favoring biodiversity could have come from statistical averaging. In simple terms, the doubters said that if some monoculture plots were planted with a productive species and others with a nonproductive species, the average biomass would be somewhere between the two. However, if the species were planted together, the productive species would take over and the average biomass for the multispecies plots would be high.

The experiment described in this week's *Science* should answer those doubts, Knops said. The scientists identified the five least-productive species in 2000 and excluded from analysis plots containing any combination of just those species. They tested the hypothesis that the most-productive species determined the effects of diversity by analyzing in 2000 only plots that contained at least one of the nine most productive species in monoculture. In both cases total biomass remained significantly dependent on species number and group composition and became more so during the course of the experiment.

"We found that species complement each other," Knops said. "Some species might be active early in the growing season, some late in the growing season. Some might do well in dry years, others in wet years. Some might be hit by grasshopper outbreaks. But together, they might complement each other. What we saw over the first couple of years was what you would expect from statistical averaging, but over time, species interaction strongly matters.

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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.

Note: Opinions expressed in this newsletter are those of the authors and do not necessarily represent the policy of the Center for Grassland Studies, the Institute of Agriculture and Natural Resources or the University of Nebraska.

Martin A. Massengale ...... CGS Director
Pam Murray .... CGS Coordinator
Jan Shamburg .... CGS Secretary
Anne Moore ....Newsletter Layout

From the Director

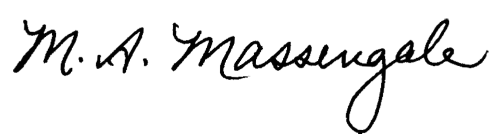
Since terrorism and biosecurity are so high on our agenda today, this is an appropriate time to consider genetic diversity in our major crops and livestock, including forage, turf and native grasses. For many years, our efforts have been away from biodiversity, but in recent times we have realized the importance of biodiversity in our plant and animal species.

The country's abundant and inexpensive supply of food is based on an intensive form of agriculture that benefits from great uniformity. However, greater genetic uniformity increases the potential vulnerability. Breeding plants and animals for increased productivity, uniformity and other improved traits has lessened the use of primitive varieties in these programs, and thus narrowed the genetic variability. In the process of developing plants and animals that are more uniform and better suited to modern agriculture, we have decreased biodiversity. From many different viewpoints, it is important that we maintain a significant level of biodiversity in the plant and animal populations that are of economic and environmental importance to the United States.

The U.S. has relatively few native plants and animals that are used in our national economy. Therefore, we are rather limited in genetic diversity. Countries, including our own, are becoming increasingly dependent upon each other for this diversity in genetic resources. Until relatively recently, it has been easy to conduct exploration trips to other countries for the purpose of collecting germplasm sources for potential use in breeding programs. With plant variety protection and the patenting of numerous genes for commercial purposes, international treaties and national legislation, countries have become much more concerned about letting germplasm flow freely out of their countries.

Wild ancestors and relatives where plants and animals are native are the keys to genetic diversity. The amount of land where plants and animals are found in the wild continues to decrease, and some species could disappear forever. In our highly populated world of the future, certain of these species could make a big difference between the abundance and scarcity of food and the quality of both our environment and our lives.

In summary, it is important for the United States to collect, preserve and have available for use a broad array of genetic resources to insure adequate genetic variability to underpin and sustain a viable agricultural economy, supply an abundance of nutritious food, provide recreational activities, and have a quality environment for our society.



Study Shows Importance of Biodiversity to Grasslands (continued from page 1)

"We answered a basic ecology question, but it's also partly applied ecology. For instance, most pastures in Nebraska have fewer plant species now than they had 100 years ago. Abandoned agricultural fields in Minnesota have on average one to five species per square meter, compared to a prairie in good condition that will have 20 to 30 species per square meter. The basic question is how does that matter long-term for sustainability, productivity and basically everything. When you reduce diversity, the ecosystem becomes unstable, sensitive to things like climate changes and insect outbreaks. If you have higher diversity, you have a buffer."

In addition to Wedin, Knops' team included lead author David Tilman, Peter Reich, Troy Mielke and Clarence Lehman of the University of Minnesota. Wedin is an associate professor of ecology in the Institute of Agriculture and Natural Resources at NU.

Separating the Myths from the Truths of Turfgrass Soil Microbiology

by Roch Gaussoin, Department of Agronomy and Horticulture, UNL

Turfgrass represents a significant amount of land area and economic impact in Nebraska and surrounding states. A well-maintained lawn, athletic field or golf course makes a significant contribution to "the good life." When properly managed, turfgrass can improve the quality of life and offer environmental benefits such as air and water quality improvement, erosion control and noise abatement. In recent years, research at the University of Nebraska and other locations has concentrated on trying to better understand the microbial ecology of turfgrass soils. Although this research has created new and academically interesting challenges for future research, fundamental questions have been answered and common perceptions have been found to be untrue. This article will attempt to summarize these studies and make assumptions based on these data concerning the use of microbial inoculants for turfgrass management.

The following are common perceptions about the microbial relationships in turfgrass soils:

- Excessive pesticide applications adversely affect soil microbiology.
- Sand-based rootzones are relatively sterile.
- Soil inoculums/additives can alter soil microbiology.
- Turfgrass soils are lower in microbial biomass/diversity than other soils.

From 1996 to 1998, golf course greens located on 16 golf courses in eastern Nebraska were sampled for microbial properties in a project funded by the O.J. Noer Turfgrass research program and the United States Golf Association (USGA). This work was conducted by graduate student Mine Aslan under the direction of Drs. Rhae Drijber and Bill Powers. The 16 courses were separated into three distinctly different management groups based on pesticide inputs, fertility and other pertinent management practices. All greens had sand-based rootzones and ranged in age from 1 to 28 years. Results indicated that:

- The age of green was the most significant factor in microbial biomass/diversity.
- Management level did not influence microbiology, indicating that higher levels of management, including relatively high pesticide inputs, did not adversely affect soil microbiology.
- Significant microorganism levels and stability occurred within 18-24 months after establishment.
- Microbial biomass of sand-based turfgrass soils 18-24 months after establishment was less than native undisturbed soils, but greater than traditional row crop soils.

This work also indicated that as a golf green matures, the microbial population is more associated with particulate organic matter (POM) than the mineral fraction. POM is the residue produced from the turnover of the plant root system as it matures and dies, sloughing off roots, root hairs, etc. into the rhizosphere. The rhizosphere is the region in the rootzone that is immediately adjacent to the root system. This region is critical for nutrient transfer and plant uptake, pathogen competition, and ultimately plant health.

Similar results concerning microbial levels and stability were reported by Bigelow & Bowman in 1999 in work conducted in North Carolina. Their data indicated that sand-based turfgrass rootzones reached significant microorganism levels and stability relatively quickly (within 12-18 months), and these levels were equal to native soils in the region. They also reported the temporal effects of microbial populations, with the largest populations being associated with the periods of greatest plant growth, i.e., spring and fall.

It is interesting to note that the period associated with the lowest microbial numbers in Bigelow and Bowman's work also coincides with the period of greatest root pathogen activity and other stresses, i.e., summer. Obviously, these other stresses such as heat and drought are contributing to the grass decline during the summer, but the microbial "health" of the soil should not be overlooked.

The research at Nebraska and North Carolina indicated that in a relatively short time, sand-based turfgrass rootzones reach microbial levels comparable to other

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Separating the Myths from the Truths of Turfgrass Soil Microbiology (continued from page 2)

"native" soils. This information can be used to develop a theoretical scenario for the use of *microbial inoculants*. These are products that are packaged and marketed to turfgrass managers as tools to improve the microbiology of the soil. These are often beneficial organisms packaged with other ingredients such as iron or biostimulants, or in some cases, packaged as spores of the desired microbe. These products may contain up to 10^9 organisms per milliliter of product, and application rates range from 1 to 6 ounces per 1000 ft^2. The soil contains 10^8 bacteria per gram of soil. The relative quantity of actinomycetes is approximately 100 times less than the bacteria and fungi 100 times less than the actinomycetes, but for our theoretical example, we will disregard both the native fungi and actinomycetes. Realizing that many soil microorganisms are sensitive to IR light and/or heat instability, and therefore survival from purchase to application is suspect, let us assume that all applied microorganisms survive and that the maximum use rates of the product are applied — the ratio of applied vs. native bacteria is approximately ***6000 native: 1 applied***, or the applied represent ***0.02*** percent of the total bacterial population. It appears that the applied microorganisms have little or no chance of effectively competing with the already established population. Further, Boehm's work at Ohio State University showed that at approximately two years post-construction in a soil/sand/compost vs. sand/peat green, microbial diversity was not different, even though the former green was significantly higher at establishment. While the compost increased microbial taxa initially, a natural equilibrium ultimately occurred.

Do microbial inoculants therefore have no merit? Other research has shown the benefits of the addition of biological pest control products, such as nematodes for grub control where the goal is control of a specific pest as opposed to increasing beneficial microorganisms in the soil. Structured research is limited, but scientific work in this area is increasing. Since it appears that new sand-based rootzones take one to two years to reach equilibrium, perhaps the use of microbial-based products has merit during establishment of turf on sand rootzones. A study was conducted in 2000 at the University of Nebraska with the Emerald Isle (EI) products GrowIn and Optimil for the establishment of bentgrass. The EI grow-in resulted in faster establishment than traditional grow-in procedures, and after the growing season, the EI plots had higher fungi and bacterium levels. Work in this area continues, and perhaps future research will shed more light on the use of microbial inoculants in turfgrass management.

In summary, it appears that some common perceptions about turfgrass soils were not true:

- Relatively high pesticide applications do not appear to adversely affect soil microbiology.
- Sand-based greens are not sterile, but in fact, reach levels of native soils in a relatively short time.
- Soil inoculums/additives can alter soil microbiology in the *short term*, but their use on established soils is questionable.

For information on data or studies described herein, please contact the author at rgaussoin1@unl.edu.

CGS Associates

At the 2001 meeting of the Nebraska chapter of Gamma Sigma Delta (honorary agricultural fraternity), **Lowell Moser** was honored with the Award for Distinguished Achievement in Agriculture by Gamma Sigma Delta International, and **Walt Schacht** received the Teaching Award from the Nebraska chapter.

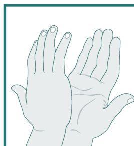
Don Adams received the 2001 Distinguished Extension Specialist Award from the Nebraska Cooperative Extension Association.

Chris Calkins was one of the faculty members cited in connection with UNL's ranking of sixth best of universities serving the meat and poultry industry by *Meat and Poultry* magazine. Chris was one of the researchers involved in the study that resulted in the new "flat iron" steak, which is a less expensive (than sirloin) steak produced by using innovative cutting techniques on the chuck and round.

Several honors were bestowed upon CGS Associates at the 2001 meetings of the American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America: **Bruce Anderson** received an ASA Fellow award; **Stephen Baenziger** became CSSA president-elect and **John Doran** became SSSA president; **Richard Ferguson, Gary Hergert** and **Charles Shapiro** were recognized for their CD-ROM, "Managing Irrigation and Nitrogen to Protect Water Quality." At these same meetings, two CGS Citizens Advisory Council members also received recognition: **Ray Ward** received a Fellow award, and **Roger Hammons** was a member of the team that was recognized for its video, "Hard White Wheat 2000."

Jim Stubbendieck received the Blazing Star Award from the Nebraska Statewide Arboretum, which recognizes significant contributions toward advancing the horticultural use of conservation of native plants in Nebraska.

Terry Klopfenstein was recently named president of the Federation of Animal Science Societies' board of directors. He will serve a one-year term.



Congratulations to Frank Bruning, who was recently named "2001 Nebraska Cattleman of the Year" by the Nebraska Cattlemen. Frank is on the CGS Citizens Advisory Council.

Managing Prairies for Biodiversity

by Chris Helzer, The Nature Conservancy

Editor's Note: This article appeared in the September-October 2001 issue of *Platte River Current*, a newsletter published by the Crane Meadows Nature Center in Wood River, Nebraska. It is reprinted here with permission.

Introduction

Early European visitors to the Great Plains recorded their awe at both the scale and beauty of the seemingly endless prairies. Even today, after years of conversion to cropland and housing developments, prairies remain beautiful and multifaceted ecosystems. Plants form diverse communities that change over time and space. Animals — from microscopic soil invertebrates to bison — range across those plant communities, relying on the diverse plant communities for both food and shelter. But because of their smaller size and susceptibility to threats such as weeds and invading trees, protecting and maintaining today's diverse prairies requires thoughtful and constant management.

Why not just "Let Nature Take its Course?"

Historically, grassland ecosystems were regulated by disturbances that included frequent and extensive fires, intensive grazing by bison, and meteorologic events such as droughts, floods, and storms. These disturbances defined the prairie and kept it robust and diverse. However, large bison herds and sweeping grass fires have nearly disappeared from the landscape and the remaining prairies are relatively small and isolated. To maintain high species diversity in these small prairie remnants, disturbances must now be provided through active management.

Without disturbance, grasslands begin to build up litter. They then lose plant species that can't fight their way up through that thick dead material. Because no light reaches the soil, new seedlings never appear and species diversity declines even further as individual plants die off and are not replaced. Eventually, trees and shrubs (like eastern redcedar, smooth sumac, dogwood, etc.) expand into the flame-free grass and the grassland becomes a woodland.

Strategies for Biodiversity Management

Biodiversity management is essentially an attempt to replace historic large-scale natural disturbance regimes with carefully planned and timed management actions. It is impossible to recreate history, but considering the historical context within which prairie plants and animals evolved is important. Using tools including grazing, prescribed burning, mowing, and sometimes herbicide treatments, managers try to give every plant species in the prairie a chance to grow and reproduce successfully, at least periodically, so that the maximum number of species can survive. Managing for the maximum diversity of animal species involves not only preserving the maximum number of plant species, but also providing a diversity of habitat structure ranging from tall stands of grass and flowers, to short-cropped vegetation, and even patches of bare ground.

To manage a prairie for the highest possible diversity, the most important strategy is to avoid repeating a disturbance in the same place at the same time of year. Plant species spread their growth and reproduction periods over the entire season so any management, whether burning, grazing, mowing, or rest periods, will positively affect plants growing during one season and negatively affect those growing at other times. For example, haying a tract of land in the late summer positively affects species that grow and bloom in the early spring because there is little competition for light in the spring after all the growth from the previous year was removed. However, any plant species that don't complete their life cycles before the hay is cut (including most warm-season grasses and late-flowering wildflowers) grow weaker over time and eventually disappear from the prairie. Any break in the annual mowing cycle can help those late season plants hold on.

In addition to being split into different growth periods, plants have different life spans. Some plants are annuals or biennials and put all their energy into one big flowering and seed production effort. Other plants are perennials and can live for at least 30-40 years, flowering and producing some seed some years but not needing to do so every year. Management strategies that favor perennials (light grazing, rest periods, spring burning, etc.) usually have negative impacts on short-lived species that require periods of bare ground and little competition for seedling establishment and reproduction. Likewise, management strategies that favor short-lived plants (intensive season-long grazing, multiple hay cuttings during the same season, summer burns, etc.) usually negatively affect long-lived perennials. In general, a biodiversity-oriented management system needs to provide disturbances that vary by intensity and season and change location periodically. In most cases, a disturbance regime that provides for maximum native plant diversity will also provide for maximum diversity of habitat structure for animals.

Cattle grazing can be one of the most valuable tools for prairie management because it provides so many options for regulating the intensity and timing of the disturbance to the prairie. For example, in one year a prairie could be grazed season-long at a high stocking rate and the repeated grazing of each plant would weaken the entire matrix of shoots and roots, opening up spaces for new seedling production — important for both short- and long-lived plants. The next year the prairie could be grazed for short periods or at low stocking rates so that the grazers

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would eat almost exclusively grasses, allow most wildflowers to grow with less competition for the season, and provide a patchy vegetation structure. Electric fence makes it easy to move cattle from one part of the prairie to the next and vary the timing and intensity of the grazing each part receives. Allowing each part of the prairie a season of rest periodically is also important. Prescribed burning can easily be incorporated into a grazing system, either following a rest period or a light grazing period. In addition to removing litter and helping to keep the prairie free of trees, burning can accentuate grazing effects or concentrate grazing in certain areas because cattle are drawn toward the fresh new growth that follows a fire.

On small tracts or other sites where grazing is less feasible, periodic haying and burning at various times of the year can be relatively successful, especially if portions of the prairie are allowed to remain idle each year. The advantage of using grazing periodically, however, is that a manager has much more flexibility in managing the disturbance and the treatment is not spread evenly across the prairie, leaving more structural and floristic diversity. Haying and burning typically remove all the vegetation at one time, and although they can be varied by season of application, they typically are not. In addition, both haying and especially burning can be very detrimental to insect diversity if the entire prairie is hayed or burned at the same time.

Special Challenges — Weeds and Trees

One of the biggest current threats to prairie diversity is the invasion of grasslands by exotic (non-native) species. Exotic perennial grasses like Kentucky bluegrass, smooth brome, tall fescue, improved varieties of reed canarygrass, and numerous others have turned many prairies into near monocultures. Officially-listed noxious weeds like musk and Canada thistles, leafy spurge, purple loosestrife, and others have also taken over natural areas and continue to expand their range. Other weeds, not yet listed as noxious, such as sweet clover, dame's rocket, ox-eye daisy, bird's foot trefoil, and chicory have invaded and degraded natural areas but have not yet gained widespread acknowledgement as problems and are still planted by well-meaning individuals and organizations.

Managing for biodiversity becomes much more difficult when weeds enter the picture because every management strategy has to be measured not only in terms of its impact on native plants and animals, but also on its positive or negative impact on non-native species. In addition, strategies for controlling weeds are absolutely necessary for protecting the diversity of a site, but often have unavoidable negative impacts on the native plants managers are trying to protect. Hand-pulling, grazing, burning, or mowing can sometimes help keep small populations in check, but herbicides are often necessary when populations get bigger. Unfortunately, few herbicides are specific enough in their effects to avoid harming nearby native species. Broadcast herbicide treatments to control weeds have resulted in many prairies degrading into low-diversity grasslands. Careful spot-spraying and the use of selective herbicides can help reduce adverse effects on native species.

Invasion of prairies by trees can sometimes be even worse than invasion by weeds. Historically, eastern redcedar, dogwood, sumac, and other native woody plant species were on the fringes of prairies and their populations would grow or shrink depending upon the frequency and intensity of fires and browsing by deer, elk, and other animals. With the exclusion of fire from most grasslands, these species have been allowed to grow unchecked and have transformed many former prairies into weedy woodlands. The problem has been exacerbated greatly by the planting of both native and non-native species for aesthetic reasons, shade for humans and livestock, and — ironically — for wildlife habitat. Non-native trees like Siberian elm, Russian olive, and others have been planted in pivot corners, windbreaks, and farm yards and have spread quickly into grasslands, lowering their value for both forage production and biodiversity.

Eastern redcedar, one of the most common invaders, can be relatively easily controlled, especially if it is caught while the trees are still small. A well-timed prescribed burn can quickly remove all the trees under about 6-8 feet in height (depending on how much grass is present to carry the fire) in one fell swoop. Cedars are also easier to get rid of than many other species because if they are burned or cut down, they don't typically regrow from the same stump. Most deciduous trees like Siberian elm, Russian olive, honey locust, green ash, and many shrubs that have invaded prairies need either repeated cutting and/or burning, or herbicide application to prevent their regrowth.

Summary

Historically, prairies were shaped and maintained by large-scale disturbances such as bison grazing and fire. Today's prairies are mainly small and isolated and their diversity must be maintained by active management. Meeting the needs of the myriad of plant and animal species can be complicated work, especially in the face of invading weeds and other challenges. However, as more prairies are converted to cropland and housing developments, making the most of those that remain is even more important.

Chris Helzer is a land steward for the Aurora, Nebraska office of The Nature Conservancy. He manages about 5,000 acres of grasslands, wetlands, and woodlands along the Central Platte River and in other locations in central and southeastern Nebraska.

2002 Nebraska Range Shortcourse

by Lowell Moser, Department of Agronomy and Horticulture, UNL

More than 23 million acres, or nearly half of the total land area of Nebraska, is in rangeland. The Nebraska Sandhills, Loess Hills and High Plains contain the largest expanse of rangeland in the state. Since rangeland occupies such a high percentage of the land area of the state, management of these lands touches Nebraskans from many walks of life: ranchers, government and higher education workers, environmentalists, animal and plant biologists, ecologists, and agribusiness—to name a few.

With this background, the Nebraska Section of the Society for Range Management, together with the University of Nebraska, established an adult education program in range management. The shortcourse offers Nebraskans the opportunity to update their education on this topic. It can also provide those with little range knowledge a solid base in the structure and management of range ecosystems.

The first range shortcourse was in 1978, and it has been offered every even-numbered year since. It is a joint venture involving the University of Nebraska-Lincoln, Chadron State College, Nebraska Section of the Society for Range Management, USDA Natural Resources Conservation Service, U.S. Forest Service, and ranchers who provide instruction and field experiences for the participants. Since 1980 UNL has provided leadership and coordination of the shortcourse, using northwest Nebraska as an outdoor laboratory.

The shortcourse starts on Sunday evening and ends at noon on Friday. In this retreat setting the participants are able to immerse themselves in range management for a week, allowing them to gain considerable depth in the subject. The main areas of emphasis are:

(1) Rangeland resources—plant function and identification, and range soils and geology;
(2) Ecology—ecological principles for grasslands, monitoring range ecosystems, and determination of range condition;
(3) Management of public and private lands—emphasizes fire, revegetation, and multiple use of rangelands for livestock, wildlife, or environmental protection;
(4) Grazing and livestock production—determining stocking rates and establishing grazing systems;
(5) Fitting livestock to the production system.

Since Nebraska is a private-land state, nearly all of the range is grazed. The final section offers an integrated summary of profitable livestock production and range sustainability. In each section fundamental principles are taught in a classroom setting in the mornings, and the concepts are applied and integrated with field trips in the afternoons.

The course has been successful in attracting those who are involved directly with management of range, such as ranchers and other range managers, as well as persons who serve in advisory roles through agencies and educational institutions. It also attracts persons with little or no range training or background. These persons are interested in a concentrated educational experience so that they have a base for appreciating range and interacting with those associated with Nebraska rangelands through businesses or personal contact. One of the greatest strengths in the course is the opportunity for this diverse group of participants to interact with each other informally in field exercises, socially in the evenings, and at meal times. The shortcourse consistently receives high ratings from participants.

The course will be offered June 23-28, 2002, at Chadron State College. If desired, academic credit can be obtained from the University of Nebraska or Chadron State College. Also, 16 CEU credits are available for the "Certified Professional in Range Management" program. The registration fee is $135 and covers all materials and transportation for field trips (additional tuition fees apply if taking the course for credit). The course is limited to the first 45 applicants, so you will want to register early. For more information, see www.ianr.unl.edu/ianr/agronomy/rangeshortcourse/, or contact the short course coordinator, Lowell Moser, 402-472-1558, lmoser1@unl.edu, or the CGS office to receive a brochure.

2002-2003 Nebraska Ranch Practicum

The fourth offering of the Nebraska Ranch Practicum will begin this June. The five-part educational program emphasizes hands-on monitoring of vegetative and livestock resources to ensure each participant will be able to use knowledge of plant and animal interactions to enhance profitability and sustainability. Participants will monitor body condition score, milk production and cow and calf weight throughout the seven-month period of the course. Forage quality will be assessed with esophageal diet collections and laboratory analysis. Amounts of available forage will also be estimated by several methods and used to calculate stocking rates as the season progresses. Classroom instruction on fundamental principles of monitoring and decision-making processes will precede hands-on training. Sessions will be held primarily at the University of Nebraska's Gudmundsen Sandhills Lab near Whitman. Dates are June 6 and 7, July 16, September 4 and 5, November 12, and January 8 and 9, 2003.

Applications must be received by May 1 (enrollment is limited to 30). The registration fee is $600, $200 of which must accompany the application. For more information, see www.panhandle.unl.edu/ranchpracticum, or contact one of the following: Don Adams, North Platte, 308-532-3211, ext. 133, dadams1@unl.edu; Pat Reece, Scottsbluff, 308-632-1242, preece1@unl.edu; Brent Plugge, Central Sandhills Area Extension, 308-645-2267, bplugge1@unl.edu.

Resources

Carbon Sequestration, Greenhouse Gas Emissions, and Nebraska Agriculture — Background and Potential. This report relating to the requirements of LB 957 of the 2000 session of the Nebraska Unicameral contains the following recommendations of the Carbon Sequestration Advisory Committee: maintain a Carbon Sequestration Committee to respond to changing conditions; provide additional funding for basic research relevant to Nebraska; provide funding to support a carbon sequestration pilot project in Nebraska; develop a state greenhouse gas inventory. CGS Associates Dayle Williamson and Shashi Verma were on the Committee, and Kim Stine coordinated the editing and review process. The 77-page report, dated December 1, 2001, is available online at www.carbon.unl.edu/report.pdf.

Post-Harvest Physiology and Preservation of Forages. $28.00. CGS Associate Kenneth Moore is co-editor and Associate Lowell Moser wrote one of the chapters in this publication available from the American Society of Agronomy. The book examines the current level of knowledge about preservation of forage crop quality as it is influenced by post-harvest physiology and microbiology. Producers, researchers, and teachers will find the information to be useful, particularly as it relates to field curing of forages, and hay and silage preservation. The contents are helpful in identifying, understanding, and managing those factors associated with forage crop losses in quality and quantity from the time of harvest through the time it is used. For details and ordering, see www.asa-cssa-sssa.org/cgi-bin/Web_store/web_store.cgi (select CSSA Special Publications and scroll down), or contact the CGS for a brochure and order form.

The American Prairie: Going, Going, Gone? This new report by the National Wildlife Federation depicts how losing native prairies to agricultural conversion, sprawl and development is impacting habitat and wildlife. See it at www.nwf.org/grasslands/americanprairie.html, or contact the NWF at Rocky Mountain Natural Resource Center, 2260 Baseline Rd. Suite 100, Boulder, CO 80302, 303-786-8001.

Reader Feedback Requested

We are now up to Volume 8 for this newsletter, meaning publication goes back to 1995. As we assess the usefulness of the various activities in which the Center for Grassland Studies engages and where to direct our limited resources in the future, it would be helpful to know the impact of our newsletters. We would greatly appreciate your taking a moment to contact us with information about how you use the newsletter, including: whether you post/forward/circulate it; if you have used information from one or more articles, and if so, how (e.g., reprinted an article, incorporated into teaching or extension materials — printed or electronic, used in a talk, contacted an author or the CGS for more information, used a practice or method described in an article, etc.); whether you receive the printed version or read it on the Web; and for those who receive a printed copy, whether you would access the Web if it were only available online. Also, any suggestions about improvements in content or format and topics you would like to see covered would be most welcomed. You can provide your feedback to Pam Murray, CGS Coordinator and newsletter editor, in one of three ways: e-mail pmurray1@unl.edu; call 402-472-4101; or write to her at the CGS office.

Calendar

Contact CGS for more information on these upcoming events:

2002

Mar. 7-9:	Great Plains Migrations, 26th annual symposium by UNL Center for Great Plains Studies, Lincoln, NE, www.unl.edu/plains/events/futuresymp.html
Apr. 13:	"All About Goats," Beatrice, NE
Apr. 23-27:	Landscapes in Transition: Cultural Drivers and Natural Constraints, 17th Annual Symposium, International Association for Landscape Ecology — United States Regional Association, Lincoln, NE, www.calmit.unl.edu/usiale2002
June 23-27:	Promoting Prairie, 18th North American Prairie Conference, Kirksville, MO, www.napc2002.org
Aug. 12-13:	2nd annual Nebraska Grazing Conference, Kearney, NE

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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