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Turfgrass Biotechnology – 2003 Update

by Terrance Riordan, Department of Agronomy and Horticulture, UNL

As many of you are aware, The Scotts Company and Monsanto are working on projects that will make several of the conventional turfgrasses such as Kentucky bluegrass, St. Augustinegrass and creeping bentgrass resistant to the herbicide Round-Up. This is just the first of many possible improvements that may be more easily accomplished by moving a gene from one organism to another without using the “normal” breeding process. There are many issues related to this new field of biotechnology—some real, some perceived, and some where we just don’t know what will happen. Some environmentalists and citizens are opposed to biotechnology because it is being done by “big business,” but there are others who are opposed because of their real scientific concerns. This is not much different than what has occurred with our agronomic food crops in the United States and in Europe. To understand some of the issues and even the “hysteria,” read *PREY* by Michael Crichton, a well known author and medical doctor (*Jurassic Park* and *Andromeda Strain*). In this story, a biologically engineered nana-particle gets out of control and starts attacking humans. This story is probably far-fetched, but who would have ever thought we would be talking about a cloned human or “pharmaceuticals,” where there is a combination of agriculture and the most advanced biotechnology? An example is a banana that would contain a vaccine to vaccinate people in underdeveloped countries. With turfgrasses, the less dramatic issues are pollen flow to other non-transgenic “normal” cultivars of the same species, gene escape to related native species, development of

tolerant or resistant weeds, and a myriad of other issues.

Before a turfgrass containing a biotechnology-inserted gene can be released and marketed, a very extensive scientific review is made by the Animal and Plant Health Inspection Service (APHIS), a federal agency of the United States Department of Agriculture. The problem is that APHIS, or really no one else for that matter, knows what questions need to be asked or answered, and how long the testing should last. The basic principle followed is that the

transgenic plant should be similar in all characteristics to the non-transgenic plant except for the new inserted characteristic.

To help APHIS, The Council of Agricultural Science and Technology (CAST) helped conduct a workshop for APHIS employees, scientists and concerned citizens in January 2003 in Baltimore, MD. Scientists, breeders, environmentalists and others were brought together to discuss the key issues surrounding genetically-engineered plants. The meeting was intense; the first day had meetings and discussions that

lasted 15 hours, and the second day was a shorter, full workday. The program included speakers who addressed several key issues, time for open public comment, and break-out sessions that covered the following areas: seed characteristics, vegetative characteristics and flowering characteristics of transgenic turfgrasses. Session participants discussed a long list of possible questions and concerns relating to each of these areas. We were allowed to bring up any new questions or issues and explore what

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This golf course uses bentgrass, one of the grasses on which genetic research is currently being conducted.

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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
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FROM THE DIRECTOR

There have been many years of uncertainty in the past, and 2002 was certainly one of those. It appears that 2003 may look much the same. The fear of terrorism, the waging of war, continued depressed financial markets, and the prolonged drought conditions are all present.

Although we have little control over most of these conditions, it is important that we prepare and manage our grasslands for another dry year as several climate experts indicate we are likely to be in an extended drought period. Although grasses generally thrive within a wide range of climatic and managerial conditions, they are susceptible to drought.

Many of our grasslands had little soil moisture as they went into the fall and winter, and they have not received much additional moisture in the interim. Heavy snowstorms this spring in Colorado, Wyoming and parts of Nebraska may not have much impact on Nebraska grasslands, as moisture is needed throughout the growing season. However, they do give hope of better things to come. Even if we do receive more rain this year, forage production will be down. Severe drought restricts root and shoot growth and the level of food reserves, thus reducing new shoot initiation.

Since grasses will most likely be emerging from the winter in a weakened condition, it is important that they be carefully managed during the spring and summer. One should delay grazing or mowing to enable the plants to develop enough leaf surface area to manufacture and store food for later growth and development. Also, the grass should not be grazed or cut as short as normal in order to provide more leaf area for the manufacture of food. A rule of thumb that has often been used is to take one-half of the green material during the growing season. Again, depending on the condition of the plant, it may be necessary to allow more time between cuttings and grazings to develop more leaf surface area.

In most years, there is enough forage produced to carry the herd through the season, but that was not the case in 2002. Therefore, we are beginning the 2003 season in a precarious condition. It is so serious that some of the rangeland in Nebraska may not be suited for any grazing this year because growth of the grass is so severely limited. Other grasslands may be grazed for varying periods of time. Even a short, delayed grazing period would be beneficial. In addition, there is a need for some ground cover to slow down the runoff of water and allow it to be absorbed by the soil when rains do occur.

The principles discussed above would apply to both lawn and forage grasses if they are not irrigated. With irrigation, a different management plan would need to be developed.

M. A. Massengale

Ecosystem Consequences of Trees in Grasslands: Insights from Bessey's Forest

by David Wedin, School of Natural Resource Sciences, UNL

Nebraska, with the highest proportional area in native prairie of any state, is proud of its grasslands. This pride rests on a century of research in grassland ecology and range management at the University of Nebraska. On the other hand, Nebraska, the home of Arbor Day, has a love of trees and tree planting. Charles Bessey, the eminent botanist and forefather of the University of Nebraska, once proclaimed: "We have to preach the crusade of the filling up of this state with trees, and to do that we must plant trees, and plant trees, and plant trees." The University of Nebraska is a leader in research on agroforestry and shelterbelt ecology, and through the Nebraska Forest Service, promotes the planting of woody vegetation across the state. Debate over the proper balance of woody and grassland vegetation for the Nebraska landscape has intensified over the last few decades as groups ranging from the USDA Natural Resources Conservation Service to the Audubon Society have promoted new efforts in prairie conservation. The debate is complicated, with confounding issues of "naturalness," aesthetics, biodiversity, agricultural practices, and soil and water health.



Nebraska National Forest in north central Nebraska where Wedin and fellow researchers study the impacts of trees on grassland ecosystems.

It has also become clear that much of the recent expansion of woody vegetation into Great Plains grasslands is not just the work of arborists and horticulturalists. Across the Great Plains, invasion by red cedar, ponderosa pine, mesquite, and other species is driving a vegetation change from grassland to open-canopied woodland, and in some cases, closed-canopied forest. Although woody species expansion has multiple, interacting causes, a primary cause appears to be the suppression of prairie fires for over a century in the Great Plains. This is not a new observation;

Herbert Webber, who worked with Bessey, was quoted as far back as 1889 as saying: "Since the checking of prairie fires, forests are springing up as if by magic, and every stream is fast becoming lined...It seems that at no distant day, were this spreading not limited by cultivation, Nebraska would again be, as we surmise it has once been, a forest." The consequences of widespread shifts from grassland to woody vegetation include a loss of habitat for grassland biodiversity and shifts in the quantity and quality of forage produced on rangeland. The consequences also include shifts in ecosystem functioning (the pools and fluxes of energy, carbon, nutrients and water). These shifts are hypothesized to include altered productivity, carbon storage, soil organic matter and nutrient cycles, microclimate, evapotranspiration and ecosystem water balance.

The ecological consequences of woody species establishment in the Nebraska Sandhills were first discussed over a century ago. Bessey and his contemporaries argued that extensive woody species establishment in the Sandhills would improve soil fertility and alter regional climate and ground water dynamics. Although the argument that "rain follows tree planting" fell from scientific favor by 1900, Bessey and collaborators at the U.S. Forest Service left us a tangible legacy of their hypotheses about the effects of woody vegetation on ecosystem functioning in the Great Plains: the Nebraska National Forest. This 25,000-acre experimental forest, planted for the most part in the first few decades of this century, may be one of the largest, most expensive ecological experiments ever performed by the federal government. Surprisingly few, if any, scientific articles have been published based on this experiment.

As the 21st Century begins, the hypotheses that vegetation change and land use may have significant feedbacks on ecosystem functioning at local, regional and global scales have returned to the fore in ecology and global change research. In particular, the critical role of the terrestrial biosphere in the global carbon budget is becoming clear. Recent atmospheric studies point to terrestrial ecosystems of the northern hemisphere as the unknown sink for the "missing carbon" in the global carbon budget. Could the carbon storage or loss associated with changes in vegetation from grassland to open woodland or woodland to closed-canopied forest be part of this carbon sink? In 1999, researchers studying carbon storage in the U.S. caused by changes in land use and land cover hypothesized that 50% of the total U.S. carbon sink is accounted for by two phenomena: woody encroachment of non-forest ecosystems and canopy closure ("thickening") of formerly open western pine woodlands. Both can be seen in

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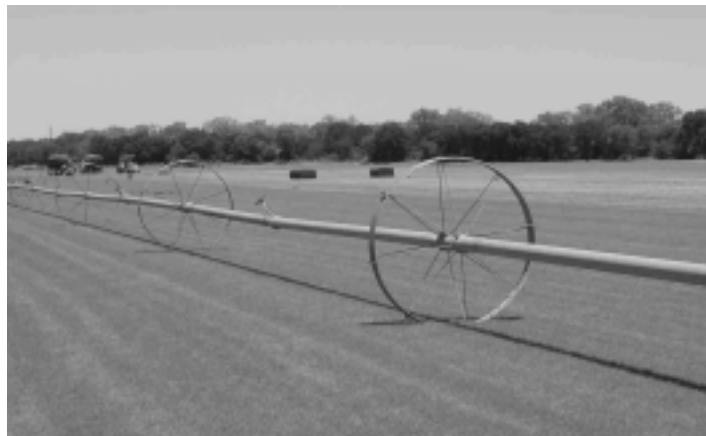
Turfgrass Biotechnology – 2003 Update (continued from page 1)

studies would need to be conducted to answer all questions and concerns, and to discuss how long the testing period should be for each question or issue. There is a writing committee of scientists that will summarize all of the information and submit this to APHIS, which will then use this information to make a decision on any future release and deregulation of a transgenic turfgrass. APHIS will then ask each company that wants to release a transgenic turfgrass to answer these new questions and concerns. Even with all of this input, political pressures and lawsuits filed by environmentalists and concerned citizens will further complicate the decision-making process for APHIS.

On the positive side, a Round-Up resistant turfgrass would have some real advantages, both for the turf manager and for the environment. The turf manager would be able to control *Poa annua* in the fairways and on the greens in a way that would have no negative effect on the bentgrass plant. Usually selective herbicides kill the weed, but have at least some negative effects on the desired species such as growth rate, rooting or stress tolerance. This is often where the turf manager has gotten into trouble—by either an excessive application of herbicide or because of an environmental interaction, e.g., rain or temperature. This would not happen with the gene-herbicide system. On the environmental side, the goal is to reduce the use of herbicides that are not considered as safe as Round-Up, or even possibly the total reduction in the use of herbicides. The United States Golf Association, through its Green Section, has supported biotechnology because of this anticipated reduction of total herbicide use.

On the negative side, the major questions that the workshop attendees asked are as follows: Does having a gene for Round-Up resistance alter the process of seed formation and/or the seed? The discussion focused on all the comparisons everyone could think of relating to seed formation, and then the resulting germination and development. It was felt that all characteristics should be studied over two years in order to make sure that the transgenic plant and its seed are the same as the non-transgenic plant and seed. One item that was not covered was the potential for the Round-Up resistant seed to be scattered by wind, animals, or by error. If this seed gets into our lawns or our golf courses, it will be a problem that can't be remedied by using Round-Up; however, this is not the concern of APHIS. It will be the responsibility of the developers of the product to mitigate any contamination problems that occur. This is completely different than the Starlink fiasco in corn because we don't eat the grass seed.

The second area asked whether the introduced gene changes the vegetative growth processes of the new transgenic plant. The main reason that APHIS asks this question is so there are no weediness issues with a new product. It is felt that if the transgenic plant grows vegetatively the same way as the non-transgenic, there will be no additional or unusual weediness issues. Again, a number of tests will be conducted over two years in order to make



Sod growers hope to be able to use transgenic grasses to have weed-free turf.

sure that the transgenic and non-transgenic plants are the same vegetatively. As with seed, the issue is unwanted contamination with no Round-Up control, but again, this is not a concern of APHIS.

The third area, which has been the most contentious with creeping bentgrass, is related to the flowering properties of transgenic turfgrasses. As with seed and vegetative characteristics, APHIS wants the transgenic plant to behave the same way as the non-transgenic plant with respect to flowering, pollination, fertility, breeding behavior and outcrossing to the same and related species. I believe that there will be very minimal differences between the transgenic and non-transgenic plants as far as these flowering characteristics are concerned, and the companies, to their credit, are making every effort to contain the plants, pollen and genes to the proper production fields and not their neighbors' fields. The Scotts Company is currently producing its Round-Up ready creeping bentgrass in a reverse quarantine area where there are no other bentgrass cultivars currently planted or planned for the future in order to greatly reduce the potential of cross pollination between cultivars. This is the area where there is the most concern because many feel that the seed industry will be unable to keep the gene from moving into other cultivars or related species. This will not cause any major problems, but it is felt that the Round-Up gene should not be allowed to contaminate other cultivars, or more importantly, other native species. Once the gene escapes, it is probably impossible to remove it from the population of plants in all the areas planted with bentgrass. If this were to happen, the Round-Up resistance gene would move randomly through the species, resulting in the inability to use Round-Up to control bentgrass in areas where it is a weed.

This is obviously a complex subject, and there is probably no right answer; however, a lot of thought is going into the decision-making process. I believe all parties are trying to do what they think is best for the turf manager, the turfgrass industry, the environment, and society as a whole. The decision will probably be made this summer, and we will hear about the resolution through the media.

Ecosystem Consequences of Trees in Grasslands: Insights from Bessey's Forest

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Nebraska grasslands: eastern red cedar and various deciduous species are expanding in the east while the densities of ponderosa pine are increasing in the Pine Ridge. This study also noted, however, that "two of the largest sinks (woody encroachment and early fire suppression leading to forest "thickening") are also the most uncertain" (Houghton et al. 1999). The documented site history, relatively uniform soils and vegetation of the Sandhills ecosystem, and length of the study (on average 75 years) make the Bessey Unit of the Nebraska National Forest uniquely suited to address the problem of C storage associated with increased woody vegetation in the Great Plains.

Our research group in the School of Natural Resource Sciences at UNL (including Tala Awada, Bill Zanner, Rhae Drijber, Xinhua Zhou and several graduate students) has been studying "Bessey's Forest" since 1999 to examine the ecosystem impacts of tree establishment in grasslands. Although many of the results are still preliminary, some results are clear. Total carbon storage does indeed go up as the density of trees goes up, but there may be strong ecological tradeoffs involved. The soil under dense pine stands is changing dramatically, losing up to 50% of its organic matter and becoming more acidic. Nutrient cycling in these stands is increasingly dominated by duff layer on the forest floor as the underlying mineral soil becomes impoverished. While 75% of the carbon found in Sandhills prairies occurs in soil organic matter, only 10% of the carbon in the dense pine stands is found in soil. Given the high risk of fire throughout the Sandhills, is the extra carbon in the forest stands secure? Another potentially negative consequence of dense pine stands in the Sandhills

is their impact on soil moisture. Although >75% of the precipitation in the Sandhills falls during the spring and summer, hydrologic research suggests that winter, when the dominant warm-season grasses are dormant, might be a critical recharge period for ground water. Physiologists in the research group are measuring daily rates of transpiration for whole pine trees and are finding significant water use whenever temperatures reach above freezing, even in mid-winter. This correlates with soil measurements made over three winters; soil moisture is significantly lower under dense pine stands than in open grasslands. Could extensive tree planting in the Sandhills as initially envisioned by Bessey significantly diminish the role this region plays in the recharge of the regional aquifers? This is a key question for our group's ongoing research.

Our initial research at Bessey's Forest has emphasized the contrast between dense pine stands and treeless grasslands. Most of this forest, however, consists of patchy open savannas and woodlands. These open savannas are more representative of the original woody vegetation scattered throughout the Great Plains and the semi-arid West. Initial results suggest that the potentially negative affects of pines on soil organic matter and soil moisture are not occurring for open, low-density pines. Our physiological data also indicate that open-grown pines are less water stressed, use nutrients more efficiently, and grow faster.

A huge fire swept through the northern half of Bessey's Forest in 1965. Today, the density of trees in that portion is much lower. Most people would say the fire destroyed a forest, but it also created a savanna, which in the long-term, may turn out to be a healthier, more sustainable ecosystem than a dense pine forest.

CGS Associates

Editor's Note: In the Winter 2003 Center for Grassland Studies newsletter, **Stephen Baenziger** was incorrectly identified as the outgoing ASA President. He is the current CSSA President. I apologize for the error.

As part of the Holling Family Award Program for Teaching Excellence at UNL, **Tiffany Heng-Moss** received the Junior Faculty Teaching Excellence Award for the 2002-2003 academic year.

Recipients of the 2002-2003 UNL Teaching Council Awards include **Dennis Brink, James Gosey, George Pfeiffer, Steve Rodie, and Kim Todd.**

Jim Gosey received the 2002 Outstanding Service Award from the Nebraska Simmental Association at the Cattleman's Classic Annual Meeting and Banquet in February.

The Cow-Calf and Forage Systems in the Nebraska Sandhills Team of **Don Adams, Dick Clark, Terry Klopfenstein, Pat Reece and Jerry Volesky** received the 2003 IANR (Institute of Agriculture and Natural Resources) Team Award.

UNL Offers New Professional Golf Management Program



Beginning in the Fall Semester of 2003, UNL will begin offering a new program for undergraduate students: Professional Golf Management (PGM), to be administered by the Center for Grassland Studies.

The goal of the comprehensive PGM program, which takes four and one-half years to complete, is to produce a graduate that has a basic background in managing golf facilities and related organizations, business and personnel management, hospitality and restaurant management, and recreation. The required curriculum for the PGM major includes courses in the College of Agricultural Sciences and Natural Resources (plant and soil sciences), the College of Business Administration (accounting, finance, management and marketing), and the College of Human Resources and Family Sciences (food service management). PGM graduates will receive a Bachelor of Science degree in Agricultural Sciences.

In addition to fulfilling curriculum requirements, the program includes 16 months of structured internship experiences, a player development program, and the simultaneous completion of The Professional Golfers' Association of America (PGA) Golf Professional Training Program (GPTP).

To be accepted into the UNL PGM program, students must have a high school GPA of 2.5 (2.25 for college transfer students) and a golf handicap of 12 or better certified by a PGA professional or high school golf coach. Students will be required to maintain a GPA of 2.5 to remain in the program.

The Nebraska golf community (PGA Professionals, Golf Course Builders Association, Nebraska Golf Association, Nebraska Women's Amateur Golf Association, Nebraska Golf Hall of Fame, and Nebraska Golf Course Superintendents Association) has confirmed the need for this type of training. These organizations are very supportive and enthusiastic about the program's implementation.

Dr. Terry Riordan, professor in the Department of Agronomy and Horticulture, is the PGM Director. Pam Murray, who has been the CGS Coordinator since its inception in 1994, is the PGM Administrative Assistant. Golf Professional Scott Holly will be joining the staff in May as the PGM Coordinator. Providing input to the program are CGS Director Dr. Martin Massengale and the PGM Policy Advisory Committee comprised of faculty in the three colleges involved with the program: Thomas Balke (Accounting); Tiffany Heng-Moss (Entomology); Gerald Horst and Robert Shearman (Agronomy and Horticulture); and Marilyn Schnepf (Nutritional Science and Dietetics).

There are currently 14 PGM programs in the U.S. that are accredited by The PGA. The application for accreditation of the UNL PGM program is pending.

For more information, contact the Center for Grassland Studies. Prospective new or transfer students can also call toll-free to the college recruitment office, 1-866-476-9865, to ask general admission questions or set up appointments with admissions staff and/or PGM staff. Information on the new program will also be available this summer from the CGS Web site.

2003 Nebraska Grazing Conference in Kearney August 11-12



The third annual Nebraska Grazing Conference will be held at the Kearney Holiday Inn on August 11 and 12.

While the program was not finalized as this newsletter went to press, we can provide some information on speakers and topics: Congressman Tom Osborn (invited), Opening Remarks; Greg Simonds, ranch management consultant from Utah, Low-cost Grazing Strategies; Jim Gosey, UNL, Matching Genetics to Resources; Don Adams, UNL, Winter Grazing and Supplementation of Cows; Bob Budd, The Nature Conservancy in Wyoming, Stewardship of Grazing and Biodiversity; Fred Provenza, Utah State University, Learned Grazing Behavior. There

will also be moderated producer panels discussing prescribed burning, drought, and irrigated pastures.

The two-day pre-registration fee of \$70 is due to the Buffalo County Extension office by August 1. The fee covers lunch both days, the evening meal, break refreshments, and materials (including proceedings). One-day registrations are also available. Late fees apply to registrations received or postmarked after August 1.

Participants of the 2001 and 2002 Nebraska Grazing Conference as well as all Nebraska extension educators will receive the brochure in the mail. Others may contact the Buffalo County Extension Office, phone 308-236-1235, e-mail Buffalo-County@unl.edu, or access information and registration form from the CGS Web site (www.grassland.unl.edu).

National Speakers to be Featured at Brush Creek Ranch Conference & Field Day

The Brush Creek Ranch Conference & Field Day, cosponsored by ranch owners Mickey and Sandy Keim and the Center for Grassland Studies, will be held June 20-21, 2003 on the 12,500-acre ranch near Atkinson, Nebraska. National speakers include Alan Nation from Mississippi, book author and publisher of *The Stockman Grass Farmer*; Dr. Barry Dunn, economist at South Dakota State University; Dr. Dick Richardson, specialist in integrative biology at the University of Texas and Dr. Pat Richardson, biochemist, Austin, Texas; Dr. Bob Steger, Steger Ranch Services, Mertzon, Texas; Jim Gerrish, grazing specialist formerly with the Forage Systems Research Center at the

University of Missouri and now in private consulting in North Fork, Idaho; Kit Pharo, Pharo Cattle Company, Cheyenne Wells, Colorado; and Charley Orchard, Land EKG, Bozeman, Montana. Rounding out the program will be Nebraska ranchers, cattle buyers, extension educators and specialists.

Information about the program, registration fees and deadlines, as well as a registration form, are available at www.grassland.unl.edu/brushcreek.htm. For additional copies of the brochure, or information on Continuing Education Units for this program, contact the Center for Grassland Studies, 402-472-4101, grassland@unl.edu.

Iowa Prairie Conference: The Practical Prairie

The 9th Iowa Prairie Conference, hosted by the Iowa Prairie Network, will be held the weekend of July 12 in Ames. The event promises information for beginners and experts alike, with speakers ranging from prairie practitioners to academic researchers.

An icebreaker picnic Friday evening allows gathering attendees to begin the conference with an opportunity for networking. Sessions on Saturday will take place at the Iowa State Center Scheman Building on the Iowa State University campus. Dr. Ron Panzer, Northeastern Illinois University, and Dr. James Trager, Shaw Nature Reserve, Missouri Botanical Garden, will deliver the keynote addresses on prairie invertebrates. Highlighted concurrent sessions include prairie management, land protection, soils, fauna, and the benefits of urban prairies. A panel discussion on prescribed burning issues will also be convened. Field trips will provide an opportunity to spend time with prairie experts in some of central Iowa's finest prairie remnants and reconstructions. Conference attendees will also have the opportunity to browse various vendor, organizational and educational displays. Saturday will conclude with an evening banquet, complete with music and an historic portrayal of Iowa-born Aldo Leopold, one of the nation's leading conservationists of the last century. Sunday morning participants will have continued opportunity to attend other field trips or explore Iowa's prairies on their own.

Registration forms will be available May 1. Register early to ensure the field trip of your choice. For additional information and registration forms after May 1, visit the Iowa Prairie Network website, www.iowaprairienetwork.org, or contact Inger Lamb at 515-963-7681 or 515-240-4358.

Richard Knight to Speak on Biodiversity on Rangelands Oct. 20

Does cattle grazing help or hurt public lands? As part of this year's Center for Grassland Studies Seminar Series, the 2003 Leu Distinguished Lecturer, Dr. Richard Knight, will discuss his recent study that led him to believe cattle ranches may be the best hope for preserving habitat for many varieties of native species. The 2000-2001 study conducted by Knight and colleagues compared data on songbird, mammalian carnivore, and plant communities on three types of land uses: private ranches, public protected areas, and exurban developments (ranchettes). Results showed that overall, the ranches had the healthiest grasslands, fewest number of weeds, and least amount of bare ground.

Knight is a wildlife biologist with the Department of Forest, Rangeland, and Watershed Stewardship at Colorado State University. His seminar will be October 20. While here, he will also visit with faculty and students, including a special session with Grazing Livestock Systems majors.

Presentations in the 2003 CGS Seminar Series will be on most Mondays during the Fall Semester, 3:00-4:00 pm, in the East Campus Union. When finalized, the schedule of dates, speakers and topics will be posted on the CGS Web site, or you can call the CGS office. Seminars are also videotaped and available for checkout from the CGS Reference Center, 221 Keim Hall.

Resources



2003 Turfgrass Research Report. Published by the UNL Turfgrass Science Team, these annual reports (beginning with 1997) are available online at the Team's new Web site:

turfgrass.unl.edu. The publication reports research

results in cultivar trials, disease and insect control trials, fertilizer evaluations, management and physiological studies, weed control and herbicide evaluation trials, and ornamental field trials.

The Color Encyclopedia of Ornamental Grasses. This book by Rick Darke is one of the most authoritative on ornamental grasses. At its heart is the illustrated (507 color photos) alphabetical encyclopedia, with many plants illustrated in more than one season. It is a valuable tool for landscape architects, garden designers, nursery professionals and home gardeners. Author, photographer, and landscape design consultant, Darke received the Scientific Award of the American Horticultural Society in 1998. He was on the UNL campus in 2002 to present the Roger D. Uhlinger Memorial Lectures in Horticulture, hosted by the Nebraska Statewide Arboretum (NSA). You can order the 325-page, hardcover book from NSA for \$49.95 (\$39.95 for NSA members) + s&h. Mail orders to: Nebraska Statewide Arboretum, PO Box 830715, Lincoln, NE 68583-0715, or order online at arboretum.unl.edu/booksandgifts.html.

"There are thus still places in Nebraska where one can lie back on a fragrant bed of last-year's bluestem in early April, with the half-intoxicating odor of freshly germinating grass invading one's nose, and the shrill but majestic music of cranes almost constantly overhead, with occasional harmonies added by arctic-bound if nearly invisible geese. There is then a true sense of belonging to and being a part of the land, and one can only give an unspoken prayer that such treasures will still be there for those of the next generation to savor and love."

Paul Johnsgard, author
The Nature of Nebraska

Calendar

Contact CGS for more information on these upcoming events:

2003

- Jun. 20-21:** Brush Creek Ranch Field Day, near O'Neill, NE
- Jul.12:** 9th Iowa Prairie Conference: The Practical Prairie, Ames, IA, www.iowaprairienetwork.org
- Jul. 26-30:** Annual Meeting of the Soil and Water Conservation Society, Spokane, WA, www.swcs.org
- Aug. 11-12:** 2003 Nebraska Grazing Conference, Kearney, NE, www.grassland.unl.edu/grazeconf.htm
- Oct. 21-22:** The Practice of Restoring Native Ecosystems, Arbor Day Farm/Lied Conference Center, Nebraska City, NE, <http://www.arborday.org/programs/conferencereg28.html>
- Nov. 2-6:** ASA-CSSA-SSSA (Agronomy, Crop Science and Soil Science) Annual Meetings, Denver, CO
- Dec. 7-10:** 2nd Annual National Conference on Grazing Lands, Nashville, TN, www.glci.org/2NCGLindex.htm

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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