

Center for Grassland Studies

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Genetically Enhanced Turfgrasses — Where Are We Going?

by Terrance Riordan, Department of Horticulture, University of Nebraska-Lincoln

Currently there are no genetically modified turfgrasses either on the market or close to commercial availability. With all the controversy over genetically modified agronomic crops, it is worthwhile to look at the reasons that turfgrasses are being considered for this new technology.

There are three major reasons turfgrasses are being considered for enhancement or genetic transformation: 1) there are environmental concerns related to the current use of turfgrasses, 2) there is currently increased economic incentive to develop improved or environmentally friendly turfgrasses, and 3) the technology is now available to successfully enhance or transform turfgrasses. A review of these three reasons concludes that it is now possible to protect the environment by substituting a safer herbicide, RoundUp, for other less-safe herbicides like 2,4-D, while earning a return on investment in an over one-billion-dollar turfgrass seed and sod market.

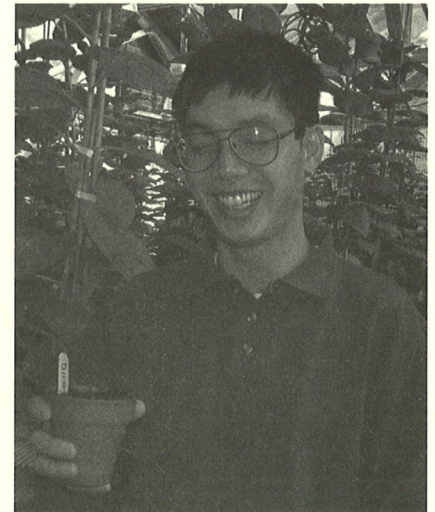
Although RoundUp resistance is mentioned as an initial introduction of an important characteristic, there are other characteristics that are being considered for research and potential transformation including insect, disease, drought, heat and cold tolerance, improved color and reduced growth. However, the characteristic most easily understood, selected for and with the most agronomic stability, is RoundUp resistance. Therefore, this will be the first characteristic that appears in a turfgrass. The turfgrass species initially targeted for transformation include Kentucky bluegrass, creeping bentgrass and buffalograss, because they would be relatively safe to use initially and their adaptation covers a significant portion of the United States. Surveys of lawn enthusiasts have shown that significant numbers would be interested in using a RoundUp-resistant product.

The technology used to transform turfgrasses is fairly well known because of the development of RoundUp-ready agronomic crops such as corn and soybeans. The

technology involves the identification of the gene for resistance, isolation and cloning of the gene, studies of function and regulation, and finally, transfer of the gene and other expressive factors to other plants (turfgrasses in this case). Many of these technologies were developed by the Monsanto Company, which also owns the patent rights to RoundUp. Monsanto and the Scotts Company have been very involved with the research and development of RoundUp resistance in turfgrasses.

Scotts managers decided early on that transformation technology would be very significant in the turfgrass industry. They made the business decisions necessary to be a major force in the research and development of genetically enhanced turfgrasses. One decision was to acquire part of Sanford Scientific, the company that developed the gene gun that provides the mechanism for getting the gene inside the cells of the turfgrass. By partnering with Sanford Scientific, Scotts was able to make agreements with other companies and universities that fit with its business plan and hopefully will generate a profit for its stockholders.

Faculty members involved with the University of Nebraska turfgrass research program were contacted



Shuizhang Fei holds a plant from his genetically enhanced buffalograss project.

(continued on page 6)



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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.

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FROM THE DIRECTOR

Mention is often made of the land-grant university and its tripartite mission of research, teaching, and service or outreach. These universities were founded upon the idea of serving their clientele and helping average citizens improve their lives. For the most part, they have remained true to their mission. The University of Nebraska makes considerable effort to share the knowledge generated through research and creative activity with people outside the University.

The academic research and classroom teaching components are mostly handled on university campuses, but the outreach component is conducted largely off campus. Also, it is often handled in cooperation with other groups. Outreach involves the delivery, application, and in some cases, the generation of knowledge for the well-being of our citizens.

I recently participated in an outstanding example of the outreach component, and I would like to share some thoughts from that effort with you. The 38th Annual Nebraska Turfgrass Conference was sponsored by the Nebraska Turfgrass Foundation in cooperation with the Turfgrass Science Team at the University. This conference has drawn 600 to 800 participants in each of the last several years. It was initiated to serve the turfgrass industry in its broadest context, and it still does an excellent job of that.

The general conference theme is determined by the Directors of the Nebraska Turfgrass Foundation and members of the University's Turfgrass Science Team. Thereafter, members of the Turfgrass Science Team take responsibility for organizing the specifics of the program, securing the speakers, and generally overseeing and operating the different sections.

Sessions include workshops on technical subjects of interest and importance to those working in the turfgrass industry for continuing education and certification purposes. Also included are general sessions on specific topics presented by specialists from within and external to the University. An important component of the conference is an industry exhibit. The arrangements are organized by the Nebraska Turfgrass Foundation staff and leaders in the industry. Those attending the conference are able to see and discuss new and modified equipment for handling all kinds of turf work with the company representatives.

This conference is a prime example of university faculty, industry representatives, turfgrass managers and their employees all working together for the benefit of the common good—improved turfgrass care and management. The importance of turfgrass is increasing each day, and here is an activity supported by several groups working for the improvement of that industry in Nebraska. Moreover, it is a prime example of the University's outreach effort.

I congratulate and salute members of the Turfgrass Science Team for a highly successful outreach effort and one that can serve as an exemplary role model for other similar efforts.

M. A. Massengale

2000 Nebraska Range Short Course

by Lowell Moser, Department of Agronomy, UNL

More than 23 million acres, or nearly half of the total land area of Nebraska, is in rangeland. Although there are only sparse amounts of the Tallgrass Prairie that remain in the eastern part of the state, 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 established an adult education program in range management. The short course 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 short course 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 short course, using northwest Nebraska as an outdoor laboratory.

The short course 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.

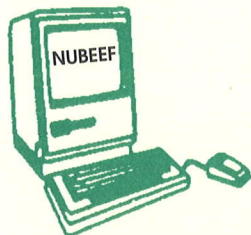
Since Nebraska is a private land state, nearly all of the range is grazed. The final section offers an integrated summary of profitable livestock production and range sustainability. In each section fundamental principles are taught in a classroom setting in the mornings, and the concepts are applied 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 and socially in the evenings and at meal times. The short course consistently receives high ratings from participants.

The course will be offered June 25-30, 2000, at Chadron State College. If desired, academic credit can be obtained from the University of Nebraska or Chadron State College. Also, CEU credits are available for the "Certified Professional in Range Management" program. The registration fee is \$125 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 <http://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.

NUBEEF — Educational Web Site for Beef Producers

by Rick Rasby, Department of Animal Science,
University of Nebraska-Lincoln



To further meet the needs of cattle producers in Nebraska, the University of Nebraska Extension Beef Specialists developed an educational Web site. The site currently targets cow/calf producers as its primary audience. For producers that are short on time or for producers

that have a full- or part-time job off the farm and are not able to attend educational programs, this Web site could be your link to educational information.

The site consists of the following features: **Timely Topics** — addresses current and timely issues that pertain to cattle management and the beef cattle industry; **Beef Forum** — two or more people are asked to address a specific problem, concern, or management practice associated with the beef industry; **Educational Programs** — lists upcoming programs, conferences, symposia, and workshops, including time, date, location, contact person(s), and how to register; **Question and Answer** — producers can submit questions and the appropriate people will respond; **Frequently Asked Questions** — allows visitors to view posted questions and answers; **Weather** — links to weather.com; **Production Calendar** — suggested general management practices and feeding and herd health considerations by month of the year for a spring-calving cow herd; **Web Resources** — links to other educational Web sites and to written material such as Nebraska's NebGuides; **Learning Modules** — producers can learn or "brush up" on cow/calf management techniques.

The Web site is designed so that the material developed in the Timely Topics, Beef Forum, and the Frequently Asked Questions are put into a searchable database.

The address for NUBEEF is <http://deal.unl.edu/nubeef>. We look forward to having you visit our Web site as a source of educational information.



Richard (Dick) Spangler Jr., a former CGS Citizens Advisory Council member, received the Distinguished Service Award from the Nebraska Turfgrass Foundation at its recent meeting in Omaha. This award is given to an individual who has contributed significantly to development of the Nebraska Turfgrass Foundation and the ideals it represents.

Bison Symposium in Lincoln April 6-8



The University of Nebraska's Center for Great Plains Studies presents its 24th annual symposium, *Bison: the Past, Present, and Future of the Great Plains*, April 6-8, 2000 in Lincoln, NE.

Since the last ice age, the American Bison has played an important role in shaping the cultures, environment, and history of the Great Plains. Bison as a spiritual force, a food source, a commercial product, and an active part of the ecology of the Plains form the focus of this interdisciplinary symposium.

Some of the areas covered by the program are bison prehistory, indigenous perspectives, historical and cultural legacies, preservation, ecological issues, grazing and grasslands, diet and management, Canadian wood bison, and fossil indicators, as well as literary and artistic portrayals.

Dan Flores, professor of history at the University of Montana, Missoula, will open the conference with a keynote address. Flores is the author of *Horizontal Yellow: Nature and History in the near Southwest*. Other keynote speakers include Arvol Looking Horse speaking on the role of bison in Native American spirituality; Louis LaRose, ITBC President and Bison Herd Manager, talking on his role in bringing back the bison to the Winnebago way of life; and Don Gayton, a writer and ecologist from British Columbia, who will talk about bison from the perspective of scientists.

Complete registration and program information can be obtained by contacting Conference Coordinator Kim Weide at 402-472-3964, kweide1@unl.edu, or see <http://www.unl.edu/plains/2000symp.htm>.

CGS Welcomes Laurice Matulka

Laurice Matulka joined the Center for Grassland Studies staff in January. She is working on a two-year USDA Higher Education Challenge Program grant to coordinate implementation of and recruitment for the new Grazing Livestock Systems major at the University of Nebraska-Lincoln.

Laurice has a bachelor's degree in Animal Science from UNL and a master's degree in agriculture from Texas Tech University, where she has worked for the past four years. You can reach Laurice at 402-472-0917, lmatulka2@unl.edu.

For more information on the Grazing Livestock Systems major, see the CGS Web site, <http://ianrwww.unl.edu/ianr/cgs/index.htm>, or contact the CGS office.

GLCI Lists Benefits of Grazing Lands

The Grazing Lands Conservation Initiative lists the following benefits of grazing lands:

- Grazing lands are our country's largest land use.
- Grazing lands are our most extensive watershed and contain the majority of our riparian areas. Well-managed grazing lands increase water yields and water quality, while providing other offsite benefits such as sustained stream flow, groundwater recharge, and flood reduction.
- Grazing lands are important areas for the recycling of organic by-products from agriculture, cities, and industry. These organic wastes are put to beneficial use by conversion of nutrients from these materials into forage, and then into grazing land products such as food, fiber, pharmaceuticals, cosmetics, and natural fertilizers.
- Well-managed grazing lands have tremendous potential to improve ecosystem health and human health through reduction of invading noxious weeds and brush. In many parts of the country, invading plants not only degrade grazing land plant communities, but also produce an abundance of allergens harmful to human health.
- Most wildlife populations—game and non-game species—are dependent on the habitat diversity occurring on grazing lands for food and shelter.
- Other benefits derived from well-managed grazing lands include restoration of natural spring flow, stream fisheries enhancement, sustained ecosystem health and productivity, and a reduction of the nation's dependence on fossil fuel energy.

Source: *GLCI News*, September-October, 1999. See GLCI Web page, <http://www.glci.org/>.

Glickman Calls for National Commitment to Preserve Private Land

At the USDA National Conservation Summit on Private Lands Conservation at Iowa State University on December 7, 1999, Agriculture Secretary Dan Glickman called for a renewed national commitment to preserving private land. Prompting the call was the release of a new national study that shows America's conservation efforts falling short.

Glickman released USDA's National Resources Inventory, a report on the health of America's private land, which accounts for about 70% of the land in the U.S. The report finds:

- From 1992 to 1997, nearly 16 million acres of agricultural and forest land were developed. We are now losing 3 million acres per year of forest and agricultural land, double what was lost each year from 1982 to 1992.

- Nearly 2 billion tons of soil are eroding into waterways each year. Despite significant gains in erosion control during the past 15 years, there has been no additional improvement since 1995.
- Gross wetland losses have increased to 54,000 acres annually on agricultural land. But wetland preservation efforts, like the Wetland Reserve Program, are helping. Wetland gains are nearly 30,000 acres.
- Tree and forest cover in urban areas is declining at an alarming rate. In the Chesapeake Bay region, for example, tree canopy has declined from 51% cover to 37% in the last 25 years.

At the Summit, Glickman urged participants from the business, agriculture and forestry communities, landowners, conservation leaders, academicians, and environmental activists to provide leadership in a collaborative effort to improve the declining health of the nation's private land. Glickman also said he would recommend that the President convene a national conference on conservation next year.

For additional information on the National Conservation Summit on Private Land or the survey itself, see <http://www.nrcs.usda.gov/WhatsNew/html>.

Nebraska Ranch Practicum Again Offered

The second offering of the new 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 13-14, July 18, September 14, November 14, and January 10-11, 2001.

Applications must be received by April 1 (enrollment is limited to 30). The registration fee is \$500, \$100 of which must accompany the application. For more information, 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; Bud Stolzenburg, Cherry County Extension, 402-376-1850, bstolzenburg1@unl.edu; Brent Plugge, Central Sandhills Area Extension, 308-645-2267, bplugge1@unl.edu.

Genetically Enhanced Turfgrasses (continued from page 1)

initially by Monsanto personnel concerning our interest in working with them on the genetic enhancement of turfgrasses. This initial contact led to a research agreement with Monsanto and later the Scotts Company. Currently a commercial agreement is being developed with these companies that also involves our sod producer cooperators, who possibly would be the suppliers of the enhanced vegetative products. In developing these agreements, the guiding philosophy was that the best agreement would be in the best interest of all the parties involved, including the consumer. I believe that a genetically enhanced turfgrass will sell at a premium—maybe even a significant premium—over a similar non-enhanced turfgrass. However, I believe that as consumers, we often are willing to pay a premium to obtain a really good product that provides value, and if a product doesn't provide the value advertised, we won't buy it.

Earlier, I indicated that there are no genetically enhanced turfgrasses on the market; however, these products are on the way. Currently there are Kentucky bluegrasses and creeping bentgrasses being evaluated that are resistant to RoundUp, and there may be buffalograsses that have the gene in their cells, but the plants are still in the laboratory; a great deal of testing or even plant breeding will be required before the final products reach the market. However, because of the perceived potential value and the rapid advances in technology, these products may make it to the market relatively rapidly.

Doctors Shuizhang Fei and Usha Raj Saran are conducting much of our work in Nebraska at the UNL Beadle Center for Biotechnology under the direction of Dr. Tom Clemente, who is Director of the Plant Transformation core facility. Our research is being supported by the Agricultural Research Division of the Institute of Agriculture and Natural Resources. This support, along with the research

licenses and encouragement from Monsanto and Scotts, makes it quite likely that the project will be successful and we will have a RoundUp-resistant buffalograss that can be considered for use in the urban landscape and the golf course.

Major concerns about genetically modified turfgrasses include: 1) effect of gene products on non-target organisms, 2) effect on competitiveness of the plant (grass becomes a serious weed), 3) accidental transfer of introduced genes to other plants (cross pollination), and 4) natural development of herbicide resistance in weedy populations. With buffalograss we have tried to address some of these concerns by selecting the right target plant. Turfgrasses, especially buffalograss, are relatively non-competitive plants and often will invade only areas where nothing else is growing. Buffalograss is not very shade tolerant, and therefore, will not be a problem in agricultural crops or other turfgrasses. Also, in an effort to make sure that the gene doesn't move to other plants or areas, we have selected female target plants that produce only female flowers. This reduces significantly the possibility of escape of the gene from an enhanced plant. Another way to control the enhanced turfgrass and the gene within buffalograss will be to market the product only as vegetative sod or plugs. This controls where the product goes and greatly reduces the chance of escape by misapplying seed. Finally, it is possible that there will be restrictions in the production and use of these products until everyone is comfortable that the turfgrass is completely safe. Similar safeguards are being developed for the other enhanced turfgrasses.

This information summarizes what is happening with the new genetically enhanced turfgrasses. Also, I have tried to suggest that when available, the product will be safe, and that, even though the cost may be higher, the value to the turfgrass manager must be there for the product to be successful.

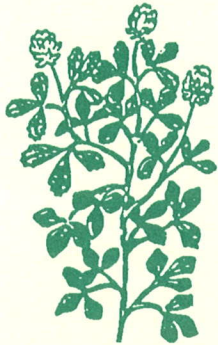
April 1 Deadline for Abstracts National Conference on Grazing Lands

The first National Conference on Grazing Lands will be held December 5-8, 2000 in Las Vegas. The conference is being hosted by the National Association of Conservation District's Grazing and Public Lands Committee (NACD), the Grazing Lands Conservation Initiative (GLCI), and several other sponsoring organizations. The conference is intended to heighten awareness of the economic and environmental effects of proper grazing land management. Target audiences include consumers, conservationists, environmentalists, urban-based resource interests, grazing land managers, landowners and others interested in effective natural resources management. Abstracts for oral

and poster papers are being accepted in the following categories: building partnerships between agricultural, grazing and urban communities; successful "cutting edge" management technologies for grazing practices; economic and public policy implications of grazing; and optimizing grazing land health for environmental and social benefits. Farmers and ranchers are particularly encouraged to present.

For details on submitting an abstract, see <http://www.glci.org/Call.htm> or contact John Peterson, 9304 Lundy Court, Burke, VA 22015-3431, phone 703-455-6886, fax 703-455-6888, jwpeterson@erols.com.

Technology Spurs Alfalfa Genome Mapping



Using computer technology to magnify light microscope images, scientists are getting the closest look yet at the chromosome housing for alfalfa's genes.

The advance opens the door to genome mapping of alfalfa's 32 chromosomes for traits like winter hardiness, stand persistence, and resistance to pests such as potato leaf hoppers.

Alfalfa is among America's most widely grown crops, generating over \$6 billion annually, primarily as hay. Yet compared to corn or soybeans, less is known about its complex genetic make-up, slowing breeding efforts. Over the past 30 years, for example, alfalfa's average yield has only increased by about one percent.

Part of the problem also stems from the fact that alfalfa plants are autotetraploid, meaning their traits are governed by genes residing on four chromosomes instead of two. The legume's chromosomes are also hard to distinguish, and barely visible under a microscope.

Or so it was until scientists Gary Bauchan and Azhar Hossain tackled the problem. With help from a Maryland firm, Loats Associates, they attached a light microscope to a computer imaging system at their Beltsville Soybean and Alfalfa Research Lab, operated by the USDA Agricultural Research Service.

The result: a 10,000-fold increase in magnification, use of false-color, and the precise identification and measurement of the chromosomes' length—key to karyotyping, or arranging them from largest to smallest.

Along the chromosomes' "arms" scientists observed thick bands of heterochromatin, material composed of DNA and protein. Like chromosomal roadblocks, the bands can impede the exchange of genes during breeding. One hope is that falcata alfalfas, which contain relatively few heterochromatin bands, will help breeders introduce new traits from wild species to domestic cultivars, broadening their genetic base.

The scientific contact for this research is Gary Bauchan, ARS Soybean and Alfalfa Research Laboratory, Beltsville, MD, phone 301-504-6649, fax 301-504-5169, gbauchan@asrr.arsusda.gov.

A longer story about the advance is online at <http://www.ars.usda.gov/is/AR/archive/aug99/gene0899.htm>

Source: ARS News Service electronic press release, Aug. 2, 1999.

Field Trip Graduate Course Focuses on East Coast Ecology

Texas Tech University, Virginia Tech, and the University of Tennessee will again host a graduate level ecology study-travel course titled "Ecology of Grazing Lands Systems." This year the course runs May 28 through June 10. The class begins in Florida and will travel through Georgia, Alabama, Tennessee, Virginia, Maryland and Pennsylvania. It will provide an opportunity to learn about ecology of grazing lands and grazing issues from the subtropical region of Florida, through the Coastal Plains and Piedmont regions, into the Appalachian Mountains across the Chesapeake Bay, up the Eastern Shore and into the Pennsylvania Dutch Country. Research and production needs and objectives in a wide range of geographical and climatic areas will be discussed as well as techniques used by other scientists in soil-plant-animal research. Students will interact with many individuals active in forage-livestock research, teaching, extension, industry and production.

The instructors handling the course and traveling with the students will be Dr. Vivien Allen and Dr. Rob Mitchell of Texas Tech, Dr. Ozzie Abaye of Virginia Tech, and Dr. John Waller of the University of Tennessee. Students sign up for an independent study course (three credit hours) through their home institutions. Course requirements include reading assignments, discussion participation, forage species collection, and a post-trip summary. Prior course work in soils, animal nutrition, and forage crops is highly desirable. In addition to tuition, students will be responsible for travel to and from the beginning and ending points of the trip. Enrollment is limited. For more information, contact the CGS office, or Dr. Vivien Allen, 806-742-1625, felician@ttu.edu.

CGS Associate News

The work of Nebraska researchers, including ARS soil nitrogen expert **Jim Schepers**, on the Management Systems Evaluation Areas (MSEA) water quality program is highlighted in the January 2000 issue of *Agricultural Research*, published by USDA-ARS. The MSEA program has been working on ways to reduce the amount of pesticides in ground and surface water (see <http://www.ianr.unl.edu/ianr/waterctr/wcimp.html>).

Info Tufts



Nebraska NRCS received \$750,000 in Emergency Watershed Protection funds to provide assistance to the landowners impacted by the Sandhills wildfire that burned 74,840 acres of grassland last spring in the Thedford area.

Resources



The 2000 *Nebraska Beef Report* is now available in hard copy and online. It contains 30 research articles on a variety of topics related to beef production. You can obtain a copy from the Center for Grassland Studies,

or print from <http://www.ianr.unl.edu/pubs/beef/beefrpt.htm>.

"Rangeland Crossroads" is a new electronic newsletter published by the Colorado State University Department of Rangeland Ecosystem Science and CSU Cooperative Extension. It covers livestock production, recreation, open space, wildlife habitat, and more. Learn how to subscribe at <http://www.cnr.colostate.edu/RES/rc/index.html>.

The Center for Grassland Studies reference center contains many videos, books, reports, newsletters, and other materials suitable for research and education in the categories of Range/Grazing/Pastures/Forages, Great Plains/Prairie/Sandhills, Biodiversity, Water/Wetlands, Landscape Design, Resource Management, Biotechnology, Turf, Ecosystem Conservation/Preservation of Environment, and many more. Among the videos are those made of selected CGS Fall Seminar Series presentations. The themes of the last two series were Prairie Restoration (1998) and Grassland Ecology (1999). See <http://ianrwww.unl.edu/ianr/cgs/seminars.htm> for a list of seminar titles and presenters. All materials are available for checkout to faculty, staff, students, and the general public. Stop by 221 Keim Hall on the UNL East Campus and see what we have!

Calendar

Contact CGS for more information on these upcoming events:

2000

- Jan.-Apr.:** UNL Water Resources Seminar Series on the past, present and future of Nebraska's interstate compacts on water and natural resources, held 3:00 on most Wednesday's beginning Jan. 12 through April 19, Lincoln, NE. For topics and speakers, contact Steve Ress, 402-472-3305, sress1@unl.edu.
- Feb. 13-18:** Society for Range Management Annual Meeting, Boise, ID, <http://srm.org/boisemeeting.html>
- Feb. 27-28:** 11th Platte River Basin Symposium, Kearney, NE
- Mar. 6-8:** 29th Nebraska Water Conference, Lincoln, NE
- Mar. 28-29:** Global Sustainability Conference (incl. carbon sequestration and ecological practices in agriculture and forestry), Springfield, IL
- Apr. 3-5:** Monitoring for Ecosystem Health Conference, Regina, Saskatchewan, <http://www.serm.gov.sk.ca/ecosystem/monitoringconference/index.php3>
- Apr. 6-8:** Center for Great Plains Studies 24th Interdisciplinary Symposium—Bison: The Past, Present, and Future of the Great Plains, Lincoln, NE, <http://www.unl.edu/plains/2000symp.htm>
- Apr. 9-13:** BES-ESA 2000: A Joint Symposium Meeting of the Ecological Society of America and the British Ecological Society, Orlando, FL, <http://esa.sdsc.edu/bes-esa.htm>
- Apr. 15-19:** Annual Symposium of U.S. Chapter of the International Association of Landscape Ecology, Fort Lauderdale, FL, <http://www.ces.fau.edu/iale2000/>
- July 16-19:** American Forage and Grassland Council and the North American Alfalfa Improvement Conference Annual Meeting, Madison, WI, <http://www.forages.css.orst.edu/Organizations/Forage/AFGC/Conferences/#AFGC>
- July 16-20:** 17th North American Prairie Conference, Mason City, IA, <http://www.niacc.com/prairie2000/>
- Oct. 15-19:** Bioenergy 2000: Moving Technology into the Marketplace, Buffalo, NY
- Dec. 5-8:** National Conference on Grazing Lands, Las Vegas, NV, <http://www.glci.org/Call.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.

Center for
Grassland
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