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Abstracts for Other Oral Presentations

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(alphabetical by first author)

CAJUN PRAIRIE HERBS: THEIR ANTIMICROBIAL ACTIVITY AGAINST *ESCHERICHIA COLI* 0157:H7

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Herbs have a long history of use in many cultures. Uses include preserving foods, enhancing flavor and aroma of foods, and medicinal applications. Most of the food-borne bacterial pathogens are sensitive to extracts from mints, garlic, and clove, with the extent of sensitivity varying with the bacterial strain and environmental conditions imposed in the analyses. The antimicrobial compounds of the herbs are usually found in the essential oil extraction. In addition to the antimicrobial activity, herbs have antioxidant properties that are effective in retarding rancidity during the storage of meat. The purpose of this paper is to report the inhibitory effects of herbs found in the Cajun Prairie in southwestern Louisiana. The following native prairie herbs were studied: *Nothoscardum bivalve* (false garlic), *Pycnanthemum albescens, P. mutacum, P. tenuifolium* (mountain mints), *Monarda fistulosa, M. lindheimeri, M. punctata* (wild bergamots or beebalms), and *Solidago odora* (sweet goldenrod). Twelve species (the eight native herbs and exotic species including dill, fennel, society garlic, and basil) were tested for activity against *Escherichia coli* 0157:H7 (a potential lethal inhabitant of meat products). Four levels of essential oil extracts (2, 4, 6, and 8% v/w) of each species were used with the target bacterium in sorbitol MacConkey agar and in ground beef. The species of herbs showed varying levels of inhibitory effects on colonial growth of the bacterium. Sweet goldenrod, dill, basil, fennel, wild bergamots, and society garlic typically reduced the bacterial populations in selective agar and ground beef by 40–80%. False garlic showed a 95% effect, while the mountain mints showed greater than a 99% reduction in bacterial colonies. Thus, the native false garlic and mountain mints are more effective among the native and exotic species tested. These results clearly show the dramatic potential of native Cajun Prairie plants in the food and medicinal industry.

SUCCESSION IN CAJUN PRAIRIE, SOUTHWEST LOUISIANA

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Cajun Prairie once covered 2.5 million acres in southwest Louisiana but has been reduced by agricultural practices (tilling) to less than 100 acres in small, disjunct remnant strips along railroad rights of way. Based on observation in restoration projects and regrowth in disturbances in remnants, the pattern of succession is reported. The initial dominants in the Cajun Prairie habitat are annuals with variation in species tied to moisture, location, and history of agricultural use. Most annuals disappear in a year or two but goatweed (*Croton capitatus*) may persisit for three to four years. The second stage in succession includes three groups of perennial species: native non-prairie, introduced, and Cajun Prairie. As succession proceeds, the Cajun Prairie species increase in number with a corresponding decrease in number of the other two groups. The non-native Brazilian vervain (*Verbena brasiliensis*) and vasey grass (*Paspalum urvillei*) are very common invaders in Cajun Prairie but disappear with time. The first non-prairie species to disappear is lateflowering thoroughwort (*Eupatorium serotinum*) and the last to be lost is common goldenrod (*Solidago canadensis*).

EDGE ACTIVITY AND HABITAT USE BY GRASSLAND BIRD NEST PREDATORS IN SOUTHWESTERN WISCONSIN

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Loss and conversion of native grasslands to an agricultural landscape has left secondary grasslands highly fragmented. This fragmentation has increased the number of edges, and may have increased grassland bird nest depredation. However, little is known regarding predator habitat patch and edge use, and which predators play the biggest role in nest depredations. From mid–May through July (2003), we monitored predator activity around edges of Conservation Reserve Program (CRP) fields, prairies, and grazed pastures. Sand track stations and infrared cameras were used to monitor predator movement on edges and habitat interiors, and comparisons were made between woody and non-woody edges and between treatments. Miniature video cameras were placed on nests to document depredations. Ten species known to depredate nests were documented on track stations in 2003. Raccoon was the most numerously detected predator along edges (track stations and photos), preferring woody edges on all treatments and was rarely found on interior stations. Red fox seemed to prefer woody edges and CRP, while coyote activity along woody and non-woody edges was similar across treatments. Coyote and 13-lined ground squirrel were found numerous times on interior stations. Species caught depredating nests with cameras

included raccoons (2), 13-lined ground squirrels (2), and a red-tailed hawk. Grassland birds face a diverse suit of predators during the breeding and nesting seasons, and management focusing on removing one predator species or woody edges may not affect nest depredation rates.

WALL STREET'S GUIDE TO PRAIRIE PLANTING

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Species diversity is of paramount importance when planning a prairie restoration. Economic considerations, however, are also an inevitable part of the planning process when deciding which species to include in a restoration. Borrowing from the financial industry's use of the Price to Earnings Ratio in evaluating potential investments, I calculate a Price to Establishment Ratio in order to determine, in economic terms, which prairie forb species may prove to be a good "investment." I evaluate the establishment from seed of 30 prairie forb species in relationship to their cost per plot. Establishment success is based on average cover per plot after 2 years of growth on a 4 ha former agricultural field in eastern Kansas. Seed prices are averaged from five regional seed suppliers. Results indicate that prairie coneflower (*Ratibida columnifera*), black-eyed Susan (*Rudbeckia hirta*), illinois bundleflower (*Desmanthus illinoensis*), and gray-headed coneflower (*Ratibida pinnata*) exhibit the highest Price to Establishment Ratio suggesting that these species provide relatively good establishment compared to cost. Species that exhibit the lowest ratio include azure aster (*Aster oolentangiensis*), rattlesnake master (*Eryngium yuccafolium*), white prairie clover (*Dalea candida*), and sweet black-eyed Susan (*Rudbeckia subtomentosa*). Although seed number per plot and cost per plot differed among plots, no statistically significant relationship was found between these parameters and establishment success. Results from this study can provide restoration practitioners with an additional consideration when deciding how to concentrate seed collecting efforts or which species to include when designing mixes from purchased seeds.

LONG-TERM CHANGE IN PRAIRIE PLANTINGS

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When a large number of species are established simultaneously it is difficult to predict what species will eventually dominate the planting. It is also difficult to predict when the primary characteristics of the planting will become evident. In other words, when will a planting look mature? We planted five different 0.5-ha prairie plots with a minimum of 65 species using the same density, seed treatment, soils, and post-planting management practices. Considerable change in aerial cover for some species was still evident after ten years even though rooted frequency changed little. Plantings maintained their distinctiveness at least through 13 years post-planting. Though it was difficult to predict what species would establish in any one year, the subsequent development of each planting, though extensive, was more predictable. This suggests that prairies are dominated by long-lived individuals of many different species. These patterns of establishment have a large bearing on research design for restoration projects as well as understanding basic prairie ecology.

HOW PREDICTABLE IS PRAIRIE ESTABLISHMENT?

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Conflicting studies are often published in prairie restoration literature. Some studies suggest that fall plantings are superior to spring plantings, for example, while others suggest that the reverse is true. We examined the variation among five identical plantings seeded in different years. Our hypothesis was that variation among treatments was due to the interaction of treatments with weather and other sources of variation that cannot be controlled in field investigations. We planted 0.5-ha plots in the fall of 1990, 1991, 1992, 1994, and 1996 at the International Crane Foundation. Among all plots, soils, species composition, seedbed preparation, seed treatment, and post-seedling management (e.g., burns, mowing, etc.) were similar. Rooted frequency of seeded native species after the second growing season was 79%, 56%, 82%, 85%, and 78% for the five plots, respectively. Among individual species planted, *Schizachyrium scoparium*, for example, was planted at 13.0% in 1991 but sampled at 1.1% in its second growing season. Conversely, *Elymus canadensis* was planted at a frequency of 1.6% in 1991 but sampled at 10.0% in the second growing season. In 1990 and 1992 plots, however, these species were found at frequencies approximately equal to their planted frequency. Differences in species abundance among the five plots occurred either at germination or during the first growing season. Independent ecological processes (such as weather) vary over time and can cause changes in planting success that transcend the influence of many planned management actions.

THE STATUS OF PRAIRIES IN OHIO: AN OVERVIEW OF CURRENT SITES, STUDIES, ISSUES, AND MOVEMENTS

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At the eastern edge of the Prairie Peninsula, Ohio in pre-settlement times was mostly forested. But about 4% of Ohio's terrestrial 40,953 miles^2 (106,096 km^2) were prairie, both in significant landscape-scale prairies and in numerous, smaller prairie openings across the state. These included the Bluegrass Region prairies of Adams County in the extreme south and, in the north, the Oak Openings Savanna and Sand Prairie Region west of Toledo. Both are areas of exceptional prairie

biodiversity. Current Ohio prairie studies include the continued discovery and management of rare species by the Ohio Department of Natural Resources, The Nature Conservancy, and others. Emerging Ohio prairie issues involve the governmental regulation of prescribed burns, appropriate frequency of burns and herbicide applications, suppression of invasive vegetation, effective management techniques applicable on both original and restored prairies, horticultural incursions of non-native prairie species and ecotypes, and the management of CRP grasslands and other created warm-season grasslands. Contemporary Ohio prairie movements include emerging horticultural and educational prairie installations, particularly along highways, in parks, and at educational institutions. All of these matters are being monitored and addressed by the Ohio Prairie Association, which conducts prairie field trips and workshops, publishes a journal and website, and sanctions the annual Ohio Prairie Conference. This year's will be the 23rd Annual Ohio Prairie Conference, where OPA members and quests will meet for presentations, field trips, and other prairie activities. Ohio prairies are continuing to attain deserved public and academic recognition. Like the Midwestern states to its west, Ohio is a legitimate prairie state, with numerous prairie sites, issues, and activities.

BOTANICAL SURVEY OF LYLE-AUSTIN WILDLIFE MANAGEMENT AREA: PRAIRIE REMNANTS OF THE CHICAGO GREAT WESTERN RAILROAD, MOWER COUNTY, MN

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Lyle-Austin Wildlife Management Area encompasses approximately 114 acres along 9.5 miles of former Chicago Great Western railroad right-of-way on the Iowan Surface landform between the cities of Lyle and Austin in southeast Minnesota. To better understand the location and quality of prairie remnants and rare plant populations, a review of historical railroad information was conducted, and a botanical survey completed between 1999 and 2003. The inventory identified 23 areas of good to very good quality remnant prairie. A total of 324 species of plants were noted, 47 of which are non-natives. Over 150 populations for ten rare plant species were encountered, including those that are State-listed, or not listed but tracked by the Minnesota Department of Natural Resources Natural Heritage Program. A new state record for sweet coneflower (*Rudbeckia subtomentosa*) was also recorded. I will discuss the history of railroads in the area, the apparent influence the culture of the Chicago Great Western railroad had on conserving these important tallgrass prairie remnants, and future inventory/management efforts.

RELATIONSHIP BETWEEN FIRE FREQUENCY AND LONG-TERM CHANGES IN EASTERN TALLGRASS PRAIRIE VEGETATION

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Little information has been available from large data sets on effects of fire on long-term change in eastern tallgrass prairie. Work on western tallgrass prairie indicates that although periodic fire maintains species richness, it declines with increasing fire frequency and grass cover without grazing disturbance. We examined 25-year changes in species richness, composition and structure in 38 high-quality currently ungrazed Chicago region prairies with known fire management histories. About half of the sites appear to have been lightly disturbed some time prior to initial data collection. Change over time in plot species richness correlated positively with increasing fire frequency, with 20% fire frequency projected to prevent loss of richness in mesic/wet mesic prairies and 10% needed to stabilize dry/dry-mesic prairies. Composition of undisturbed late-successional prairies stabilized with 50% fire frequency, while disturbed prairies did not stabilize, presumably due to successional change enhanced by fire. Change in structure measured by the ratio of woody/graminoid species abundance increased with decreasing fire frequency in mesic/wet-mesic prairies, with 65% fire frequency projected to prevent change in this ratio. This relationship did not hold for dry/dry-mesic prairies, possibly due to greater rates of natural disturbance and lower rates of accumulation of woody vegetation and litter. However, in all habitats there was a negative correlation between change in forb species richness and increase in the woody/graminoid ratio. These results suggest that for ungrazed eastern tallgrass prairie, 1) more frequent burning is needed to stabilize composition and structure than species richness, 2) less frequent burning is needed for dry/dry-mesic than for mesic/wet mesic habitats and 3) increasing fire frequencies do not result in loss of species richness.

TESTING THE EFFICACY OF SPECIES RICHNESS AND FLORISTIC QUALITY ASSESSMENT OF QUALITY, TEMPORAL CHANGE AND FIRE EFFECTS ON PRAIRIE NATURAL AREAS

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Despite extensive use, few studies have tested competency of Florist Quality Index and coefficient of conservatism C values by comparing them with alternative statistics and independent measures in large prairie data sets. To do so, we compared species richness and floristic quality within and among tallgrass prairie remnants. Species richness was based on small (0.25-m^2 plot) and large (20 plots) scales, as well as a multiplicative Index that integrates these measures. We made within-site

comparisons of temporal change in prairie vegetation sampled in 1976 and in 1998, following 22 years of fire exclusion, and in 2003 after five years of management. Among-site comparisons included 39 prairies sampled in 1976 and graded by the Illinois Natural Areas Inventory, which we re-sampled in 2001 and analyzed for vegetation change in relation to their fire-management histories. Within-site comparisons of temporal change in species richness corresponded to independent measures that documented deterioration of community composition, structure and quality. In contrast, mean C values failed to detect these changes. Among sites, species richness measures corresponded to *a priori* assignments of quality made in 1976 and were positively correlated with fire frequency. C values were not sensitive to *a priori* quality or to fire frequency. These results indicate that, for tallgrass prairie, measures of species richness can be very sensitive indicators of vegetation change, and can help gauge differences in vegetation quality. Measures of floristic quality were problematic, possibly due to errors and bias in assigning C values, as well as instability in the FQI formula.

SOIL PHYSIOCHEMICAL CHANGES FOLLOWING 12 YEARS OF ANNUAL BURNING IN A NATIVE TALLGRASS PRAIRIE IN CENTRAL ARKANSAS

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Burning is known to stimulate growth of prairie vegetation, by removing the radiation-absorbing litter layer covering the soil surface and allowing faster soil warm-up, promote species diversity, and inhibit natural invasion by woody plants. However, the frequency at which prairies are burned as part of their management can affect soil nutrient content and, ultimately, productivity. The objective of this study was to characterize changes in soil physical and chemical properties in a native tallgrass prairie after 12 years of annual burning. In 1989, five soil samples from the 0 to 10 cm depth were collected along a transect through a 7-ha parcel of native tallgrass prairie in central Arkansas. Soil sampling was repeated in 2001 to assess changes over time in bulk density, pH, electrical conductivity, extractable soil nutrients, organic matter, and total nitrogen and carbon. Results showed that bulk density, electrical conductivity, extractable phosphorus, sodium, iron, and manganese decreased significantly), while organic matter, total nitrogen and carbon, and the carbon:nitrogen ratio increased significantly ($P < 0.05$) within the 12-year period during which annual burning was the only imposed management practice. Mean extractable potassium, calcium, magnesium, sulfur, and zinc levels were all lower in 2001 than in 1989, but differences were not significant. Soil pH did not change from 1989 to 2001. The results of this study indicate that annual burning may be too frequent and that annual nutrient export during the burning of relatively small, remnant prairie fragments exceeds annual imports from atmospheric deposition and/or organic matter mineralization. Decreasing the frequency of prescribed prairie burning may help to retain more soil nutrients to sustain a higher level of productivity.

BUTTERFLY SURVEYS OF THREE EASTERN NEBRASKA PRAIRIES

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We conducted 20 weekly Pollard Transect butterfly surveys at two prairies near Omaha, Nebraska, each summer from 1998 to 2003, and four monthly surveys at a prairie near Lincoln, Nebraska, each summer from 2001 to 2003. Study sites were Allwine Prairie, a 64-hectare restored prairie, Bauermeister Prairie, a 12-ha prairie remnant, and Ninemile Prairie, a 97-hectare native prairie (the Lincoln site). Each site is divided into areas that are burned on a three-year rotation; our surveys thus covered two complete cycles at the Omaha prairies and one complete cycle at the Lincoln prairie. Overall, we present results from over 24,000 individual observations. We present results on the following: comparisons of butterfly communities between sites and between habitat types within sites; degree of habitat specialization/generalization of different butterfly species; variation in butterfly numbers in specific areas as a function of time within 3-year burn cycles (in every case, numbers were significantly reduced in an area in the year of a burn but recovered in subsequent years); and population trends over the duration of the study for species of especial interest (such as monarchs, regal fritillaries, and painted ladies).

USE OF MOWING TO ESTABLISH FORBS IN A MATURE PRAIRIE RECONSTRUCTION: EARLY AND LONG-TERM EFFECTS ON PLANT SIZE AND SEEDLING ESTABLISHMENT

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Many mature prairie reconstructions lack diversity but may be too competitive for seeds of new species to establish. We are testing the feasibiltiy of incremental or successional restoration of these sites by adding forb seed and reducing competition from the existing sod via mowing. In 1999 we seeded a species-poor prairie reconstruction on the UNI campus with 23 species of forbs, and assigned 24 replicate plots to one of three mowing treatments (none, one year, two years). Mowing decreased forb seedling mortality and increased size and maturity relative to unmowed controls, resulting in twice as many established forbs by the beginning of 2003. In 2003 we added ten new forb species at a rate of 25 seeds/m^2 per species to the same plots and randomly assigned plots to three new treatments: no mow, mow weekly, or mow every third week. This treatment

continues in 2004. Destructive sampling of previously established forbs in 2003 showed a reduction in crown size and shoot number with mowing frequency, but no effect on seedling emergence or survival. Data from 2004 on seedling establishment, plant response to mowing, and light, moisture and litter layer will be presented.

RELATIONSHIP OF PLANT ORIGIN AND ARBUSCULAR MYCORRHIZAL INOCULUM TYPE TO GROWTH RESPONSE OF BIG BLUESTEM IN NON-STERILE SOILS

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Big bluestem (*Andropogon gerardii*) is a key grass of tallgrass prairies and is commonly included in prairie reintroduction and restoration projects. In many cases, it has been found to benefit significantly from arbuscular mycorrhizal (AM) fungi. Several studies, however, have shown growth of big bluestem to be suppressed under non-sterile soil conditions. There has also been some indication of AM specificity. This study investigated the effects of two types of AM inoculum (commercial and prairie) on growth and root colonization of five big bluestem genotypes grown in two types of non-sterile soils (prairie and urban) which varied in nutrient availability. The effect of mycorrhizae on growth was influenced by plant origin. Treatments that received inoculum generally grew better than those that did not receive inoculum, although there were some cases in which added inoculum did not benefit plant growth. There was also some indication of AM preference by host genotypes. Mycorrhizal colonization was greatest with added prairie inoculum and significantly varied between big bluestem genotypes. The degree of colonization was significantly correlated with total dry weight of plants. These results demonstrate the importance of considering both plant genetics and inoculum type before the incorporation of AM inoculum to prairie restoration and reintroduction projects.

REPAIRING THE FABRIC OF A TALLGRASS PRAIRIE: RESULTS OF TEN YEARS OF MONITORING AT PRAIRIE STATE PARK, BARTON COUNTY, MO

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Prairie State Park is located in the Osage Plains Section of Missouri. As a sizeable tallgrass prairie preserve it includes high quality and degraded prairie remnants within its 3,942 acres (1,595 ha). In 1994 The Nature Conservancy established vegetation monitoring transects to serve as a baseline against which to assess changes in response to management which includes prescribed burns (spring, summer, fall, winter), grazing (bison and elk), exotic species and woody plant control. Ten years of cumulative management effects are represented by the data. Changes in frequency and cover percent for conservative, matrix, ruderal-competitor, ruderal, and exotic classes of vascular plants as determined by the floristic quality index developed for the flora of Missouri are reported. The analysis includes trends in the average coefficient of conservatism per transect, dominance of woody species and the invasive exotic, sericea lespedeza (*Lespedeza cuneata*). The monitoring program as a coarse level tool has been effective in identifying management concerns and stimulating further inquiry.

EFFICIENT TALLGRASS PRAIRIE AND SAVANNA CONSERVATION: USING ENVIRONMENTAL MODELING AND GEOGRAPHIC INFORMATION SYSTEMS TO DETERMINE RELATIVE CONSERVATION POTENTIAL OF POCKET PRAIRIES IN SOUTHERN ONTARIO

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Tallgrass habitat is among one of the most threatened ecosystems in Ontario with approximately 97% of its original distribution having been destroyed to date. The alarming fragmentation and destruction of tallgrass habitat demands the creation of efficient and effective measures to conserve these rare ecosystems. This challenge has been taken up by Tallgrass Ontario, an NGO focused on the community-based conservation of reaming Tallgrass prairie and savanna in Ontario. We present here a method of ranking remaining habitat locations for conservation through the use of a Geographic Information System. This GIS contains data gathered during Tallgrass Ontario's Save Our Savanna (SOS) project, when every known fragment of tallgrass habitat in Ontario was the subject of fieldwork where data on size, vegetation composition, substrate, adjacent land use, and geographical characteristics were gathered. We then created a model within ARCView that ranked tallgrass habitat across Southern Ontario based on a combination of biotic and abiotic criteria, including habitat area, shape, vegetative composition, and proximity to other areas of tallgrass habitat, as well as the type, area, and shape of surrounding land parcels. In addition, species lists were compared with a list of indicator species to allow each fragment to be ranked based on tallgrass species richness. The results of this work are now allowing Tallgrass Ontario to begin the creation of a series of recovery plans for both individual tallgrass species and tallgrass habitat, generally.

LANDSCAPE FRAGMENTATION AND GRASSLAND PATCH SIZE EFFECTS ON NON-GAME GRASSLAND BIRDS IN XERIC MIXED-GRASS PRAIRIES OF WESTERN SOUTH DAKOTA

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Grassland bird population throughout North America have been attributed to landscape fragmentation, loss of grassland habitats, and the size and isolation of remaining grasslands. We evaluated non-game bird populations on xeric mixed-grass prairies of various sizes in fragmented and non-fragmented landscapes of western South Dakota to determine what effects landscape fragmentation and grassland patch size have on avian (bird) communities. Avian species were surveyed once between May 20 and July 5 in either 1999 or 2000 within a randomly placed 150-m x 120-m, fixed-width belt transect in 125 grasslands located throughout western South Dakota. Grasslands ranged in size from 12.3 to 2,590 ha. A total of 52 avian species were observed, of which were 19 grassland obligates, 18 facultative grassland species and 15 edge/generalist species. Six species comprised more than 85% of the total birds observed; these were: grasshopper sparrows, western meadowlarks, brown-headed cowbirds, chestnut-collared longspurs, bobolinks and red-winged blackbirds. Grasshopper sparrows and western meadowlarks were observed in more than 99% of grassland patches. Avian community composition was affected by landscape fragmentation and grassland patch sizes. Chestnut-collared longspurs were more abundant in grasslands within non-fragmented versus fragmented landscapes. The grasshopper sparrow exhibited area-sensitivity, increasing in abundance with increasing patch size in fragmented landscapes. The brown-headed cowbird, a notorious edge species and nest parasite, was more abundant in small grasslands within fragmented landscapes than in grasslands within non-fragmented landscapes. These results indicate that landscape fragmentation and resulting variability of patch sizes affects the avian species composition of grassland patches, and may result in higher abundance of generalist/edge species and corresponding lower abundance and productivity of grassland obligate species. Efforts to conserve grassland birds should be placed on large grassland patches located in landscapes with high percentages of grassland to compensate for grassland patch size and fragmentation effects on grassland birds.

NIPPING 'EM IN THE BUD: A PROGRAM TO STOP NEW INVASIVE PLANTS IN WISCONSIN

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The invasives already here in Wisconsin are bad enough, but imagine if new species of invaders joined forces with leafy spurge, spotted knapweed, wild parsnip and other current grassland weeds? Without local and regional vigilance, it could, and likely would, happen. A new EPA-funded program, jointly sponsored by the UW–Madison Botany Department and Wisconsin DNR, is underway to identify and control new invasives before they become unstoppable. Beginning in Summer 2004, 12 species became the target of reporting and control efforts being carried out statewide. In the future, more plants will be added to the target list. Some of these new invasives, such as common teasel and black swallow-wort, are already here, but in small numbers or in limited areas. Others, such as giant hogweed or wineberry, are not known to have crossed our borders but are causing serious trouble elsewhere, in climate zones similar to Wisconsin's. An illustrated brochure was developed that features the target species, with photos, descriptions and information on control methods. Web-based resources also aid in identification and reporting. Volunteer cooperators around the state have been trained to identify the weeds, collect and press voucher specimens, report sightings to the UW Herbarium, and launch control efforts. A mapping database keeps track of occurrences, and a long-term control and monitoring strategy of each population helps ensure that containment and eradication efforts are working. This session provides an introduction to the program, and reviews progress in the field to date. Participants are invited to share tales of early detection and strategic response initiatives elsewhere and offer perspectives on "prairie invasives of the future" we all should be concerned about.

THE NATURAL HISTORY OF THE LESPEDEZA WEBWORM IN KANSAS

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The lespedeza webworm, *Tetralopha scortealis* Lederer, Family Pyralidae, a foliage feeder can effectively reduce the productivity of the invasive sericea lespedeza (*Lespedeza cuneata* Dum.-Cours.) G. Don. Lespedeza webworms were observed forming webs and feeding on sericea lespedeza foliage from early July until late September each year. Larvae that did not actively form webs or feed constructed a "tent" or shelter by pulling one or more layers of leaves around themselves and securing them with silk threads. By September 30, larvae left the stems and formed earthen cocoons in the soil beneath the plant. The larvae assembled granules of soil into elliptical chambers and fixed them together with labial secretions resembling liquid silk. The soil-covered puparia (1.0 cm long, 0.75 cm wide) provided overwintering chambers for the pupae.

Moths began to emerge in early summer, and they flew to host plants in the vicinity where eggs were laid on the foliage. Flight distance and direction appeared to be affected both by direction and velocity of the wind. Lespedeza webworm population numbers fluctuated annually, with some doubling in area and/or density, and others declining in area and density or all dying. Extremes in temperature and dry soils may be responsible for major population changes and reduced control benefits of the species.

PASSERINE ABUNDNACE IN CONSERVATION RESERVE PROGRAM GRASSLANDS OF DIFFERING AGE-CLASSES AND COVER TYPES IN EASTERN SOUTH DAKOTA, 1998–2000

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During the past 50 years increasing agricultural practices have transformed native habitat into row-crop fields, thus making the Conservation Reserve Program (CRP) grasslands very important to numerous wildlife populations. Limited information exists on how passerine bird species relate to different stand ages and cover types of CRP. CRP grassland study sites (n = 42) were stratified by stand age (old [10–13 years] versus new [0–3 years] grasslands), and cover types (CP1-cool-season grasslands versus CP2-warm-season grasslands) in eastern South Dakota. Passerine bird sampling was conducted once each year in 100-m x 100-m belt transects and vegetation sampling was conducted twice each year. Red-winged blackbirds (*Agelaius phoeniceus*), dickcissels (*Spiza Americana*), brown-headed cowbirds (*Molothrus ater*), western meadowlarks (*Sturnella neglecta*), and bobolinks (*Dolichonyx oryzivorus*) were the most abundant species in the CRP grasslands. Seventeen species were identified in old grasslands, while 23 species were observed in new grasslands. Nineteen bird species were detected in cool-season grasslands, whereas 23 species were observed in warm-season grasslands. Grassland obligate species were more abundant in cool-season CRP grasslands, whereas for the generalist/woodland edge species there was no difference in abundance between cover types. Based on our findings, we submit that extending ten-year contracts for another five to ten years is justified relative to non-game birds. We also recommend that USDA administrators and field staff provide broader and more flexible guidelines on what seed mixtures are to be used in CRP grassland plantings in the northern Great Plains. Our findings show that cool-season grass/legume mixtures (CP1) support higher grassland bird richness, and thus should be given equal or higher ratings than warm-season (CP2) grass stands.

THE EFFECTS OF SEASONAL PRESCRIBED FIRES ON PRAIRIE VEGETATION

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Spring prescribed fires have long been the standard for management of tallgrass prairies, but burning in other seasons—summer, winter, and autumn—yield specific and unique vegetative results. The study at Prairie State Park was conducted over six years on the park's highest quality prairie sites. Seasonal burn treatments were done on side-by-side plots. Plant yield, flowering rates, and species composition and frequency were measured for each burn treatment. Spring fires were shown to favor warm-season grasses, suppress cool-season domestics and ultimately decrease species richness and diversity. Conversely, summer burns promote cool-season grasses, increase forb production, suppress warm-season grasses and have the greatest plant diversity. Knowledge of the vegetative responses to burning in different seasons has allowed the park staff to manipulate the vegetation to meet specific needs.

REUSE, RESTORATION, AND RECONCILIATION AT THE BADGER ARMY AMMUNITION PLANT

Amanda Fuller, Coordinator

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Why would a 7,354-acre dilapidated Army Ammunition Plant inspire and mobilize thousands of people in a rural community in Wisconsin? The discussions about the future of the Badger Army Ammunition Plant have brought people together and captured the imagination of local residents. The vision for the future of the Badger Plant includes prairie and savanna restoration, recreation trails, educational tours and programming, community gathering space, agriculture, research, historical interpretation, and access to the Baraboo Hills and the Wisconsin River. The planning process has also provided an unusual model for restoration and land-use planning for public land. The Restoration of the Badger Plant began in the 1980's, when the U.S. Army began cooperating with local conservation groups to restore prairie. Currently, Badger is home to several prairie and savanna remnants and restorations, and two prairie nurseries. When the Army announced in 1997 that the plant would be decommissioned, some local citizens proposed restoring a large portion of the former Sauk Prairie and savanna at Badger. This began a community dialogue about the future of the Plant through lectures, panel presentations, and other public events. As the federal disposal process moved along, the community requested more opportunity for input. Congresswoman Tammy Baldwin secured funding for a facilitated public process to develop a plan for reuse of Badger. In 2001, twenty-one different stakeholders worked together for

nine months to create the Badger Reuse Plan, a concept plan for beneficial reuse of the Badger land. The Reuse Plan outlines various land uses, to be integrated in a way that maintains the Badger land as a single unit, involves the community, and contributes to the reconciliation of past conflicts: Ecological restoration; Agriculture; Recreation; and Education and Research. Citizens are looking forward to future volunteer opportunities to realize the vision for Badger.

INVASIVES SPECIES MANAGEMENT PLAN FOR LAKE WINGRA WATERSHED

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The aquatic and wetland vegetation of the Lake Wingra watershed has changed considerably since European settlement, as a result of major hydrological changes, unabated storm water runoff and introduction of non-indigenous species. These human-induced changes have facilitated spread of introduced species. Plans to manage invasive species must be directed at these underlying ecosystem alterations. The Friends of Lake Wingra (FOLW) have developed a comprehensive, strategic approach to invasive species management in the Lake Wingra watershed that is based upon values and management principles that focus on addressing the underlying human-caused disturbances that facilitate exotic species invasions. It recommends a range of short-term, mid-term and long-term management actions that provides land managers, neighborhood groups and citizens with the tools for developing appropriate tactics to encourage native species and discourage pest species. These values include: 1) Prevent—to the extent possible—the entry and establishment of invasive plants and animals into the watershed. FOLW supports educational and outreach programs that inform watershed residents of native alternatives to known invasive plants. 2) Control or eradicate invasive plant and animal species. Coordinated efforts with a watershed perspective should be made to develop site-specific invasive species management plans for public and private lands for the watershed's most troublesome invasive species. 3) Native habitat restoration. Improve natural habit through increased planting of native species, restoration of degraded habitat and reversal of ecosystem damage and system alteration caused by storm water and invasive species. 4) Improve storm water management practices in the watershed. Storm water itself disturbs natural communities and creates openings for invasive species. The nutrients and sediment loads carried by storm water further create conditions that are favorable for invasive plant species.

GRASSLAND BIRDS IN SOUTHWESTERN WISCONSIN: THE IMPORTANCE OF PRAIRIE REMNANTS

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Tallgrass prairie habitat across the Midwest has been reduced to less than 1% of its historical acreage. Southwestern Wisconsin was historically prairie and savanna, but most of these habitats were rapidly converted to agriculture after European settlement. The remaining prairie remnants, though small, continue to be important habitat for grassland birds, however. We studied the habitat use and productivity of grassland birds in dry and dry-mesic prairie remnants and surrogate grasslands (pasture and Conservation Reserve Program [CRP] lands) in the Military Ridge area of southwestern Wisconsin in 2001–2003. Prairie remnant sites were typically mosaics of native vegetation patches and areas of exotic cool season grasses. Areas of remnant prairie sod were degraded to varying degrees due to different amounts of grazing pressure in the past. Vegetation structure on these sites ranged from sparse and short to relatively thick, tall stands with a heavy litter layer; some woody vegetation was usually present. Species occurrence varied with vegetation structure. We found sparrows (grasshopper, field, song, clay-colored, savannah, Henslow's, and vesper), Eastern meadowlarks, bobolinks, upland sandpipers, and horned larks in or near prairie remnants, with most species nesting within areas with native vegetation (Henslow's sparrows preferred the taller cover of exotic grasses). We found more nests/area (all species combined) in prairie remnant sites than in pasture or CRP, but overall productivity was lower in these remnants. Overall productivity was highest in CRP, but numbers of nests were low. Grasshopper sparrow and Eastern meadowlark occurred at relatively high densities in prairie, and grasshopper sparrows nests were found most often in prairie. Management in the study area is focused on grasslands and grassland birds, with efforts underway by The Nature Conservancy and others to protect remaining prairie and grassland and restore native vegetation to relatively large areas. Our work shows the importance of the remaining prairie to species such as the grasshopper sparrow, that depend on the short vegetation structure found in dry to dry-mesic prairie stands.

SEEDS CARRIED IN SHED FUR OF BISON GRAZING IN THE NEBRASKA SANDHILLS

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An estimated 30 million bison (*Bison bison*) grazed in prairie regions of North America prior to Euroamerican settlement. Bison may be a vector for epizoochory (external adhesion and

dispersal of seeds by animals) in prairie ecosystems. To investigate epizoochory by bison, shed bison fur was collected at The Nature Conservancy's Niobrara Valley Preserve in late May and June of 2002 and 2003. The preserve has around 350 bison that graze in approximately 500 ha of Nebraska Sandhills prairie. Much of the shed fur was found in trees that were rubbed by bison. The collected fur was sorted and floral propagules contained in the fur were identified. The majority of propagules found were from blue grama (*Bouteloua gracilis*), hairy grama (*Bouteloua hirsute*), little bluestem (*Schizachyrium scoparium*), and mat sandbur (*Cenchrus longispinus*). Other propagules commonly found were from big bluestem (*Andropogon gerardii*), sand bluestem (*Andropogon hallii*), Indiangrass (*Sorghastrum nutans*), cheatgrass (*Bromus tectorum*), and little barley (*Hordeum pusillum*). More than 96% of the 1,277 propagules found in the 2002 fur samples were from the Poaceae (grass family). The propagules of many Poaceae found in the Nebraska Sandhills have multiple potential adaptations for epizoochory. The possible historical role of bison in the distribution of plant species in the Great Plains will be discussed.

ROTATIONAL GRAZING OF SCOTTISH HIGHLAND CATTLE FOR SHRUB MANAGEMENT IN OAK SAVANNA RESTORATION

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Fire is one mechanism used for savanna recovery, but not always successful at reducing dense concentrations of shrubs. This study compared impacts of fire and rotational grazing on shrub and herbaceous layers within overgrown oak savanna (canopied) and interspersed prairie pockets (non-canopied). A randomized complete block design with five replicates was established at Yellowstone Lake Wildlife Area in southwest Wisconsin. Each block was divided into four 1-acre paddocks randomly assigned to control, burn, graze, and burn/graze. Scottish Highland cattle grazed two days on each paddock within each block per rotational cycle. Paddocks were grazed for a cumulative total of eight and six days during the first and second years, respectively. Shrub density and height and herbaceous cover were sampled each year. Shrub stem density declined under both grazing ($P = .0005$) and fire ($P \leq .0001$) in canopied areas. Shrub height declined with burning ($P = .0074$). There was no significant burn-graze interaction. Species-specific responses were dependent upon the vegetative zone. Within grazed canopied zones, stem densities of *Rubus* spp. ($P = .0236$), *Xanthoxylum americanum* (prickly ash) ($P = .0008$), and *Corylus americana* (hazelnut) ($P = .0023$) declined. Fire had no impact on brambles ($P = .3304$) but reduced the densities of *Ribes missouriensis* (gooseberry) ($P = \leq .0001$) and *Cornus racemosa* (gray dogwood) ($P = .0077$). Several exotic forb species increased within the fire treatments ($P = .0251$). Within non-canopied zones, prickly ash density declined with fire ($P = .0498$) and native grass cover declined with grazing ($P = .0275$). Weed species cover increased within the burn/graze treatments ($P = .0293$).

NATURAL AND CULTURAL HERITAGE MANAGEMENT AT RED CLOUD CEMETERY PRAIRIE

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Red Cloud Cemetery Prairie is located near Castleton, Northumberland County, Ontario. This Rice Lake Sand Plain prairie remnant has been severely impacted by: cemetery plots; the establishment of a memorial, red pine grove; invasive, alien ornamentals planted at grave sites and by fire suppression. Priorities of the Red Cloud Cemetery Management Board are the conservation of the grave markers, retention of a portion of the memorial pine grove, poison ivy control and the establishment of a trail network to facilitate access to the tombstones and the prairie. During the past ten years, management efforts towards fostering both the development and promotion of the tall grass prairie and the cultural heritage of the cemetery have been "undertaken." Efforts specific to prairie restoration include: base data collection and monitoring; red pine removal; prescribed burns; invasive, alien species removal and the production of interpretive signage and brochures. The prairie is responding well to restoration efforts: coverage by native prairie species has increased significantly as the alien component has been reduced, species composition has shifted noticeably and diversity has increased as several "new" species have appeared. A delicate balance between conserving the prairie and maintaining the cultural heritage has made for a challenging involvement at Red Cloud. A history of the efforts of the cemetery board, volunteers, researchers and funding agencies with management of this provincially unique site will be presented.

BIG UGLY COWS MIGHT HELP KEEP PRAIRIES BEAUTIFUL

Chris Helzer, Land Steward

The Nature Conservancy, Aurora, NE 68818

Notwithstanding their reputation amongst many prairie enthusiasts, cattle may turn out to be an excellent tool for managing and improving both restored and remnant prairies. In south-central Nebraska, The Nature Conservancy has been conducting research on the effects of cattle grazing on both restored and remnant prairies. In general, the results have shown that with appropriate stocking rates and grazing systems, cattle much prefer to graze grass, even those forbs normally thought of as vulnerable to cattle grazing. This creates a competitive edge for both short-lived and long-lived forbs that should lead to higher plant diversity. In particular, a system called patch-burn grazing has shown very positive effects on

both high-diversity prairie restorations and moderate-diversity remnant grasslands. In addition, data have shown that cattle can be useful tools for dealing with other prairie management challenges by suppressing exotics, encouraging seed germination and seedling survival, and providing targeted disturbances to keep the plant community strong and diverse.

COMPARISON OF TWO LARGE-SCALE HIGH-DIVERSITY PRAIRIE RESTORATION PROJECTS: CENTRAL PLATTE RIVER, NEBRASKA AND KANKAKEE SANDS, INDIANA. Part 1.

Chris Helzer, Land Steward

The Nature Conservancy, Aurora, NE 68818

In 2003, The Nature Conservancy (TNC) implemented a Grassland Restoration Network as a tool to facilitate the sharing of information and resources between large-scale grassland restoration projects across the country. The Network now includes ten landscape-scale sites, and more than 20 partner organizations in 12 states and Canada. Two of the mentor sites in the Network are the Central Platte River in Nebraska and the Kankakee Sands Restoration Project in Indiana. The two sites have similar restoration objectives, but striking differences in the methods employed toward meeting those objectives. The Central Platte River harvests seeds mainly from remnant and restored prairies, broadcasts the seeds onto recently harvested crop fields with no packing, mowing, or other follow-up treatments, has very loose guidelines for seeding rates for each species, and manages established restorations with both fire and grazing. The Kankakee Sands site is developing an extensive seed nursery to provide much of its seed, has used various seeding and follow-up treatment methods, has strict seeding rates for each species planted, and plans to manage established plantings mainly with fire. In spite of these differences, both sites feel good about their progress toward their objectives – though each has benefited from improved communication and collaboration with the other site. There are some common hurdles encountered by any large acreage restoration, but good planning and the flexibility allowed by willing adaptive management can help to overcome them. We will discuss how sharing information has helped to improve our restorations and how planning has helped to keep us on course. We will also give examples of site-specific problems and how we are solving or at least attempting to solve them.

EFFECTS OF PLANT DIVERSITY ON ANIMAL COMMUNITIES IN NORTHWEST MN RESTORATIONS

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Early restorations and programs such as CRP concentrated on establishing grasses. More recently we have begun to concentrate on establishing forb species within this grass matrix. However, this can be expensive and time-consuming. One purpose of prairie restorations is to provide habitat for animal species. The goal of this research is to determine whether increasing plant diversity and abundance had positive feedbacks in animal populations and communities. This study was conducted on a series of paired USFWS restoration sites in northwestern Minnesota. Half of the sites were planted with a low-diversity, primarily grass, mix. The other sites were planted with a high diversity forb mix. Plant diversity was censuses at three permanently marked 50-m transects at each site for two years. Residual vegetation structure was measured during the early part of the growing season to determine available nesting material and cover for birds and small mammals. Small mammal populations were censused using two 4-day trapping periods. Terrestrial insects were collected weekly with sweep nets and pitfall traps. Butterflies were identified and recorded during weekly censuses. Songbirds were censused in the morning during May. Results will be used by USFWS to determine the best seed mixes for prairie wildlife in this region.

ESTABLISHING AND MAINTAINING NATIVE GRASSES IN PASTURE ECOSYSTEMS

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Only a small fraction remains of Wisconsin's native prairie and oak savanna habitats. Prairie restorations on public land and through cropland retirement programs such as the Conservation Reserve Program have increased the amount of area in native vegetation in recent years. Native plant restoration may occur on wider areas if native plantings can be incorporated into working pasture ecosystems. Although grazing by native ruminants was an integral component of prairie ecosystems, grazing by domestic livestock has long been viewed as detrimental to native prairie. We are evaluating grazing management effects on the establishment and maintenance of prairie grasses to produce a blend of production and conservation benefits. Products of these studies will include grazing management guidelines, ecosystem responses to management, and forage yield and quality estimates. We seeded warm-season grasses (big bluestem, switchgrass, Indiangrass) into a cool-season pasture in Spring Green, WI in autumn 2001. Tiller density in 2003 was low (5 tillers/m^2) with warm-season grass cover inversely related to cool-season sod thickness and net nitrogen mineralization. We have initiated a replicated experiment varying grazing intensity, soil amendments, and burning to determine management combinations that will promote warm-season grass establishment within productive pastures. To understand grazing effects on established native grasses, stands of big bluestem, little bluestem, Indiangrass, switchgrass, side-oats grama, and a mixture of these were established in Marquette County, WI in 1996. One or two July/August grazing events were applied annually beginning in 2001.

Native grass cover averaged 80% in 2001 and 2002, but declined to 45% by 2003. A 22% increase in non-native cool-season grass cover was observed indicating rapid re-colonization. We predict that these native grass stands will continue to diversify eventually reaching an equilibrium state. Sub-experiments will examine how changes in grazing intensity and addition of carbon and nitrogen to soils alter community trajectories.

PRAIRIE SCHOOL PROJECT: A TALLGRASS PRAIRIE CURRICULUM

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Prairie School Project is a national award-winning curriculum developed to help students study many aspects of the tallgrass prairie. The goal of Prairie School Project is to encourage environmental stewardship and ecological restoration of the Illinois tallgrass prairie by instilling a sense of the uniqueness and local biodiversity of native prairie habitats. This project is both broad and deep in its approach. We address topics as diverse as prairie history, animals of the prairie, food web interactions, prairie plant identification and botany, types of prairies, and climatic conditions that formed the prairie. Within many of these topics there are several activities to choose from and extensions to encourage classes to delve as deep as they wish. The project includes a manual containing over 30 hands-on activities and support materials. One section of the manual gives a detailed plan for planting a schoolyard prairie. This plan takes the students through all the steps from collecting seeds in the prairie, to growing plants in their classroom, and finally planting their seedlings in their schoolyard. Other materials include two CDs, containing teaching aids that are easy for teachers to reproduce and use, and an extensive set of prairie animal and plant images and descriptive profiles. The manual and CDs are available to people who participate in one of our Prairie School Workshops. We have held Prairie School workshops throughout the state of Illinois impacting over 200 teachers. Through our materials and our workshops we are introducing teachers and students to the beauty, diversity and value of the prairie. We hope that as they learn more about the prairie they develop a sense of place and maybe even becoming stewards of the tallgrass prairie ecosystem.

ALDO LEOPOLD AND THE WILD PRAIRIE ORCHIDS: A VIDEO DOCUMENTRAY

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This 45-minute video covers the story of professor Leopold at Faville Grove and what became the beginning of prairie preservation in Wisconsin. The video also touches upon the beginnings of prairie restoration with the public prairie plantings at the UW Arboretum and the Leopold Family project at "The Shack." A discussion of the making of the video will follow.

THE ECOLOGY OF BULLSNAKES (*PITUOPHIS CATENIFER* SAYI) IN UPPER MIDWESTERN PRAIRIES

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Bullsnakes (*Pituophis catenifer sayi*) are the largest snakes native to the Upper Midwest. Despite having a close association with oak savannas/sand prairies and experiencing significant population declines within the past several decades, little research has been conducted on these snakes in the Upper Midwest. Objectives of this study include determining: 1) general habitat preferences for thermoregulation, hibernation, nesting, and foraging; 2) home range size and movement rate; and 3) the effects of agriculture and prairie management techniques (i.e. controlled burning) on home range sizes and habitat preferences. Radio telemetry equipment was used to track 20 snakes (11 males, 9 females) during periods of activity in 2003 (and is currently ongoing). Upon location with telemetry equipment (at least weekly) location data, and several structural habitat and environmental parameters were recorded. Because controlled burns, invasive vegetation species removal and pesticide application are often incorporated during prairie restoration/management, it will be useful to know the response of bullsnakes to such activities. Currently, both of the study sites are part of a habitat management plan that includes scheduled spring burning of specified areas, and snake responses to this management is being documented. While no difference was found in the Overall Movement Rates (OMR) of male and female snakes, a significant difference in the size (Ha) of Minimum Convex Polygon home ranges between male and female snakes was observed. Male snakes utilized Open Bluff Faces (27.8%), Bluff side Closed Canopy Forest (17.9%) more frequently; females utilized Open Bluff Faces (20.5%), Oak Savanna (18.2%). It was determined by chi-squared analysis that snakes did not select habitat based on the proportion in which it was available and three habitat types were used less often than expected, while two were used more often than expected.

SNAKE USE OF GRASSED WATERWAYS IN SOUTHEASTERN IOWA

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Prairie once dominated the Iowa landscape and has largely been replaced by row-crop agriculture and non-native herbaceous habitats. In some areas of the Midwest, grassland strip-cover habitats, such as roadsides, field borders, fencerows, and conservation buffers strips constitute a significant proportion of the grassland habitat available to wildlife. Buffer strips are primarily established to reduce soil erosion and improve water quality, but

are also managed to provide suitable habitat for wildlife. Grassland buffer strip use by snake species is relatively unknown, however. We evaluated the effects of the local habitat characteristics and the composition and configuration of the surrounding landscape on snake use of a conservation buffer-strip practice, grassed waterways, in southeast Iowa. Through the use of artificial shelters placed in 31grassed waterways, we captured 119 individuals of five snake species. Capture frequency declined substantially by the last week in June; 70% of the captures occurred from mid–May through mid–June. The brown snake (*Storeria dekayi*) was the most common and abundant species in grassed waterways. We encountered the smooth green snake (*Lioclonorophis vernalis*), a species of special concern in Iowa, at nearly 25% of the sites. Both local and landscape variables helped to explain snake occurrence in grassed waterways. Among the local variables that we measured, waterway width occurred most frequently in local variable models and was positively associated with the presence of three snake species. The occurrence of snake species was also associated with the amount of herbaceous cover in the landscape and the proximity of a grassed waterway to both herbaceous block cover and wooded habitat. The value of grassed waterways to snakes may be enhanced by a multi-scale approach to waterway management and design. Grassed waterways, a buffer-strip practice, may provide valuable grassland habitat for snake species in Iowa.

PRAIRIE RESTORATION, RAISING THE BAR

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For the past decade or so, standard prairie restoration processes have resulted in the establishment of 20 to 40 species in a relatively uniform pattern with grasses dominating. Many prairie restoration practitioners have become complacent in their acceptance of this standard. A natural remnant prairie however, may contain 100 or more species in a patchwork pattern. This presentation suggests ways to increase the diversity and success of prairie restorations significantly without raising costs substantially and includes many of the opinions that have formed in this field. Specific examples of prairie restoration designs and their relative success will then be presented with particular emphasis on The Nature Conservancy's Kankakee Sands project in northwestern Indiana.

GAUGING ECOLOGICAL RESTORATION SUCCESS AT CURTIS PRAIRIE: ASSESSING STRUCTURE AND FUNCTION USING COMPARATIVE MEASUREMENTS OF THE CARBON CYCLE

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Frequently, the measuring stick of restoration success through time has been through studies of plant species abundance, animal and insect biodiversity, and using our visual senses. Allison (2002) suggested that the ultimate goal of early restoration efforts was to have "complete restoration" or the establishment of a community of plant species that approximate similar proportions and frequency found within undisturbed ecosystems so that natural processes thrive. We interpret this statement to mean that both above- and below-ground structure and processes should be re-established in unison. The few prairie studies that exist have generally failed to provide descriptions of soil and vegetation responses, which are highly influential to ecosystem structure and function, and impact longer-term vegetation dynamics. In response, we initiated measurements of the carbon cycle and vegetation structure in remnant and planted portions of Curtis Prairie at the University of Wisconsin Arboretum on the same soil series in 2001. Results from two field seasons (2002–03) illustrate that aboveground similarities are significant between the prairies. The recreated species community appears to function similarly to the adjacent prairie remnant when assessed in terms of plant phenology, maximum leaf area index (~4.2), total soil CO_2 respired, and aboveground productivity. However, other data (e.g., soil carbon and bulk density, root biomass, and soil pH) suggests that complete soil recovery has not taken place. Peak root biomass was 800 g m^{-2} in the remnant portion and only 575 g m^{-2} in the planted portion. Interannual variability in weather and varied fire management look to be the primary causes of varied aboveground productivity (~820 g m^{-2} in 2002 and ~585 g m^{-2} in 2003) between the two years. Further study of the trajectories of ecosystem properties over time will help elucidate whether observed carbon cycling differences are a direct result of land-use history or subtle differences in soil moisture.

ECOSYSTEM RESTORATION AT THE SCUPPERNONG RIVER HABITAT AREA IN SOUTHERN WISCONSIN

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The WI Department of Natural Resources (DNR) initiated a 3,500-acre low prairie restoration in 1999 within the Kettle Moraine State Forest-Southern Unit in southeast Wisconsin, containing fens, wet-mesic prairies, sedge meadows, oak savannas, and degraded wetlands in the former Scuppernong Marsh. Before the DNR purchased the land beginning in the 1940s it was used by farmers for growing crops, harvesting marsh hay, and pasture land. The restoration includes two state natural areas. Restoration management includes brush mowing, tree cutting and large scale prescribed burning on 1,500 acres. By 2004, the area has changed significantly. Degraded prairie areas are increasing in quality and high quality prairie remnants are being connected. New populations of state endangered and threaten plants have been discovered, including small white lady's-slipper (*Cypripedium candidum*), prairie Indian plantain (*Cacalia tuberosa*), and eared false foxglove (*Tomanthera auriculata*). The foxglove was thought to have been extirpated, but was discovered shortly after a prescribed burn. Prairie wildlife

being benefited includes northern harrier, short-eared owl, Henslow's sparrow, bobolink, and the federal endangered butterfly, Powesheik skipper. The Kettle Moraine Natural History Association (KMNHA), a local friends group, is coordinating fund raising efforts. To date, KMNHA, private foundations, state and federal grants, and private individuals have provided $200,000. If adequate funding can continue it may be possible to complete restoration of a large part of the area by 2010. This site is located near a large urban population, which provides a great opportunity to raise awareness and appreciation of the prairie community. When completed this will be the largest low prairie east of the Mississippi River and would be a prime tourist attraction.

USE OF PHOTOGRAPHY IN THE IDENTIFICATION, PROTECTION, AND RESTORATION OF TALLGRASS PRAIRIE

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The use of photography has played a very important role in the identification of prairie remnants, which has lead to their protection and management. Numerous individuals have been inspired by the photos of high-quality prairie and as a result have assisted in the prairie conservation movement. The species diversity of new prairie reconstructions has also been increased when landowners see photos of the potential outcome. This paper will use color slides to show numerous examples.

WRITING ABOUT THE PRAIRIE: A WRITING WORKSHOP

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Whether you're an ecologist, educator, prairie advocate or enthusiast, this hands-on writing workshop will give you helpful tips—and practice—in writing about the prairie. In addition to doing some in-session writing exercises, we'll also talk about the different forms this writing can take: professional or trade journal articles; opinion pieces; popular science articles; literary essays; or personal journal entries. All levels of writers welcome. Carol LaChapelle is a Chicago-based writer and writing consultant who specializes in teaching adults to write. She has conducted workshops and worked one-on-one with scientists, physicians, teachers, business people, counselors, writers, and the general public. For more information, see her Website, www.carollachapelle.com.

BUTTERFLY NECTAR PLANTS OF THREE EASTERN NEBRASKA PRAIRIES

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In conjunction with Pollard Transect butterfly surveys, we recorded all observations of nectaring butterflies at two prairies near Omaha, Nebraska, and one prairie near Lincoln, Nebraska, in the summers of 2002 and 2003. Study sites were Allwine Prairie, a 64-ha restored prairie; Bauermeister Prairie, a 12-ha prairie remnant; and Ninemile Prairie, a 97-ha native prairie. Twenty weekly surveys were conducted at Allwine and Bauermeister Prairies each summer. Four monthly surveys were conducted at Ninemile Prairie each summer. At Allwine Prairie, 1,237 records from 26 butterfly species on 32 plant species were obtained in 2002, 470 records from 26 butterfly and 31 plant species in 2003. At Bauermeister Prairie, 503 records from 25 butterfly species on 28 plant species were obtained in 2002, 268 records from 27 butterfly and 30 plant species in 2003. At Ninemile Prairie, 79 records from 12 butterfly species and 16 plant species were obtained in 2002, 71 records from 16 butterfly and 21 plant species in 2003. We present findings on importance of particular plant species in different habitat types at the study sites, on nectar plant usage by particular butterfly species, and on degree of nectar plant specialization of different butterfly species. Nectar plant usage by butterfly species of particular interest, such as monarchs and regal fritillaries, will be highlighted.

THE RARE PRAIRIE PLANTS OF FORT MCCOY MILITARY RESERVATION

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Fort McCoy Military Reservation is a 60,000-acre Army training facility located in west-central Wisconsin. The region prior to Euro-American settlement was largely oak savanna with large wetland complexes. The sandy, nutrient-poor drought-prone soil and frequent wild fires helped maintain much of the savanna-like character of the uplands and openness of some wetlands. In 1991 and 1992 I searched much of the Fort for rare plant populations and have sought new populations in the area ever since. In this talk, I report on occurrences of rare prairie-plant populations, with insights regarding habitat and conservation threats. Perhaps the flagship species for compatibility with military training is *Talinum rugospermum*, which appears to thrive in very small disturbances. Other rare species persist mostly on steep slopes or other out-of-the-way places. Some species seem to be restricted to prairie remnant habitat (i.e., *Artemisia dracunculus, Polytaenia nuttalii*). Other species occur primarily in previously heavily disturbed locations (i.e., *Gentiana flavida, Opuntia fragilis, Rhexia virginica)*. While with others, it's just not clear (i.e., *Asclepias ovalifolia, Polygala cruciata, Prenanthes aspera,* and *Scleria triglomerata*). In the past, the survival of rare plants at the fort was incidental to military activity. With over 100,000 personnel trained per year, the land is disturbed, but in ways much different than elsewhere in Wisconsin. Generally, military trainers prefer the open landscapes of prairies and savannas and perceive value in helping maintain that landscape. In recent years, the fort's Natural Resource Management Division has taken a pro-active approach to rare species protection, such as placing three areas in the Wisconsin Natural Areas Program. In addition, an

ecosystem approach to protecting the federally protected Karner blue butterfly may benefit rare plants. However, the long-term co-existence of the military and rare species is by no means assured.

THE VANISHING PRESENT: DETERMINANTS OF CHANGE IN PRAIRIE FRAGMENTS

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Humans may not perceive slow change in natural vegetation. To document long-term change, scientists in Wisconsin are resampling places originally sampled by John Curtis and his colleagues in the 1940s and early 1950s. In this talk, we report from Wisconsin prairie fragments, focusing on changes in diversity and composition, their presumed underlying processes, and their implications for prairie conservation. Contrary to what you might expect, in general, the numbers of plant species found in prairie fragments has increased at small, medium, and large scales. This may sound positive, but a closer look reveals that habitat-generalist species compose the bulk of increase. The underlying processes are complex, involving both the under-appreciated invasibility of grasslands and a novel landscape that is chockablock with generalist species. Fire suppression exacerbates community instability, increases loses of habitat specialist species, and hammers formerly abundant species. In contrast, the growth of trees and shrubs (up to a point) had much less affect on change, perhaps because of the high floristic similarity among prairies and oak savannas. The losses of originally sparsely distributed species was very high (48 to 84%), but were not influenced by fire regime or woody canopy. The results suggest that conservation efforts benefit more from focus on fire than on woody plant control, and that more could be done to decrease immigration, and protect those populations that are most at risk, such as through restrictions on seed harvesting.

WISCONSIN'S GLACIAL HABITAT RESTORATION AREA (GHRA) PROGRAM: FOURTEEN YEARS OF ECOLOGICAL SCATTERED PATTERN MANAGEMENT

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Started in 1990, thanks in large part to WDNR initiative and Wisconsin legislative recommendations, Wisconsin's GHRA program is attempting to utilize a landscape scale approach to habitat management to recreate and incorporate grassland restoration and enhancement, and wetland restoration, back into the rural agricultural landscape. The primary wildlife focus of the program is to establish self-sustaining populations of upland nesting wildlife, specifically grassland songbirds, waterfowl and ring-neck pheasants. The specific habitat objectives of the program are to establish 38,600 acres of permanent grassland nesting cover and restore 11,000 acres of wetlands within 24 townships (530,000 acres) in Columbia, Dodge, Fond du Lac and Winnebago Counties. In order to accomplish those objectives fee-title acquisition, conservation easements, cost sharing, and partnerships with other agencies are all utilized. Project biologists rely on Geographic Information System (GIS) habitat suitability models to determine the land most suitable for restoration. GIS is also being implemented to efficiently manage the acquired properties. Fourteen years into the program, over 24,000 acres of grassland, primarily native warm season prairie, and over 7,000 acres of wetlands associated with those grasslands have been restored. In addition, over 13,000 acres has been permanently protected through the GHRA's easement or fee-title acquisition programs.

RESTORATION OF CAJUN PRAIRIE IN SOUTHWEST LOUISIANA, INSTANT GRATIFICATION: MYTH OR METHOD

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Cajun Prairie once covered 2.5 million acres in southwest Louisiana but has been reduced by agricultural practices (tilling) to less than 100 acres in small, disjunct remnant strips along railroad rights of way. This means that restoration is in the forefront of preserving this rapidly disappearing ecosystem. Also to be able to educate the public in hopes of creating a trend that increases the amount of Cajun Prairie through further restoration the sooner there are more examples the greater the chance said activity will occur. Based on observation and activities in restoration projects during the last several years it is quite apparent that though you can transplant prairie to a restoration site in large quantities there by creating "instant gratification" said plant material still needs time to become re-established in its new site. Even with the over seeding of prairie species on sites where transplanting occurs it appears that it takes two to three years before one will find a visual "instant gratification". This conclusion is based on three particular projects. The first, which is entering its third year, is located at my home in east Texas. The second is located in Eunice, Louisiana in what was once the heart of the Cajun Prairie and is entering its second year since transplanting and over seeding. The third was only transplanted this past winter and is located a few miles south of Eunice and is the only project that was not over seeded with prairie species as of this moment. The data for each project include dates and times of activity, amount of transplants, and the amount of seed applied (when applicable). It is only through follow up visual inspects that one realizes that though the material is on site it does not give a visual picture of established prairie or "instant gratification" for the first couple of years or what could be called the establishment period.

PRELIMINARY RESULTS OF THE FLORISTIC AND GEOGRAPHIC CENSUS OF TALLGRASS PRAIRIES IN QUETICO PROVINCIAL PARK

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This paper will present the preliminary results of our analysis of tallgrass prairies in Quetico Provincial Park. There have been numerous records of tallgrass species being found in the park but no research has ever been done on the topic. We have performed a quadrate based floristic composition survey to identify all constituent species within suitable sites. At each location, qualitative measurements of soil type and moisture, soil charcoal presence/absence, evidence of forestry activity and ecotone sharpness were made to determine a relative assessment of habitat stability (a key component in any vegetation management consideration- i.e. what is the point in concentrating a conservation effort on an area that is naturally succeeding into another habitat type). In addition to this biotic analysis we have also performed a geographic analysis in order to identify any correlations that exist between tallgrass prairies and landscape features such as cliffs or rivers. Field sites have been identified using several methods including: historical records analysis, plant records analysis and aerial photo interpretation. Preliminary research indicates the presence of northern pin oak (*Quercus ellipsoidalis*) at several sites and the researchers have personally observed other big bluestem (*Andropogon spp.*) species at other sites. Vegetation records of the park are sparse and rarely focused on grasses, which further underlines the importance of this research. Preliminary research indicates a possible correlation between tallgrass prairie location and abandoned logging camps as well as a possible link with the cliff environments that are prevalent throughout the southeastern and central portions of the park.

CAN CRP GRASSLANDS RESUSCITATE TROUT STREAMS IN SOUTHWEST WISCONSIN?

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In southwest Dane and southeast Iowa counties, participation in the USDA Conservation Reserve Program (CRP), since its inception in 1986, has been high and yielded many environmental benefits. CRP grasslands now account for approximately 20% of the Military Ridge Prairie Heritage Area (MRPHA). As land use changed from row crop to CRP, phosphorus and other pollutants in nearby trout streams were expected to decline. Fish communities in local streams ultimately shifted from populations dominated by eurythermal tolerant species to stenothermal coldwater communities, more typical of healthy trout streams. These changes include both greater brown trout abundance and improved coldwater Index of Biotic Indegrity scores. The biological data suggests that both water quality improved and favorable cold-water temperatures were restored in the streams. Intensive water chemical sampling and modeling were not performed on these streams. However, phosphorus export coefficients and unit area runoff rates, derived from similar land uses in nearby watersheds, indicate that phosphorus loading declined by approximately 80% and surface runoff water declined by approximately 70% from CRP lands. The information suggests that maintaining these grasslands is essential for sustaining the healthy trout streams.

ESTABLISHMENT AND PERSISTENCE OF PRAIRIE SPECIES AT VARYING SEEDING DENSITIES

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The loss of prairie throughout the Midwest has created an interest in prairie restoration. Despite efforts, critics say that we have yet to create an authentic, diverse prairie. Restorations tend to have lower structural diversity and lack conservative species. While previous studies have examined the effects of seed mixes and planting methods on diversity, the issue of seeding density has not been adequately addressed. Therefore, we are examining the effect of seeding density on the establishment and persistence of prairie species. Three study sites were planted on the Leopold Memorial Reserve in Baraboo, WI – one in November 2001 and two in November 2002. All study sites have similar topography and soil type. The 2001 site consists of 45 species and the 2002 sites consist of 48 species. Each study site was divided into three replicates comprised of four treatments. Treatment areas were planted at 100, 200, 400 or 800 seeds/m^2. In 2003, all sites were sampled through the use of presence/absence walk-throughs. The 2001 site was additionally sampled for rooted frequency and percent cover in twenty 1-m^2 plots within each treatment area. In 2003, presence/absence data indicated that all seeding densities have similar diversities and rooted frequency data revealed higher densities of planted individuals found at higher seeding densities, but a higher percentage of planted individuals found at lower seeding densities. Data collected in 2004 continue to reveal interesting trends.

WHAT ASPECTS OF COMMUNITY STRUCTURE AND ECOSYSTEM PROCESSES ARE RESTORABLE IN TALLGRASS PRAIRIES?

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We do not know what parts of community structure and ecosystem processes are restorable for tallgrass prairies, yet this

information is crucial for producing successful restorations. We quantified success of eight- to ten-year-old plantings in a large-scale tallgrass prairie restoration in Iowa (Neal Smith NWR) by comparing it to three reference sites. The restoration included both native ungulates and fire, which are two important regulators of species diversity and patchiness in intact grasslands, but which have not been simultaneously incorporated into studies of restoration success. We used the additive partitioning model, where α diversity is quadrat-scale diversity and β diversity is accumulation of species diversity with distance. We decomposed α diversity into its richness and evenness components to determine if both components were restored. Aboveground net primary productivity and proportion of exotic biomass were similar to remnant levels, but proportion of exotic species remained 2.4–4.0 times higher in the restoration. Alpha scale evenness was similar to remnants, but α scale richness and diversity (Simpson's) were 1.7–2.3 and 2.1–2.3 times higher in remnants. The restoration and remnants differed in fundamental ways in their degree of patchiness: the proportion of β species richness was 3.5–3.9 times higher in remnants, whereas the proportion of β diversity (1–D) was 2.0–2.2 times higher in the restoration on two sampling times, possibly because patches of individual species were larger in the restoration. Our results suggest that NPP and proportion of native biomass can be restored more quickly than proportion of exotic species and the richness component of diversity. Our results also suggest that β diversity may be the most difficult aspect to restore, even with the positive influence of native ungulates and fire, without restoring the species pool.

MESIC PRAIRIE RESTORATION AT MADISON AUDUBON SOCIETY'S GOOSE POND SANCTUARY IN COLUMBIA COUNTY, WISCONSIN

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Madison Audubon Society (MAS) is conducting a large tallgrass (mesic) prairie restoration at Goose Pond Sanctuary in Columbia County, Wisconsin. The Sanctuary is located 15 miles north of Madison in the former Arlington (Empire) Prairie. MAS began acquiring land at Goose Pond in 1967 to protect a prairie pothole and to provide a waterfowl refuge. In the 1990's land acquisition and prairie restoration at Goose Pond greatly expanded. Currently MAS owns 530 acres and has restored 200 acres of prairie. Madison Audubon Society is also working on prairie restoration with three local landowners who have 110 acres entered into the federal Conservation Reserve Program. By 2010, plans are to have 450 acres restored to prairie (400 acres of mesic prairie and 50 acres of dry-mesic prairie) on MAS land and nearby private lands. Grassland birds benefiting from the prairie restoration include sedge wren, dickcissel, and common yellowthroat. The restoration goal is to plant species using seed from southern Wisconsin. More than 100 species have been planted including five rare species. Seed for early restorations was collected at the UW–Madison Arboretum. Seed has also been collected from local prairie remnants. Older restorations now provide seed collecting opportunities. Forb seed is hand-collected and grass seed is collected using a seed stripper. Some seed and plants are purchased. Seed is hand-planted in fall on harvested soybean fields. Volunteers and interns conduct most of the prairie restoration efforts. Madison Audubon Society members, conservation organizations and state and federal grants provide funding for land acquisition and restoration. Madison Audubon Society assists private landowners, conservation organizations, and government agencies with prairie restoration projects. Education activities include tours, workshops, and an annual MAS public event—Prairies Jubilee.

EFFECTS OF GREY DOGWOOD INVASION ON PLANT COMPOSITION AND SPECIES RICHNESS

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The frequency of occurrence of *Cornus racemosa* (grey dogwood) in the Curtis Prairie at the University of Wisconsin Arboretum has been increasing steadily since 1951 raising concerns about the effects of this trend. This study examined the response of plant species richness and average coefficient of conservatism along the gradient of increasing *C. racemosa* dominance. In August of 2003, using 1-m^2 quadrats, data were collected on *C. racemosa* height, basal area, stem density, and percent cover and prairie plant presence/absence and percent cover. Average coefficient of conservatism decreased in response toincreased *C. racemosa* height, basal area, stem density, and percent cover while species richness decreased only in response to increased stem density. These data suggest that *C. racemosa* affects the plant community primarily by encouraging a change in plant composition. However, given the multitude of studies that have found decreased species richness along gradients of increasing shrub dominance, these data may indicate that, in the case of the Curtis Prairie, a change in plant composition is a precursor to decreased species richness in response to *C. racemosa* invasion.

PRAIRIE-SAVANNAH MANAGEMENT ON THE FORT MCCOY MILITARY RESERVATION

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Fort McCoy, an army installation in west-central WI, encompasses ~24,282 ha. The fort's primary mission is to serve as a wartime training center for reserve and active military personnel. The fort lies within Wisconsin's Driftless Area and

is floristically influenced by its proximity to the Tension Zone. The oak savanna-barren-prairie communities on the fort (~12,146 ha) are the largest contiguous block of this vegetative association in the state. To manage these communities, a five-year prescribed burn plan and an intensive invasive plant control program have been implemented. Intensive management efforts are also made for the Karner blue butterfly, (*Lycaeides melissa samuelis*), a federally endangered species and for grassland bird species. Eleven grassland bird species of management concern for WI and the U.S. Fish and Wildlife Service have been recorded. An integrated weed management plan that includes burns, mowing, herbicide applications, and biological control agents are being used to control spotted knapweed (*Centurea bierbersteinii*), leafy spurge (*Euphorbia esula*), cypress spurge (*E. cyparissias*), wild parsnip (*Pastinaca sativa*), and woody invasive shrubs. Fort McCoy encourages partnerships and research studies that allow staff biologists to better manage the diverse natural landscape.

THE DESCRIPTION OF SIX SPECIES OF MOTHS, NEW TO SCIENCE, IN EASTERN TALLGRASS PRAIRIES

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Research sponsored by a 1995–2002 U.S. Fish and Wildlife Service's Partnerships for Wildlife project to gather data about the insect fauna in the tallgrass prairie region of Illinois, Indiana, Iowa, Minnesota, Ohio, and Wisconsin, administered by the Wisconsin Department of Natural Resources, led to the discovery of six species of moths new to science. The project involved several scientists in a variety of endeavors to learn more about the insect fauna of tallgrass prairies in the Midwest. Moths were inventored at 21 prairie sites in Ohio, eight prairie sites in northwestern Indiana, and two prairie sites in northwestern Iowa by Eric H. Metzler. Leslie A. Ferge inventoried moths in 21 prairie sites in Wisconsin, and George Derkovitz Jr., Karl Gnaedinger, and Ron Panzer collected moths in Illinois. In Ohio, Indiana and Iowa, 94,000 individual moths were captured and identified to species—more than 1,100 species are documented. Identification of the moths revealed eight species new to science. Descriptions of six species were published and are illustrated here. More specimens are required before publication of the remaining two species can proceed. The newly described species are *Neodactria glenni* Landry and Klots (Crambidae), *Gnorimoschema huffmanellum* Metzler and Adamski (Gelechiidae), *Glyphidocera wrightorum* Adamski and Metzler (Glyphidoceridae), and *Aethes patricia* Metzler, *Cochylis ringsi* Metzler, and *Spinipogon resthavenensis* Metzler and Sabourin (Tortricidae). *Gnorimoschema huffmanellum* and *Glyphidocera wrightorum* were named to honor Huffman Prairie, near Dayton, Ohio, which the Wright brothers used as flying field. *Spinipogon resthavenensis* was named to honor the prairies at Resthaven Wildlife Area at Castalia, Ohio. All of the species, except *Cochylis ringsi*, appear to be prairie-dependent species.

THE RED-HEADED WOODPECKER: REGIONAL POPULATION DECLINES AND RECENT MANAGEMENT SUCCESSES

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Primary reasons for the decline of the red-headed woodpecker (*Melanerpes erythrocephalus)* include habitat loss and alteration, with loss or alteration of oak savanna a major factor. Oak savanna once occupied ~2.3 million ha (5.5 million acres) in Wisconsin; only ~200 ha of the original, pre-settlement-quality savanna remained as of 1995. This is less than .01% of the original area. Restoration of savanna and open oak woodlands shows much promise for restoring numbers of the red-headed woodpecker in the Midwest. Data from restoration activities at Necedah NWR show increasing use of restored areas by breeding red-headed woodpeckers, with positive results evident in just a few years' time. Improved numbers of breeding pairs are evident from point-count surveys. Habitat management guidelines resulting from restoration work focused on this species are in preparation.

GRASSHOPPER AND KATYDID COMMUNITIES OF NATIVE AND RESTORED WET-MESIC TALLGRASS PRAIRIES IN CENTRAL NEBRASKA

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Grasshopper and katydid communities were compared between three native and three restored wet-mesic tallgrass prairies along the Platte River in central Nebraska to assess both the relative success of restorations and the relationship between insect and plant communities. Insects were sampled using sweep nets in early June, mid–July, and mid–August 2000. Plant species composition was assessed in early June and mid–August. A total of 15 grasshopper and eight katydid taxa were collected, of which two were highly *remnant-dependent*. Eighty-five plant taxa were also collected. Shannon diversity (H') was significantly higher for native than for restored prairie for both grasshoppers (H' = 0.560) and katydids (H' = 0.480). Species Richness (S) differed somewhat being significantly higher for restored than for native prairie for grasshoppers (mean S = 3.0) and significantly higher for native than for restored prairie for katydids (mean S = 3.1). Both Species Richness and Shannon diversity of plants were higher at restored than at native prairies although differences were not significant, most likely reflecting the combined effects of the high-diversity seed mix used in prairie restorations and the effects of long-term management or fragmentation on native remnants. The unexpected differences in grasshoppers and katydids between native and restored prairie may be explained

by a close relationship between the distribution of insect species and the distribution of their host plants, regardless of whether a site was native or restored.

SPECIES CHANGE IN SMALL PRESERVES: MORE GAINS THAN LOSSES IN A STEWARDED SMALL PRAIRIE

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Paintin (1929) published an inventory of plant species (134) present in 10 acres of remnant prairie in Glenview, Illinois. At the time of the earliest aerial photos (1938) the remnant was completely surrounded by cultivated or commercial land. By 1956 the prairie was reduced to 5.3 acres (2.1 ha). Betz and Cole's (1969) inventory added 12 new prairie species. Since 1972 the James Woodworth prairie has been managed including regular burning. Apfelbaum and Rouffa (1981) reported seven additional prairie species. An unpublished 1995 inventory found seven more prairie species and two more have been found since 1995. None of those counts include seven deliberately introduced prairie species. In all this time only eight prairie species have disappeared. Despite the fact that this remnant has been isolated for at least 65 years, the prairie has gained 20 more prairie plant species than it has lost. Currently there are 73 exotic, 84 native but not prairie, and 126 prairie species present. Additionally, large invertebrates such as the prairie cicada, *Okanagana balli*, the walking stick, *Diapheromera blatchleyi blatchleyi*, and the grassland crayfish, *Procambarus gracilis* persist in this small remnant. Revitalization (effective management) of remnants will conserve far more biodiversity than the restoration of large tracts currently so popular.

ECOLOGY OF THE ORNATE BOX TURTLE (*Terrapene ornata*) IN A NORTHWEST ILLINOIS SAND PRAIRIE

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The ornate box turtle (*Terrapene ornata* Agassiz) is a terrestrial prairie turtle that is near the northeastern extent of its continental range in Illinois. A population of the ornate box turtle in a 64-ha landscape of sand prairie, crop fields, and lightly inhabited subdivision was studied during a single season's activity period of April through October. A total of 84 individuals were hand captured, marked (Cagle, 1939), measured/aged (Legler, 1960) and ecological observations recorded. Males comprised 65% (55) of the population captured while females made up 35% (29). Adult turtles accounted for 82% of the turtles found. While sub-adult and juveniles were only occasionally found, hatchlings were rarely observed. This is probably a result of the survey techniques used. Aging was determined by counting the annual rings on the plastron. Ecological uses by the box turtles of the study area revealed expected but interesting observations. The study area was going through an extended drought period at the time and two wildfires occurred during the activity period of the turtles. The omnivorous nature of this turtle revealed a diverse array of food items used by this animal. Thermal regulation appeared to be critical to this species in several aspects of its life history.

COMPARISON OF TWO LARGE-SCALE HIGH-DIVERSITY PRAIRIE RESTORATION PROJECTS: CENTRAL PLATTE RIVER, NEBRASKA AND KANKAKEE SANDS, INDIANA. Part 2.

Chip O'Leary

The Nature Conservancy, Morocco, IN 47963

In 2003, The Nature Conservancy (TNC) implemented a Grassland Restoration Network as a tool to facilitate the sharing of information and resources between large-scale grassland restoration projects across the country. The Network now includes ten landscape-scale sites, and more than 20 partner organizations in 12 states and Canada. Two of the mentor sites in the Network are the Central Platte River in Nebraska and the Kankakee Sands Restoration Project in Indiana. The two sites have similar restoration objectives, but striking differences in the methods employed toward meeting those objectives. The Central Platte River harvests seeds mainly from remnant and restored prairies, broadcasts the seeds onto recently harvested crop fields with no packing, mowing, or other follow-up treatments, has very loose guidelines for seeding rates for each species, and manages established restorations with both fire and grazing. The Kankakee Sands site is developing an extensive seed nursery to provide much of its seed, has used various seeding and follow-up treatment methods, has strict seeding rates for each species planted, and plans to manage established plantings mainly with fire. In spite of these differences, both sites feel good about their progress toward their objectives—though each has benefited from improved communication and collaboration with the other site. There are some common hurdles encountered by any large acreage restoration, but good planning and the flexibility allowed by willing adaptive management can help to overcome them. We will discuss how sharing information has helped to improve our restorations and how planning has helped to keep us on course. We will also give examples of site-specific problems and how we are solving or at least attempting to solve them.

A TALLGRASS AND OAK SAVANNA ECOLOGICAL RESTORATION AND COLDWATER STREAM HABITAT IMPROVEMENT PROJECT: THE SYNERGY OF PRAIRIE AND COLDWATER FISHERIES ENTHUSIASTS

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This project is a comprehensive tallgrass prairie and oak savanna restoration and coldwater stream habitat improvement effort on 98 acres in Allamakee County, Iowa and includes three trout streams. It is the project thesis that the ecological restoration of the original natural system will foster synergistic benefit beyond which restoration of any singular natural community can provide. To date, there has been limited research to assess the impact of concurrent efforts of restoring presettlement vegetation (i.e. tallgrass prairie and oak savanna) and the rehabilitation of coldwater trout streams on trout and terrestrial and aquatic insect population dynamics. Furthermore, long-term analysis of both hard armor (fish bank hides, rock riprap and tree root balls) and soft armor (coir fiber erosion control products and prairie grass and forbs bank stabilization) erosion controls, as part of a comprehensive ecological restoration project, is undocumented. This project is attempting to determine the impact of these measures and provide an evaluation of the most cost-effective means for similar comprehensive ecological restoration projects in the Driftless Area. It also brings together for the first time the collective experience and resources of tallgrass prairie restorationists and coldwater fisheries biologists and fishing advocates in a collaborative research and applied program approach. Results of the project to date will be presented and approaches used to maximize collaboration will be detailed.

WORKING PRAIRIE: COMBINING EDUCATION, RESEARCH, AND FORAGE PRODUCTION ON A WISCONSIN FARM

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Surveys suggest that many farmers are willing to maintain habitat for wildlife on their farms. In the Upper Midwest where remnant prairies are rare, incorporating prairie species into pasture systems may be an option to increase the acreage of grassland habitat. Challenges include the expense of establishment, lack of management skills and income requirements. We worked with a bison producer in south-central Wisconsin to establish a 28-acre prairie planting to serve the multiple purposes of research, education, and forage production. The farm includes 300 acres of cool-season pasture for a herd of 250 bison. Income streams include farm tours in addition to bison meat, leather goods, and breeding stock. Visitors to the farm learn about bison natural history and their role as a key component of the prairie ecosystem. In addition to its educational value, the farmer utilizes the native grass planting as late summer pasture for her bison herd. Warm season grasses complement the cool-season pastures, which often decline in production in July and August when the prairie grasses are ready to graze. The prairie pasture was seeded in 1998 using USDA Wildlife Habitat Incentives Program (WHIP) funds. It is laid out in three replicates consisting of single species strips of big bluestem (BBS), little bluestem (LBS), Indiangrass (IND), switchgrass (SWG), and side-oats grama (SOG), plus a mixture of BBL, LBL, IND, and SOG. It has been rotationally grazed once or twice annually beginning in 2000. Research goals include investigating forage quality and yield of prairie grasses and determining appropriate grazing management practices for prairie pastures.

A STUDY OF BIOTIC PRESSURES AND THEIR CORRELATIONS IN MELGHAT TIGER RESERVE, INDIA

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In a traditionally agricultural society, like India where 80% of the people are dependent upon agriculture and human population is huge, the pressures on all natural areas are tremendous. The establishment and management of protected areas is one of the effective ways of ensuring conservation of natural resources. However, in most of the developing countries, the majority of the natural areas are inhabited by indigenous people, whose sustainability within the natural area, along with wildlife values, is the major challenge to the management of the area. Distribution of biotic pressure on the forests of Melghat Tiger Reserve was assessed and pressure areas were delineated. This was done with the intention of bringing in the active participation of the field staff, as well as, of developing it as a management tool for the natural areas/managed forests. The individual impact of ten major biotic parameters were assessed both at the level of management units as well as the administrative units (rounds). They were grazing by livestock, lopping, fuelwood collection, illicit felling, grass cutting, waterhole use by livestock, fire, fishing, hunting, and encroachment. Eight pairs of various biotic parameters showed a strong correlation (r 0.5) at .01 level of significance (2 tailed). While grazing by domestic livestock showed a very high correlation with fuel collection (r = 0.720) and lopping (r = 0.704), it also showed a strong correlation with felling (r = 0.601) and use of waterholes by domestic livestock (r = 0.539). Fuel collection was found strongly correlated to lopping (r = 0.637) and felling (r = 0.679). It also showed significant correlations to grass cutting (r = 0.466) and waterhole use by domestic livestock (r = 0.419). While lopping of trees showed a strong correlation to felling (r = 0.646), it was also correlated

to waterhole use (r = 0.470). Fishing and waterhole use by domestic livestock were also found to be correlated (r = 0.545).

ENDANGERED SPECIES ADVOCACY: FRANKLIN'S GROUND SQUIRREL, A CASE STUDY

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In 1998, a model that predicts extinction probability predicted a significant probability that Franklin's ground squirrel (*Spermophilus franklinii*) was extinct in the counties surrounding Chicago. This prediction aroused our interest in the animal's conservation status throughout its range. We started an information clearing house web page (www.fgs.info), nominated the species for endangered or threatened species status in Illinois (in 1999 and 2004), founded the Chicago Wilderness Franklin's Ground Squirrel Conservation Task Force, gave various talks at conservation groups, lobbied congressmen, began the federal listing process, wrote popular articles (Pergams and Pergams 2001, Pergams and Nyberg 2003a), and participated in local live-trapping censuses. We wrote an assessment in response to a request from the World Conservation Union (IUCN), in which we assigned the squirrels a rating of Vulnerable in the 2003 IUCN Red List (Pergams and Nyberg 2003b). We then focused on getting the species listed in Illinois, and learned to deal with various news media in the process. On Feb. 20, 2004 it was listed as an Illinois Threatened Species. We also organized the 1st Intl. Franklin's Ground Squirrel Symposium (www.fgs-symposium.com) held on August 21, 2004 at Brookfield Zoo. As of writing this abstract, seven prominent Franklin's ground squirrel researchers had agreed to speak and 40–80 conservation biologists and managers from up to 14 states and Canadian provinces were expected to attend.

MONITORING EASTERN PRAIRIE FRINGED ORCHID IN WISCONSIN 1997–2003

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The eastern prairie fringed orchid (*Platanthera leucophaea*) was federally listed in 1989. This species requires about five seasons to produce flowers and is difficult to detect during the non-flowering stage in its wet-mesic prairie habitat. The annual average number of these plants observed at 13 known sites in Wisconsin from 1990 to 1996 was 86 (range 28–169). Our agency obligation for protection of this species led to a statewide monitoring project of the species and its habitats. We were aided by a host of volunteers and private groups as well as other agency personnel. We organized annual training workshops the first four years, a summary symposium the fifth, and on-site training the last two years. We coordinated the counts with most being held the first and second week of July. We led, or participated in, these annual counts and fruit-set checks. Our volunteers and owners rediscovered old sites and found new ones, owners and managers increased their efforts at habitat restoration and management, and methods to control some natural threats to the species evolved from our field observations. Under this consistent monitoring approach the annual state average increased to 744 (range 375–1021) plants at 18 sites, and locations of natural pollination were identified.

REMOTE SENSING METHODS FOR PRAIRIE IDENTIFICATION AND INVENTORY IN EASTERN KANSAS

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Landscape-level inventories of native prairie resources are of increasing value as decisions are made about present and future land uses in an increasingly fragmented rural landscape. In this study, a GIS/remote sensing methodology was used to develop a technique for the identification, classification, and characterization of grassland resources within a 25-km x 15-km study area. Using a time series of synoptic digital aerial multi-spectral radiance images collected every 2–3 weeks during the growing season, vegetation indices (VI) were calculated across two seasons (2002 and 2003) for 30 test fields representing both native and non-native grasslands in northeast Kansas. These data are supplemented by ground-based characterization of the grasslands with respect to type and management (haying, grazing, or USDA Conservation Reserve Program). The warm-season native grasslands, dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), switchgrass (*Panicum virgatum*) and Indiangrass (*Sorghastrum nutans*), exhibited a distinct phenology as compared to the cool-season nonnative grasslands, dominated by smooth brome (*Bromus inermis*) and tall fescue (*Festuca arundinacea*). The warm-season native community exhibited a later onset of greenness and seasonal VI peak than the cool-season non-native type. The VI data presented here also exhibit distinct differences in the mid- and late-season for these two types, as well as for the various management regimes. Although collecting time series from airborne systems such as the one demonstrated in this study can be expensive and impractical over large areas, these results will help to further refine previously published knowledge about the critical time periods during the growing season for making optimum use of available Earth-viewing satellite data resources to conduct grassland classification and inventory. These data sources, frequently subsidized by state and federal government, are generally much less expensive, allowing scientists to use the data for repeated inventory of large areas.

THE FEASIBILITY OF PRESCRIBED BURNING TO CONTROL REED CANARY GRASS (*PHALARIS ARUNDINACEA*) IN SEDGE MEADOWS IN SOUTHERN WISCONSIN

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Prescribed burning has been advocated to control reed canary grass (*Phalaris arundinacea* L.); but to be most effective it needs to prevent recruitment from the rhizome bud bank of the population. We conducted an observational and experimental study to measure the bud population and assess the potential of fire to cause bud mortality. Soil cores collected from May to October from Waubesa Wetlands State Natural Area in Dane County, Wisconsin demonstrated that bud density correlates to rhizome abundance and that a dense stand can produce from 3,000 to more than 6,500 buds/m^2 of soil surface, of which up to 1,900 are alive. Buds were found at depths up to 15 cm, but most were located within the first 5 cm of soil. Soil cores were divided into wet and dry soil moisture treatments; a propane torch simulated prescribed burning while belowground temperatures were monitored with thermocouples. Burning had no significant effects on bud mortality; however, drying did have an impact on the percentage of dead buds. Wet and dry soil cores experienced similar temperatures at the surface and at 5 cm depth; however, dry soil cores experienced greater heat penetration in terms of duration, and maximum temperatures attained at intermediate depths. Thermocouples indicated a great deal of variability between core temperature profiles; however, few of the cores experienced significant heat penetration below 3 cm. It is extremely unlikely that prescribed burning in the field can directly impact the bud bank even though it kills the aboveground material.

PERSISTENCE PAYS: AN ANALYSIS OF COLLECTION EFFORT AND INVERTEBRATE RICHNESS

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Collecting over a seven-year period at more than 150 sites, the Prairie Invertebrate Biodiveristy Inventory has generated a large dataset with which analysis of effort and resulting species richness can be correlated. This analysis examines site visitation and the probability of single species collection, similarity between collections based on site and time, and effort needed to collect a "representative sample" of species. The broad scope of the inventory complicates analysis. Edaphic factors, time of collection, methodology and the individual collector all influence sample composition. Early analysis shows that new species continue to be added to the total species collected at a steady rate without a leveling of the species accumulation curve.

TESTING THE EFFECT OF SEEDING DENSITY, GRASS TO FORB RATIOS, AND SPRING VS FALL PLANTING IN MAXIMIZING FLORISTIC DIVERSITY IN PRAIRIE RECONSTRUCTIONS

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Methods for maximizing floristic diversity in prairie reconstructions have been poorly quantified. Most reconstruction recipes rely on anecdotal heuristics and often focus on establishing warm-season grasses with only minor amount of forbs. The St. Croix Watershed Research Station has initiated a suite of study sites designed to test several variables for their effect on maximizing floristic diversity. A 3-ha site was divided into a series of 10-m x 10-m study plots. Using 69 species, each plot tests one unique combination of five different seeding rates: 107, 215, 430, 650 and 860 seeds/m^2 and three compositions: 75:25, 25:75, 50:50 of grass to forbs ratios (number of grass seeds to number of forb seeds). Each combination of variables was planted in triplicate and tested in both a fall and spring planted set of plots. Within the forb (or grass) component of a composition ratio, an equal number seeds of each species are used, theoretically allowing each forb (or grass) species to have an equal opportunity for establishment. Plots were broadcast seeded onto "weed free", tilled soil in the fall/spring of 2002/03 and repeated in 03/04 (and scheduled again for 05/06). Plots planted in the fall of 2002 also compared tilled vs. no-till site preparation. A subset of the variables are being tested on an assembly of 1-ha plots (20 ha total) at two additional nearby sites. Simpson's diversity index, individual species abundances, species richness, and rooted abundance of weed species will be measured for each plot beginning in July of 2004 and repeated annually for at least ten years. Planting variables will be evaluated to determine the combination(s) that promote the greatest floristic diversity. Because an equal number of viable seeds of each species was used on any particular plot, a relative comparison of species establishment factors can be estimated. Results from the 2003 and 2004 growing seasons, representing the establishment phase, will be presented.

RESTORATION SUCCESS? USE OF SMALL MAMMAL ABUNDANCE AND PHEASANT NEST LOCATIONS AS METRICS TO EVALUATE RECONSTRUCTED PRAIRIES WITH VARYING FLORISTIC DIVERSITIES

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Many prairie reconstructions climax as communities dominated by three to five species of warm-season grasses and minor amounts of a few forb species. If the objective of prairie reconstruction efforts is to reestablish habitat function, the impor-

tance of maximizing floristic diversity must be considered. This study uses comparisons of small mammal abundance and pheasant nest locations in a variety of prairie reconstructions as metrics to evaluate the relationship between floristic diversity and habitat function. The main study area is a 30-acre site containing multiple, adjacent plots of four habitat types: old field vegetation dominated by exotic cool season grasses; warm season grass dominated plantings, and two types of diverse plantings with more than 40 species of forbs. The entire site was burned on April 14 of 2002 and evaluated throughout the summer for small mammal abundance. A total of 335 unique individuals (10 transects, 1,920 trap efforts) of five species (*Blarina brevicauda, Peromyscus leucopus, Microtus pennsylvanicus, Sorex cinereus, Zapus hudsonius*) was captured. Reconstructions with the highest floristic diversity had significantly greater abundance ($P < 0.05$) of small mammals than plots dominated by warm season grasses or old field vegetation. Two additional sites comparing diverse plantings and old field vegetation showed similar results. Combined data from all transects showed a positive and significant correlation between small mammal abundance and floristic diversity ($r^2 = 0.47$, $P = 0.002$). In April 2002, following burning of the main site, a grid of 10-m transects was surveyed for fragments of year-old pheasant nest locations. Twelve of 15 nest remnants were located in the diverse plantings, three in old field vegetation and none in the warm season plantings. Results from this study confirm that increasing floristic diversity is likely a key element in creating "successful" habitat in prairie reconstructions.

REVISITING THE ISSUE OF "WHAT ARE OUR RESPONSIBILITIES" REGARDING THE BIOLOGICAL POINT OF ORIGIN OF PRAIRIE SEED?

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Since a presentation on this topic was given at the Third Midwest Prairie Conference, in 1972, there have been many prairie plantings done both with and without a strong focus on using relatively local-origin seed sources. Using Olmsted's (1944) classic paper on "12 latitudinal strains of Side-Oats Grama," as the core concept, some definitions and standards will be proposed as have been molded and fine-tuned by both genetics reports (of other researchers) and anecdotal-type assessment done mostly in the 32 years since the Third Midwest Prairie Conference. These guidelines will not exclude or invalidate the many plantings, done without the local-origin focus, but will suggest that they be described in a terminology that is more in keeping with "horticultural" prairie applications or plantings and, thereby, less with "ecological restoration type plantings."

STRUCTURAL CLASSIFICATION OF PRE-EUROAMERICAN SETTLEMENT PRAIRIE AND SAVANNA VEGETATION OF WISCONSIN

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We compiled a tabular database of bearing tree and associated vegetative data from the U.S. General Land Office (GLO) Public Land Survey of Wisconsin, which was conducted primarily between 1832 and 1866 prior to widespread Euro-American settlement. Following the point-quarter sampling methodology of Cottam and Curtis (1956), we calculated relative dominance, density, and importance value of significant tree species as well as absolute density by PLS quarter section (0.5 x 0.5 mi). As part of a larger effort to characterize the presettlement land cover of Wisconsin based on the GLO surveys, we used absolute density values to develop a presettlement structural classification for the state, breaking it into the following general classes: forest, woodland, savanna, and prairie. We present several versions of this classification, using different density-based class boundaries, as well as a comparison of our classification with structural elements of Robert Finley's Original Vegetation of Wisconsin (1951). This work provides a more refined distribution of presettlement prairie, and variation in savanna tree density classes, which was not possible across broad areas before the compilation of the bearing tree database.

CO_2 AND BIODIVERSITY EFFECTS ON PHENOTYPIC PATTERNS OF SELECTION FOR TWO PRAIRIE PERENNIALS: *LESPEDEZA CAPITATA* AND *SCHIZACHYRIUM SCOPARIUM*

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Much of the research into the effects of global environmental changes on plants has targeted the ecophysiological consequences at the species or community level. However, the influence that multiple climate change factors may exert on the evolution of plants remains largely unexamined, particularly for perennials. To obtain an understanding of how elevated CO_2 and biodiversity level may alter patterns of selection on native perennial plants, I examined fitness and phenotypic traits in individuals of *Lespedeza capitata* (round-headed bush clover) and *Schizachyrium scoparium* (little bluestem) within the preexisting BioCON field experiment, running since 1997 at Cedar Creek Natural History Area in Bethel, MN. *Schizachyrium scoparium* plants were studied in monoculture treatments at ambient (~370 ppm) and elevated (~560 ppm)

CO_2, and *L. capitata* plants were studied in both monoculture and 16-species treatments at ambient and elevated CO_2. I use regression analysis of fitness on phenotypic traits to estimate phenotypic selection gradients to evaluate and compare patterns of selection among different experimental treatments. The most striking comparison in *L. capitata* shows that plants in monoculture had few flowers whereas most plants in the 16-species treatment were much larger with more than 10x as many flowers, with trends towards more flowers in the elevated CO_2 treatments. The regression of seed mass on clump size for *S. scoparium* shows different patterns of selection between plants in the elevated and ambient CO_2 treatments, such that a small increase in clump size produced a much higher increase in seed mass in the ambient CO_2 treatment. These experiments show that natural populations of perennial grassland plants may experience altered patterns of selection as a response to different selective environments due to ongoing global climate change.

THE BLUFFLANDS PROJECT: CONSERVATION OF PRAIRIES AND SAVANNAS ON PRIVATE LANDS IN SOUTH CENTRAL WISCONSIN

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The Blufflands Project demonstrates the incredible potential of private landowners to be stewards of our native prairie and savanna communities. In Wisconsin, 85% of the land is in private ownership, representing an enormous opportunity for sustaining biodiversity and healthy landscapes for future generations. Yet, continued land division and short land tenure present challenges to conservation efforts on private lands. Coordinated by The Blufflands Project Manager, Project volunteers conduct prescribed burns, invasive species control, prairie plantings, and vegetation inventories. In the past seven years, the Project has demonstrated the tremendous potential for private lands conservation through assisting 40 landowners in the management of roughly 3,000 acres. Our success is attributed to committed relationships, flexible visions of land stewardship and a diverse "toolbox" of options to reach those visions.

QUANTIFYING THE LOSS OF PRAIRIES AND SAVANNAS USING GIS ANALYSES OF AERIAL PHOTOGRAPHS

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The loss of prairies and savannas through encroachment of woody vegetation in the absence of natural disturbance is widely understood. However, the rate at which this change is taking place is less understood. Series of aerial photographs spanning six decades were scanned, rectified, and analyzed to determine rate of prairie loss and tree canopy development. Preliminary results suggest that, in general, rates of decline in prairie for units analyzed were similar and have some interesting differences. These rates of prairie loss can be extrapolated into the future to suggest the number of years before there is continuous canopy coverage and complete loss of the prairie.

THE USDA ORNAMENTAL PLANT GERMPLASM CENTER – ITS ROLE IN THE CONSERVATION OF AMERICAN NATIVE FLOWERS

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The Ornamental Plant Germplasm Center (OPGC) is a new repository of the USDA National Plant Germplasm System (NPGS) at The Ohio State University, Columbus, Ohio. It is the first specialized genebank in the country mandated to conserve, evaluate and distribute herbaceous ornamental plant germplasm. Its mission is to conserve and nurture the world's wealth of herbaceous ornamental plant diversity by systematically collecting, saving, evaluating and enhancing its use to bring happiness and health to humankind, and to promote awareness in herbaceous ornamental crop germplasm conservation. At its inauguration in July 2001, a three-phase development plan was approved by the USDA Herbaceous Ornamental Crop Germplasm Committee for implementation. The Committee recommended the conservation of 30 priority genera (*Aglaonema, Alstroemeria, Anthurium, Aquilegia, Aster, Baptisia, Begonia, Campanula, Chrysanthemum, Dianthus, Dieffenbachia, Euphorbia* (Poinsettia), *Geranium, Hemerocallis, Impatiens, Iris, Lilium, Narcissus, Pelargonium, Petunia, Phalaenopsis, Philodendron, Phlox, Rudbeckia, Salvia, Spathiphyllum, Tagetes, Verbena, Veronica* and *Viola*), representing some 6,700 taxa. Eighteen of them have endemic species in North America. An OPGC survey to rank the 30 priority genera in terms of importance for conservation showed that ten of the top 15 genera have native species in North America. The Center is networking with the floriculture and seed industry, botanic gardens and arboreta, public and independent plant conservation agencies, crop specific societies, seed savers groups and individuals to establish joint conservation efforts. The genebank facilities, genebanking procedure, the concept of long-term 'base collection' and medium-term 'active collection' are described. To date, 966 accessions of herbaceous ornamental species previously stored at other NPGS repositories have been transferred to the OPGC and about 1,000 new accessions have been acquired. The accomplishments in the last 3 years are highlighted, and the first and second year annual reports are posted on the OPGC Website (http://opgc.osu.edu).

RESTORATION OF THE FORMER JOLIET ARMY AMMUNITION PLANT TO MIDEWIN NATIONAL TALLGRASS PRAIRIE

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Midewin National Tallgrass Prairie was created by an act of Congress in 1996, resulting in the transfer of about 15,000 acres of the Joliet Army Ammunition Plant to the USDA Forest Service in 1997. This land supports less than 400 acres of natural vegetation; the remainder is pasture, agricultural fields, and seral vegetation such as shrubby old fields and dense stands of invasive trees. However, some of these habitats do support tallgrass prairie fauna and flora, especially grassland birds. Restoring a site this size presents a practical challenge in large-scale restoration. Much of the land has been extensively altered by agricultural or Army activities; considerable infrastructure from previous private and Army uses remains on Midewin. At present, approximately 900 acres are undergoing active habitat restoration. Current restoration activities are focused on sites requiring less demolition of existing infrastructure. Also among high priorities for restoration include those sites with some native vegetation, such as prairie remnants, degraded savannas, and wetlands. Other areas being restored include agricultural fields, where disabling drainage tiles, filling drainage ditches, and planting represent are only the first steps in the restoration process. Getting the work done has required considerable adaptive management, including taking advantage of funding opportunities. Partners and volunteers have been essential for initiating these projects. Partners have provided essential funding to accomplish the heavy work (fencerow removal, hydrologic restoration, controlling shrub encroachment, seed and plant purchases), while volunteers have provided a work force for precision tasks (seed production and harvest, planting diversity plots, hand control of invasive herbaceous plants) and monitoring. Of the six restoration projects currently underway on Midewin, five involve major inputs from partners, while volunteers have contributed to all. Upcoming projects include more ambitious landscape reconstruction, which will require removal of several ammunition bunkers.

FRESHWATER INVERTEBRATES OF THE CAJUN PRAIRIE IN SOUTHWESTERN LOUISIANA: COLONIAL ROTIFERS (ROTIFERA: MONOGONONTA: FLOSCULARIACEA: FLOSCULARIIDAE AND CONOCHILIDAE)

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Free-swimming colonial rotifers are common to abundant in rice fields and other bodies of standing water in the Cajun Prairie ecosystem in southwestern Louisiana. This paper introduces the seven most common species and their general ecology. The species are: *Conochilopsis causeyae* (Vidrine, McLaughlin and Willis 1985), *Lacinularia flosculosa* (Mueller 1773), *Lacinularia ismailoviensis* (Poggenpol 1872), *Lacinularia elliptica* Shepard 1897, *Sinantherina socialis* (Linnaeus 1758), *Sinantherina semibullata* (Thorpe 1889) and *Sinantherina spinosa* (Thorpe 1893). This paper discusses the unusual nature of the high diversity of these rotifers in the ecosystem, and the possible use of these rotifers in physiological research.

USING HYPERSPECTRAL IMAGERY TO DETECT TALLGRASS PRAIRIE DISTRIBUTION AND QUALITY IN THE LOESS HILLS OF IOWA AND NEBRASKA

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The Loess Hills region of western Iowa and eastern Nebraska is one of the few areas in the Midwest that has escaped extensive conversion to row-crop agriculture. The rugged, steep topography support a mix of grassland and forest, with some croplands in more level parts of the landscape. We used hyperspectral imagery and field work to describe the distribution and quality of tallgrass prairie at several sites in this region: Hitchcock Nature Area in Iowa, Neale Woods Nature Area and the Winnebago Native American Reservation, both in Nebraska. Hyperspectral imagery data were acquired via aircraft and include at least 20 bands from 440 nm to 850 nm, with fine coverage in portions of the spectrum that are most useful for discriminating vegetation. Ground truthing was done in selected areas and included measurements of plant species composition and abundance. Our results suggest that hyperspectral imagery was successful at 1) discriminating native tallgrass prairie patches from smooth brome fields and 2) providing an index of species diversity on prairie patches and 3) showing the portions of the landscape most affected by invasion of woody species, like *Juniperus virginiana*. Remote sensing using hyperspectral imagery is a promising technique to describe and manage this unique landscape.

THE BIRD COMMUNITY OF FORT MCCOY'S NATIVE GRASSLAND HABITAT

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Fort McCoy Military Installation in Monroe County, Wisconsin has a unique compilation of natural habitats within its boundaries. It is characterized by vast amounts of oak-barrens and savanna habitat, has been ranked in the top ten priority grasslands in the state of Wisconsin by the Wisconsin Department of Natural Resources. Grassland habitat is dominated by big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*) with associated wild flowers such as

hoary puccoon (*Lithospermum canescens*), wild lupine (*Lupinus perennis*), and birds-foot violet (*Viola pedata*). We documented the grassland bird community and its productivity on Fort McCoy grasslands May–July 2000–2002. Point-count surveys and nest searching were conducted in almost all of the grassland patches. Grasshopper sparrow (*Ammodramus savannarum*) and Vesper sparrow (*Pooecetes gramineus*) were abundant. Common species were field sparrow (*Spiza pusilla*) and Eastern meadowlark (*Sturnella magna*). Eleven grassland bird species of management concern in Wisconsin were recorded including Henslow's sparrow (*Ammodramus henslowii*), which is currently on the state Threatened Species list. Grasshopper sparrow tended to use the larger grassland areas, whereas field sparrow used the smaller grassland patches that had more of a savanna character. A total of 272 nests of grassland bird species were monitored. Predation was the greatest source of nest mortality. Adult abandonment, military disturbance, and weather events affected nest success at a lower rate. The reproductive success for grasshopper sparrow was 0.307, vesper sparrow was 0.219, dickcissel (*Spiza americana*) was 0.503, and field sparrow was 0.245. Overall, the grassland habitat on Fort McCoy is an important resource for birds in Wisconsin.

PARTNERS FOR FISH AND WILDLIFE PROGRAM

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The U.S. Fish and Wildlife Service "Partners for Fish and Wildlife" program is the Service's primary mechanism for delivering voluntary on-the-ground habitat improvement projects on private lands for the benefit of Federal trust species. The Partners program provides technical and financial assistance to landowners to help meet the habitat needs of Federal trust species on private lands. In 1998, the Wisconsin Private Lands Office focused attention on imperiled grassland ecosystems of southern Wisconsin. During the last six years, more than 2,000 acres of prairie and oak savanna have been enhanced and restored through the Partners program. Restoration activities include prescribed burning, brush control, invasive species management, planting, mowing, and grazing management. The dynamics of prairie and oak savanna restoration have challenged the paradigm of the Partners program. Long-term management plans, multi-fiscal years funding issues, herbicide usage, and prescribed fire created new challenges for the Partners program. To meet these challenges, the Partners program evolved by recognizing the flexibility needed to be an effective tool for landowners to utilize to meet their needs and restore grassland habitat. Through adaptive management strategies, partnerships, and alternative management techniques, the Partners program continues to be a proactive results-oriented private lands program working with landowners to restore prairie and oak savanna habitat in southern Wisconsin.

WISCONSIN LOCAL GENOTYPE SEED FARM AND FOUNDATION SEED PROGRAM

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The Scientific Areas Preservation Council (now known as the State Natural Areas Program), along with other scientists and enthusiasts, promoted the idea of establishing seed production beds of Wisconsin genotype prairie species by the Department of Natural Resources in 1974. With the interest in prairie restoration growing, the Council was concerned that widespread planting of non-local genotype seed might result in the loss or dilution of locally adapted species, especially when the plantings were adjacent to State Natural Areas. At the time, the supply and cost of locally sourced seed prohibited its widespread use for State projects. The Native Plant Seed Farm Project, however, did not begin until 1986 when a proposal involving the Wisconsin Departments of Natural Resources (DNR), Transportation (DOT), and Corrections (DOC) was drafted. The DNR established seed production beds of several forbs and grasses using seed collected from State Natural Areas and other public and private remnants from the three major prairie and savanna regions of Wisconsin. The project is now a partnership between the DNR, DOT, the private nurseries, and the Wisconsin Crop Improvement Association. The Department has allowed private nurseries access to foundation seed in exchange for three times the amount of seed provided once the nursery beds are in production. The result of the project is a major increase in the amount and diversity of local seeds the State purchases and plants on public lands. We have experimented with a variety of planting, harvesting, and cleaning methods that are cost effective and easy to use. We have also realized which functions are best either contracted out or left to the private sector.

BIOLOGY AND MANAGEMENT OF LOST MOUND SAND PRAIRIE AT THE FORMER SAVANNA ARMY DEPOT IN NORTHWEST ILLINOIS

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The former Savanna Army Depot (SAD) encompasses more than 13,000 acres adjacent to the Mississippi River in northwestern Illinois. The site contains 5,500 acres of forest and wetlands in the floodplain. The uplands include about 5,000 acres of sand prairie and sand savanna—the largest remnant prairie in the state and one of the largest in the eastern portion of the tallgrass prairie peninsula. The base was established in 1917 and since that time most of it has been used for grazing (rather than cultivation). As a result, much of the area remains true prairie dominated by native plant species, many of which occur as isolated populations. The site includes 45 endangered

and threatened species, including several plants that occur nowhere else in Illinois. The prairie has large populations of many regionally declining grassland bird species, including at least ten bird species on the USFWS's 2002 list of Birds of Conservation Concern for the Midwest Region. A 10-mile dune formation along the transition from bottomland forest to upland prairie and savanna is another unique feature of the site and is the longest stretch of undeveloped Mississippi River shoreline in Illinois. The base closed in March 2000. More than 9,400 acres were incorporated into the Upper Mississippi River National Wildlife and Fish Refuge as Lost Mound Unit. We will discuss the natural resources at SAD, land transfer issues, and the prospects and challenges for restoration at this unique sand prairie/sand savanna ecosystem.

SHORTGRASS PRAIRIE RESTORATION AT THE ROCKY MOUNTAIN ARSENAL NATIONAL WILDLIFE REFUGE, COMMERCE CITY, COLORADO

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The Rocky Mountain Arsenal National Wildlife Refuge was a former military base during World War II where large quantities of chemical weapons were manufactured. Shell Chemical Company used the facility for many years after World War II to manufacture pesticides. The Rocky Mountain Arsenal NWR is currently an EPA Superfund cleanup site that is in transition to becoming the largest urban national wildlife refuge in the United States, some 16,000 acres in size. Thousands of acres are dominated by exotic grass and forb species that need to be replaced with native plant communities. In addition, thousands of acres are being disturbed as a result of environmental cleanup activities, which also require restoration to native plant communities. The unique aspects of cleanup and restoration occurring concurrently have resulted in the development of specialized field practices and techniques to restore native shortgrass prairie to the arsenal. Sandy soils, clayey soils, and reconstructed soils are prepared for seeding using a variety of farm implements. Specific seed mixes have been developed for each soil textural type. First year seedings are irrigated, and are mulched if seeded in the fall. A variety of Integrated Pest Management (IPM) techniques are utilized for weed control, and long-term trends in species composition and per cent cover are determined by vegetation monitoring using line intercept transects to determine project success.

SOURCE IDENTIFIED NATIVE PLANT AND SEED CERTIFICATION

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Association of Official Seed Certifying Agencies (AOSCA), Meridian, ID

Large-scale natural and human-caused ecosystem disturbances generate a voluminous demand for native plant reproductive materials (most commonly seed) intended for restoration, revegetation, and stabilization of natural communities. This demand is enhanced by an increasing interest in establishing populations of native wildflowers, grasses, trees, and shrubs in parks, wildlife refuges, roadsides, tree farms and orchards, and residential landscapes. The reproductive materials required to satisfy these planting needs have some special constraints. Most plant species consist of more or less continuous genotypic arrays reflecting differential adaptation to variation in soils, climates, and disturbance regimes across a species' range of distribution. Long-term success in restoring a species to a given site is dependent upon obtaining adapted plant materials. Adapted plant materials are most likely to originate from the same site or nearby sites with similar physical and biological environments, unless the species' population is known to be broadly adapted or particular accessions have proven to be widely adapted within the species' range of distribution. For some broadly adapted species characterized by copious seed production, wildland collection can supply a significant seed volume for direct plantings. For most species, however, accessions consisting of limited quantities of seed obtained from defined wildland stands must be increased in fields or nurseries. Unfortunately, accurate documentation of collection site and/or cultivated production has often been unavailable to those seeking site-appropriate native plant materials. This situation led to the expansion of AOSCA third-party inspection and labeling programs to specifically address the needs of the native seed and plant industry. AOSCA has implemented certification requirements and standards that accommodate plant germplasm (whether newly acquired accessions or named varieties) of native grasses, forbs, and woody plants. These certification procedures provide third-party verification of source, genetic identity, and genetic purity of wildland collected and field or nursery grown plant germplasm materials.