University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Center for Grassland Studies Newsletters | Grassland Studies, Center for

10-1-2008

Center for Grassland Studies Newsletter, Fall 2008, Volume 14, No. 4

Follow this and additional works at: http://digitalcommons.unl.edu/grassland_newsletters

Part of the Other Plant Sciences Commons

"Center for Grassland Studies Newsletter, Fall 2008, Volume 14, No. 4" (2008). *Center for Grassland Studies Newsletters.* Paper 53.
http://digitalcommons.unl.edu/grassland_newsletters/53

This Article is brought to you for free and open access by the Grassland Studies, Center for at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Center for Grassland Studies Newsletters by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Center for Grassland Studies

E-mail: grassland@unl.edu
www.grassland.unl.edu

Phone: (402) 472-4101
Fax: (402) 472-4104

Volume 14, No. 4
Fall 2008

University of Nebraska Lincoln

Managing Grasslands for Structural Heterogeneity

by Alexander Smart, Department of Animal and Range Sciences, South Dakota State University

During the last 30 years, scientific scrutiny of standard grazing practices designed to optimize livestock production on grasslands of the Great Plains has led to observations that other ecosystem services that grasslands provide are constrained. In addition to livestock production, grasslands provide habitat for wildlife, sequester carbon, improve water quality, and are a refuge for maintaining native plant diversity. Strong profit motives are likely responsible for decisions to apply high stocking rates, which often results in a landscape dominated by shorter, more grazing resistant plant communities. It's easy to place blame on this practice because of the striking impacts overstocking has on wildlife, water quality, and plant diversity. Yet, use of some more sophisticated techniques of rotational grazing often results in a uniform vegetation structure across the landscape, albeit not as short as heavy continuous grazing.

Figure 1. Patch-burn in eastern South Dakota tallgrass prairie, spring 2007 (Photo A.J. Smart, 2007).

Recent investigations suggest that age-old management tools aimed at improving grazing distribution have resulted in a predictable habitat structure that may actually reduce plant and animal diversity across a managed landscape. Grassland bird diversity has become the focal illustration to prove this point. Proponents of a multiple-use concept, meaning grasslands could be managed for both ecosystem goods (livestock production) and services (habitat, carbon sequestration, diversity, etc.), argue for a change in how we manage livestock grazing. Historically and still to this date, rest-rotation and deferred-rotation grazing strategies have been effective tools at providing contrasting vegetation structure that have benefitted wildlife. In the last 10 years, a new strategy called "patch-burn grazing" has been proposed as an alternative to conventional rotational grazing techniques (Figure 1).

The concept behind patch-burn grazing is to reintroduce ecosystem processes that once dominated the Great Plains. Historical evidence suggests that fire and large ungulate grazing co-existed for a long time in the Great Plains such that these ecosystem processes created a shifting mosaic of vegetation structure across the landscape. This mosaic of vegetation structure created a tight evolutionary bond between plants and animals, and maximized regional diversity.

Patch-burn grazing offers several intriguing benefits to the landscape and the land manager. First and most obvious, patch-burn grazing brings back fire as a management tool to the landscape. Fire has been suppressed in the Great Plains for the last 100+ years. There are unique places such as the Flint Hills of Kansas or the Osage Hills of Oklahoma where fire is still a consistent part of the land management process. For the most part, however, fire is quite rare, especially in the northern Great Plains states of Nebraska, South Dakota, and North Dakota.

Secondly, no rest period is required after fire. Cattle can be placed in the pasture immediately after the burn or can even be in the pasture when the burn occurs. Thirdly, no fences or additional water developments are needed. The desired outcome of patch-burn grazing is to increase the structural heterogeneity across the landscape, with a corresponding increase in plant and animal diversity: "if you build it, it will come." Several recent publications from the southern Great Plains have provided evidence that plant and animal diversity is increased through patch-burn grazing. Research has shown that traditional grassland management yields less forbs, insect species, and grassland birds compared to patch-burn grazing.

(continued on page 5)

IANR

The University of Nebraska–Lincoln does not discriminate based on gender, age, disability, race, color, religion, marital status, veteran's status, national or ethnic origin, or sexual orientation.

Policy Advisory Committee Members

Ann Antlfinger
Department of Biology, UNO

Alan Baquet
Department of Agricultural Economics, UNL

John Craig
Nebraska Department of Roads

Steve Chick
USDA, Natural Resources Conservation Service

Jim Douglas
Nebraska Game and Parks Commission

Roch Gaussoin
Department of Agronomy and Horticulture, UNL

Terry Gompert
Cooperative Extension, UNL

Greg Ibach
Nebraska Department of Agriculture

Terry Klopfenstein
Department of Animal Science, UNL

Svata Louda
School of Biological Sciences, UNL

Jim Stubbendieck
Department of Agronomy and Horticulture and Center for Great Plains Studies, UNL

Ken Vogel
USDA, Agricultural Research Service

Steven Waller
IANR Administration, UNL

David Wedin
School of Natural Resources, UNL

Dayle Williamson
Formerly with Nebraska Department of Natural Resources

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

Philanthropy has had a major impact on public education and, especially, the University of Nebraska. The Center for Grassland Studies is one of the benefactors of that philanthropy to the University. The State of Nebraska provides basic support for the Center, but the work of the Center has been greatly enhanced by private support. Funds intended for the University's benefit are normally donated to the University of Nebraska Foundation and earmarked for specific purposes within the university.

I would like to share some examples of where private support has made a difference in our programs. Two significant working ranches in Nebraska were donated to the Foundation for use by the University for grasslands, grazing and livestock research and educational programs. The Gudmundsen Sandhills Laboratory near Whitman and the Barta Brothers ranch in southern Brown and Rock counties have provided opportunities for students and faculty to conduct projects that would not have been possible previous to our having these facilities. Other contributions later have enabled us to add buildings and equipment to provide even better facilities for conducting research and educational programs at these locations.

Another generous donation made it possible for the University Foundation to purchase the Nine-Mile Prairie near Lincoln. This is a sizeable tallgrass prairie in which the sod has never been broken, and provides a wonderful outdoor laboratory for our faculty and students to handle numerous projects relating to tallgrass prairies and grassland ecology.

The Center has been enriched on several occasions by hosting distinguished lecturers made possible by an endowment from the Frank and Margaret Leu family. Just recently, Dr. Dennis Ojima, a senior scholar at the H. John Heinz III Center for Science, Economics and the Environment in Washington, D.C., was on campus to present a lecture and to interact with faculty and students on the subject of grasslands adapting to global change. His visit was made possible by the Leu Endowment Fund.

Numerous individuals and companies have supported scholarships, fellowships, assistantships and professorships. Tuition and fees have increased significantly in recent years; therefore, these funds have made it possible for many talented young people to obtain an education that would have been very difficult without this kind of support.

Another type of contribution that is often overlooked is an "in-kind" contribution whereby people contribute their time, talent and/or product. The Center benefits greatly from two important advisory committees: the Policy Advisory Committee and the Citizens Advisory Council. The Policy Advisory Committee consists primarily of university faculty and government agency people, whereas the Citizens Advisory Council is composed of stakeholders who experience the impact of our scientists' and educators' efforts. The time, ideas and efforts these individuals devote to the Center activities are highly valuable and much appreciated.

All of the kinds of contributions discussed above play a vital role in helping with our research and educational programs, and provide opportunities for faculty and students to experiment, learn and grow professionally. It is a comforting feeling to know that one's time and resources are benefitting others, and those of us who are benefactors of that generosity say "Thank You!"

M. A. Massengale

Yellow Nutsedge: The Scourge of Lawns and Landscapes in Nebraska

by Roch Gaussoin, Department of Agronomy and Horticulture, UNL

Yellow nutsedge *(Cyperus esculentus)* is a common, persistent and troublesome weed in lawns and landscapes in Nebraska. This is especially true from Kearney east into Iowa. Yellow nutsedge thrives in waterlogged soil, and its presence often indicates that drainage is poor, irrigation (frequency/quantity) is excessive, or sprinklers/valves are damaged and leaking. Once this tenacious weed becomes established, it can survive and persist with no irrigation, and has been documented to survive prolonged drought. More than 150 sedge species can be found in Nebraska such as annual *Carex*; none is as problematic as yellow nutsedge in lawns and gardens. The nutsedge problem is not isolated to Nebraska, with documented occurrence in 48 of the 50 states including Alaska, and several Canadian provinces (Figure 1). This is a species capable of tolerating extremes in temperature and precipitation, but is generally found in lower elevations. This article will describe basic biology of this persistent pest and ongoing work at UNL to identify strategies for management and control.

Identification

Although yellow nutsedge is often referred to as "yellow nutgrass" and the leaves resemble those of a grass, it is not a grass but a true sedge. The leaves are thicker and more rigid than most grasses and are arranged in sets of three at the base, whereas grass leaves are opposite in sets of two. Nutsedge stems are solid, and when looked at in cross section, they are triangular; grass stems are hollow and round, and in cross section they are almost flat or oval. One of the common references for identification of sedges is "sedges have edges." By rolling the stem between your fingers, the triangular or "edge" of the stem is easily recognized.

Yellow nutsedge reproduces by underground storage organs called tubers, which are incorrectly called "nuts" or "nutlets," thus the origin of its common name. These tubers are produced on rhizomes (underground stems) that grow as deep as 8 to 14 inches below the soil surface. Buds on the tubers sprout and grow to form new plants; thus, individual nutsedge plants eventually form patches that can range up to 10 feet or more in diameter. Yellow nutsedge produces round, smooth, brown or black tubers that are about 1/2 inch at maturity. Only one tuber is formed at the end of a rhizome. Tubers of yellow nutsedge have a pleasant almond taste. It has been estimated that, if planted in a pure stand, yellow nutsedge would produce approximately the same yield as potato.

Life Cycle

Yellow nutsedge is a perennial plant. Its leaves and flowering stalks die back in fall as temperatures decrease, but tubers and rhizomes survive in the soil and sprout the following spring when soil temperatures remain above 43°F. The majority of tubers can be found in the top 6 inches of soil where they can survive for 1 to 3 years. In field crops, research indicates that most plants sprout from tubers, and seeds do not contribute much, if any, to the spread of nutsedge.

Figure 1. USDA Plant Database (http://plants.usda.gov/java/profile?symbol=CYES) distribution for yellow nutsedge (*Cyperus esculentus*). Darkened states/provinces indicate documented collection. Species may not be distributed uniformly within states and provinces.

Damage

Yellow nutsedge is a problem in lawns because of accelerated growth during the summer months, a more upright growth habit, and a lighter green in color than most grass species, resulting in a nonuniform turf. In gardens and landscapes, it will emerge through bark or rock mulches and landscape fabric in shrub plantings and vegetable and flower beds throughout the growing season.

Management

The online publication http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7432.html provides the following management suggestions (in italics and quotation marks) for yellow nutsedge. "*Tubers are key to yellow nutsedge survival. If you can limit production of the tubers, then the nutsedge will eventually be controlled. To limit tuber production, remove small nutsedge plants before they have five to six leaves; in summer this is about every 2 to 3 weeks. Up to this stage, new tubers have not yet formed. By removing as much of the plant as possible, the tuber will be forced to produce a new plant, drawing its energy reserves from tuber production to the production of new leaves. Continually removing shoots eventually depletes the energy reserves in the tuber because 60% of the reserves is used to develop the first plant and 20% for the second. However, mature tubers can resprout as many as 10 to 12 times. Even though these newer sprouts start out weaker than the previous ones, they will gradually resupply the tubers' energy reserves unless they are removed.*

(continued on page 4)

Table 1. Preemergence yellow nutsedge control in spring seeded tall fescue with herbicides and subsequent effects on turf cover, College Park, MD 2007.

		Tall fescue coverage							Yellow nutsedge coverage		
Herbicides [y]	Rate lb ai/A	31 May	8 Jun	14 Jun	20 Jun	28 Jun	12 Jul	1 Aug	31 May	20 Jun	1 Aug
		%							%		
Tenacity 4SC	0.25	51.8 a [z]	40.5 b	40.8 b	46.3 c	33.8 bc	35.5 cd	73.8 a	41.7 b	43.8 b	21.3 b
Tenacity 4SC	0.125+0.125	61.3 a	72.0 a	81.8 a	72.0 b	76.5 a	69.0 ab	76.3 a	21.7 c	20.3 c	11.0 c
Tenacity 4SC	0.187+0.187	52.5 a	84.8 a	85.3 a	83.8 a	87.0 a	86.5 a	85.0 a	12.0 d	1.8 d	3.3 cd
Dismiss 4F	0.125+0.125	12.5 b	18.0 c	27.5 b	38.3 c	47.0 b	60.0 bc	69.5 a	0.2 e	0.0 d	0.1 d
Dismiss 4F	0.25	1.6 c	7.5 cd	10.8 c	13.8 d	25.0 cd	41.0 cd	47.5 b	2.8 e	2.9 d	3.4 cd
Echelon 4SC	0.57	1.0 c	2.8 cd	3.5 c	6.3 d	10.8 de	18.5 de	36.8 bc	5.8 e	7.8 d	9.5 c
Echelon 4SC	0.75	0.5 c	1.0 d	1.0 c	2.5 d	2.5 e	8.5 e	16.5 cd	2.1 e	2.5 d	5.8 cd
Untreated	-	0.0 c	2.4 d	1.5 c	5.9 d	1.9 e	2.8 e	11.0 d	100.0 a	81.7 a	65.0 a

[y]Treatments were initially applied on 20 April and sequentials were applied on 21 May 2007. All mesotrione treatments were reapplied on 1 August 2007. Mesortione was tank-mixed with 0.25% NIS on 21 May and 1 August 2007.
[z]Means in a column followed by the same letter are not significantly different based on Fisher's least significant difference test ($P \leq 0.05$).

The best way to remove small plants is to pull them up by hand or to hand-hoe. If you hoe, be sure to dig deeply (at least 8-14 inches) to remove the whole plant. Using a tiller to destroy mature plants will only spread the infestation because it moves the tubers around in the soil. However, repeated tillings of small areas before the plants have six leaves will reduce populations. Many people mistakenly use systemic herbicides such as glyphosate to try to kill the tubers after the plant is fully grown. Unfortunately, when tubers are mature there is little translocation of the herbicide from the leaves to the tubers, thus tubers are not affected. If nutsedge is found in small patches in turf, it may be best to dig out the patch at least 8 inches deep, refill, and then seed or sod the patch."

Other cultural practices that have been shown to be effective include shading. Nutsedge does not grow well in shade. In the lawn, raising the mowing height may suppress growth and deplete tuber reserves. Planting larger shrubs and perennials in landscape beds will achieve the same result. Proper timing of mulch applications at the proper depth will also suppress nutsedge growth.

Obviously, cultural practices should be the first line of defense in any weed control strategy. While hand weeding may be a viable option for retirees with lots of time on their hands, it is not practical on a commercial or large-scale turf and landscape installation.

Data from recent studies at UNL indicate that any removal or eradication strategy post emergence, including hand weeding and herbicide applications, is most successful if done prior to the longest day of the year (June 21). This has also been documented in studies in Louisiana and Indiana. Current recommendations from UNL include SedgeHammer® for postemergence control. More recently, chemicals have been identified that have good to excellent preemergence control of yellow nutsedge. Dismiss® (sulfentrozone) and Echelon™ (Dismiss & prodiamine) and Tenacity™, to a limited extent, have documented preemergence activity on yellow nutsedge based on results of research conducted by Dr. Peter Dernoeden at the University of Maryland (see summary in shaded box). Early post control is excellent with SedgeHammer. Spraying after June 21st, however, with any systemic product often results in germination stimulation of the mature daughter tubers and will require additional applications. Contact products such as Dismiss do not appear to release the dormancy of the daughter tubers, but these tubers will germinate the following spring/summer. We now have products which offer multiple strategies for controlling/suppressing yellow nutsedge.

Currently there is work being done at Nebraska investigating yellow nutsedge biology and ecology and strategies for control. Previous work concentrated on traditional herbicide timings and chemistries. Work is now concentrated on a better understanding of the target weed and optimizing chemical control through better application timing approaches. This work is being conducted by Lowell Sandell, Weed Science Educator, as part of his PhD graduate program.

The following is an excerpt; full summary may be accessed at http://www.psla.umd.edu/faculty/dernoeden/2006_ResearchSummaries.cfm. Reprinted here with permission of the authors.

Preemergence Yellow Nutsedge Control In Spring Seeded Tall Fescue With Tenacity, Dismiss and Eschelon, 2007

P. H. Dernoeden and J. Fu, Dept. of Plant Science and LA University of Maryland

This study showed that Dismiss and Eschelon provided excellent preemergence yellow nutsedge control, but these herbicides should not be used in a tall fescue seedbed. Tenacity applied twice at 0.1 87 lb/A provided a level of yellow nutsedge control similar to Dismiss and Eschelon. However, Tenacity works slowly and must be applied twice to achieve the same yellow nutsedge control levels as Dismiss or Eschelon applied once. Regardless, Tenacity was shown to be safe and can be used effectively in spring seeded tall fescue for preemergence and early postemergence yellow nutsedge control.

Managing Grasslands for Structural Heterogeneity (continued from page 1)

This patch-burn grazing strategy has been tested in the tallgrass prairie ecoregion of Oklahoma and Kansas where the predominant native grass species are warm-season and late-spring burns are effective in controlling exotic cool-season species. In addition, these experiments have been carried out on large tracts (>4,000 acres) in a region where grassland fragmentation is less severe. In the northern tallgrass prairie region of the US, landscapes are highly fragmented, tract sizes are smaller, and dominant plant species are quite different, which makes them vulnerable to invasive species and reduces environmental quality.

Preliminary results of patch-burn grazing studies conducted in the northern tallgrass prairie of eastern South Dakota indicate similar ecosystem processes of burning and grazing have resulted in increased spatial structural heterogeneity across the landscape. We used a multivariate technique called principal component analysis to compare continuous seasonal grazing to patch-burn grazing in vegetation structural components across the landscape. As shown in Figure 2, the first axis, which accounts for 52% of the variation, separates the sites based on the amount of grass, litter, and visual obstruction. The second axis, which accounts for 23% of the variation, separates the sites based on native versus introduced species.

Sampling locations within treatments were separated based on principal component scores for axis 1 and axis 2 (Figure 3). Continuous grazing resulted in sampling locations being more similar and representative of higher visual obstruction, introduced grass, and litter. Patch-burn grazing sampling locations were spread farther apart based on principal component scores. The two sampling locations on the left side of the graph were burned in 2007 and 2008, and the two sampling locations on the right side of the graph have not been burned. Notice the two unburned sampling locations within the patch-burn grazing treatment are more similar to the continuous grazing treatment. These data provide evidence that structural heterogeneity is increased through patch-burn grazing compared to traditional continuous grazing in native northern tallgrass prairie.

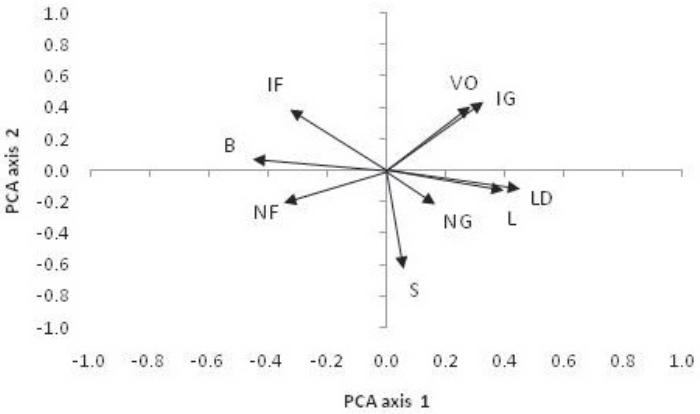


Figure 2. Eigenvector loadings on principal component axes for vegetation components measured in August 2008 from continuous grazing and patch-burn grazing in an eastern South Dakota native prairie. First principal component (PCA axis 1) and second principal component (PCA axis 2) accounts for 52% and 23% of the variation, respectively. VO = visual obstruction, IG = introduced grass cover, LD = litter depth, L = litter cover, NG = native grass cover, S = shrub cover, NF = native forb cover, B = bareground cover, and IF = introduced forb cover.

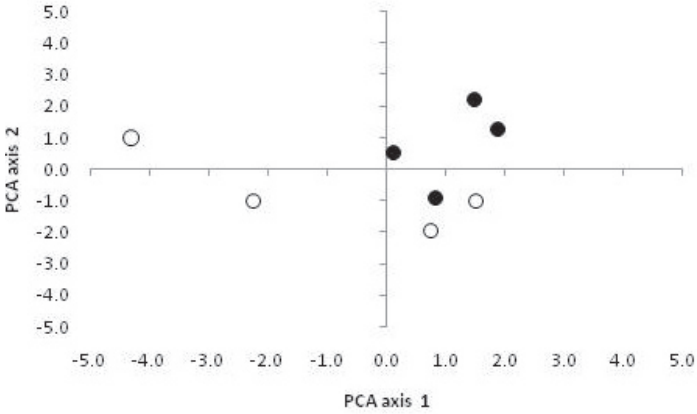


Figure 3. Principal component scores of vegetation measurements conducted in August 2008 from sampling locations within continuous grazing (closed circles) and patch-burn grazing (open circles) in an eastern South Dakota native prairie.

We have not yet collected other ecosystem service measurements such as invertebrate or grassland bird diversity. Further research is needed to confirm the response to patch-burn grazing by other ecosystem structural components. However, we believe that the northern tallgrass prairie will respond in a similar manner as the southern tallgrass prairie.

In conclusion, advocates of multiple-use management for grasslands in the Great Plains have suggested that incorporating ecosystem processes of fire and grazing is beneficial at restoring a shifting mosaic of vegetation structure across the landscape. Supporters of patch-burn grazing use landscape heterogeneity in vegetation, insects, and grassland birds as evidence to support their claims. In South Dakota, we have also documented shifts in vegetation heterogeneity across the landscape with patch-burn grazing. Further research is needed to assess animal diversity in this highly fragmented region of the northern Great Plains.

CGS Associates

Martin Massengale is the 2008 recipient of the "Distinguished Achievement in Agriculture Award," presented by Gamma Sigma Delta (the Honor Society of Agriculture). This is the highest award given by the Society in recognition of outstanding achievements among agriculture professionals and faculty throughout the nation. The award will be presented to Dr. Massengale during the initiation ceremony and awards banquet on Sunday, November 2.

Fred Baxendale and **Tiffany Heng-Moss** were recently honored by the Entomological Society of America. Baxendale received the Distinguished Achievement Award in Extension for his outstanding contributions to extension entomology programming. Heng-Moss, who received the Distinguished Achievement Award in Teaching, has developed seven undergraduate and graduate courses while providing leadership for development and implementation of a new undergraduate major in insect science.

2008 Nebraska Grazing Conference Best Yet!

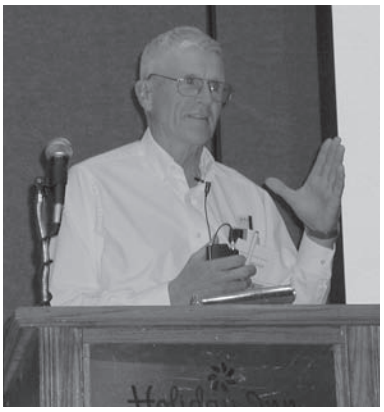
"This was an excellent lineup of speakers." "I was very impressed with all of the speakers." "Good mixture of professionals and producers." "Last 3 speakers [grazier panel] were very good to listen to and had some real world ideas." "All interesting topics." "Well organized and great location." "Excellent food and facilities." "Very good – keep up the good work." "Well done, excellent conference." "One of the best." "I look forward to coming again next year!"

Those are some of the comments on the evaluation sheets from the eighth annual Nebraska Grazing Conference held August 12-13 in Kearney. In attendance were 250 participants from several states. Two dozen speakers presented on a variety of topics including: marketing grass-fed beef; legumes in grass pastures; modifying animal behavior; land monitoring for management decisions; utilizing co-products in a beef livestock operation; transitioning to organic production; the basics of grazing; and winter grazing strategies.

Proceedings from the 2008 and previous conferences are still available for purchase; they contain the material submitted by most of the presenters prior to the conferences. The conference web site (www.grassland.unl.edu/grazeconf.htm) contains the programs for each conference. To order proceedings, send a check payable to Nebraska Grazing Conference to the CGS office – note which year(s) you are ordering.

If you have not attended previous conferences but would like to be on the mailing list to receive notice of next year's conference, to be held in the same location on August 11-12, simply send your name and address to the CGS office. Details of the 2009 program will be posted on the conference web site as they become available early next year.

The Nebraska Grazing Conference has several sponsors including this year's conference underwriters: Center for Grassland Studies, Nebraska Game and Parks Commission, and Nebraska Grazing Lands Coalition.



Ray Banister from Montana keeps things lively as he incorporates his unique sense of humor in his talk on modifying animal behavior.

Allen Williams with Tallgrass Beef Co. discusses issues and methods of marketing grass-fed beef.

Congressman Adrian Smith updates the participants on the 2008 Farm Bill.

In one of the evening bullpen sessions, Walter Schacht, Dave Hamilton, Steve Chick and Jon Albro talk with student participants about grazing-related careers.

Bob Scriven and Terry Gompert team up for a presentation on grazing basics.

Graziers Jay Wolf, Homer Buell and Alan Janzen close the conference with a discussion on grazing management and how they have adapted to high feed and fuel costs.

Targeting Habitat Dollars with Computers: Maximizing the Value of Data for Conservation

by Drew Tyre, School of Natural Resources, UNL
with Naikoa Aguilar-Amustechegui, University of North Carolina-Wilmington and
Max Post van der Burg, SNR, UNL

Many federal and non-governmental programs aim to help landowners improve the habitat value of their property. Unfortunately, the number of species in need of conservation and the areas on which they occur far exceeds available funding. How can biologists better target the available funds to maximize habitat benefits?

Identifying where species of concern occur is one of the critical components of the Nebraska Legacy Project. Once biologists can predict *where* species of concern occur, or should occur, they must still solve the problem of deciding *which* species to benefit. I worked on this problem for the past two years with Naikoa Aguilar-Amustechegui, a postdoctoral researcher, and Max Post van der Burg, a PhD student in the School of Natural Resources. Naikoa's project focused on building prototype predictive models for identifying and prioritizing high quality shortgrass prairie habitat in western Nebraska – in particular, with data of variable quality and over huge spatial extents. Max's doctoral work uses high quality survey data at smaller extents to make predictions about how populations change in both space and time. Aside from keeping Naikoa and Max working hard, my personal contribution outlines how to use their work in an Adaptive Management framework for managing restoration dollars.

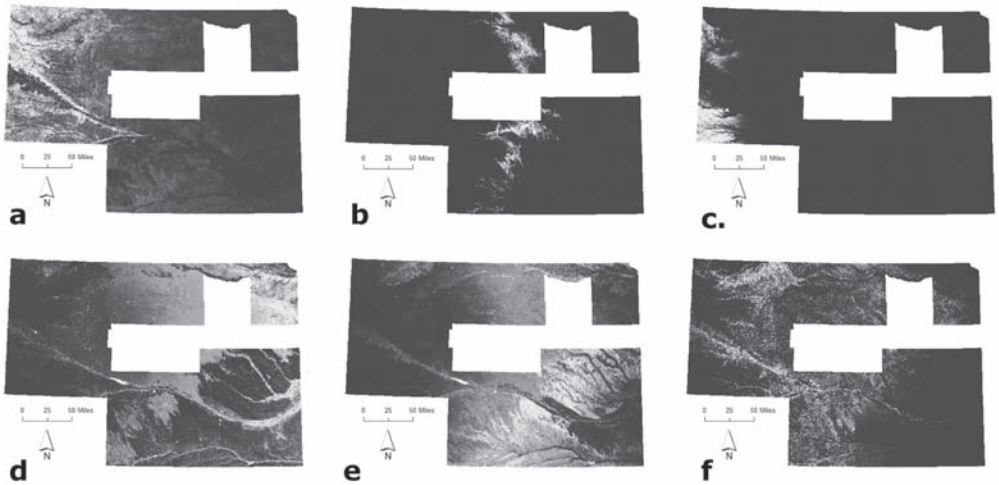


Figure 1. Habitat modeling of Nebraska Natural Heritage Tier I Species within MAXENT: a) Ferruginous Hawk, b) Iowa Skipper, c) Mountain Plover, d) American Burying Beetle, and e) Trail Fitbane; f) Ranking of conservation importance by ZONATION.

We examined two primary data sets that identified good quality shortgrass prairie habitat (SPH) – a presence-only dataset collected over several years, and a single-year, large-scale stratified transect survey that recorded locations of high quality shortgrass habitat. We constructed several GIS layers describing a range of covariates that we expected would influence the probability of a site containing SPH including percent clay, soil depth, elevation, slope, landcover class and a measure of ecosystem productivity based on satellite remote sensing data. All layers, including the response variable "presence of SPH," were either sub-sampled or downscaled to a consistent 250m pixel size. Several methods of analysis were explored, but the one that was best able to cope with the resolution and extent of the data was the maximum entropy based method MAXENT. This produces maps of the relative probability of occurrence of SPH from presence-only data. To identify areas that should be prioritized for restoration funding, we used the predicted occurrence maps in the ZONATION algorithm, a spatial conservation planning software. ZONATION can accept multiple layers representing different species or community types and identify minimum areas that meet many conservation objectives simultaneously. Our initial use of ZONATION was limited by the fact that there was only a single conservation objective, SPH, but it was clear that this approach had merit and was able to deal with large datasets quickly and effectively. We are presently testing the MAXENT / ZONATION combination on a set of Tier I and Tier II species using the Natural Heritage Data set (Figure 1).

Our second effort involves using higher quality datasets – repeated surveys by professional biologists at randomly chosen locations. We can use these data to build quantitative models of the relative abundance of species like the burrowing owl and mountain plover. One issue that commonly arises with survey data is that different surveyors have different abilities to detect the species of interest and record them. In addition, the behavior of the animals changes depending on the time of day, the weather and many other factors. This can make comparing survey data from one year to the next difficult or even impossible. Are there really more burrowing owls this year or are the surveyors just more "on the ball?" Our methods take advantage of the information in repeated surveys of the same site to correct for variation in detectability. We combine detectability models with spatial statistics to obtain maps of the relative abundance of species across regions (Figure 2).

We made three recommendations to guide future development of Adaptive Management for making decisions about restoration funding in Nebraska:

1. The extent to which real decisions are made about habitat incentive programs should be evaluated. Real decisions arise when there are more opportunities (landowners volunteering) to spend program dollars than dollars to spend. If opportunities are limited, there is no need to invest in further decision support.
2. Evaluate the objectives for each Tier I and Tier II species to ensure that they are consistent with the species biology, and develop a framework for evaluating the uncertainty in those objectives. How will we know when we are successful?
3. Design and carry out surveys for a sample of Tier I and II species to evaluate the fitness of existing data and prediction methods for measuring our conservation objectives, and obtain estimated costs for surveys of the entire suite of Tier I and II species in Nebraska.

Recommendations 1 and 3 require a substantial amount of research, including human dimensions research. Recommendation 2, while possibly involving some research, will definitely require workshops with stakeholders, managers and scientists to refine objectives for species conservation.

At a fundamental level, even if we could efficiently tell where these species occur now, should we use these locations as representative of the habitats where they would thrive? The landscape has changed tremendously over the last century and a half; our analysis assumes that the species occupies "optimal" habitat now. Some species may have preferred grassland on productive soils – land that was long ago converted to farmland and is least likely to be restored under voluntary conservation programs. The present distribution of such species is a poor guide for habitat restoration. Resolving this difficulty will take considerably more knowledge about the needs of individual species, but also an extended debate about how much value we as a society place on them.

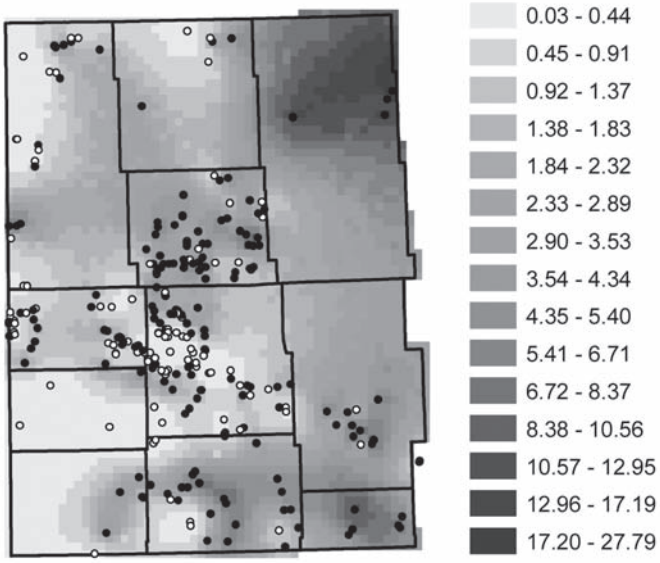


Figure 2. Spatial prediction of Burrowing Owl abundance in the Nebraska panhandle in 2006. Circles indicate survey sites; filled circles indicate that one or more owls were observed on at least one occasion.

University of Nebraska Lincoln | Center for Grassland Studies
222 Keim Hall
P.O. Box 830953
Lincoln, NE 68583-0953

Address Service Requested

Non Profit
US Postage
PAID
UNL