2004

Abstracts for Poster Presentations

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(alphabetical by first author)

RESEARCH OPPORTUNITY: PRAIRIE, SAVANNA, AND KARNER BLUE BUTTERFLY RESTORATION IN WISCONSIN

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A project to restore dry prairie and oak savanna ecosystems is getting underway on 120 acres at the Hamerstrom Reserve in central Wisconsin. Restoration objectives include re-establishing populations of the federally endangered Karner blue butterfly (*Lycaeides melissa samuelis*), which depend on specific plant assemblages in savanna/dry prairie habitats for survival. Fire suppression, agriculture, and development reduced oak savannas in Wisconsin to less than 0.01% of their pre-settlement extent; in 1850 the Hamerstrom Reserve was mainly oak savanna. The reserve currently has a diverse collection of ecological communities including woodland stands of oak, pine, elm, maple, and aspen; a plot of what may be virgin native grassland; and several old field habitats. Restoration efforts will include controlling invasive plants, opening up woodland tree canopies, and planting appropriate mixes of native forbs and grasses. Structural barriers to Karner blue butterfly dispersal will be removed to create travel corridors and to open the landscape to a more contiguous savanna/prairie complex. These ecological restoration activities offer many great scientific opportunities to investigate topics associated with the process of restoring oak savanna and dry prairie ecosystems. For example, relevant studies might include: 1) experimentally comparing the effectiveness of different restoration treatments (e.g., burning, cutting, herbicide application) to different zones (e.g., woodland vs. old field), 2) monitoring floral and faunal responses to restoration activities, and 3) assessing recolonization rates of Karner blue butterflies and other savanna species. Researchers who are interested in conducting experiments, surveys, monitoring, or other studies in association with these prairie, savanna, and butterfly restorations at the Hamerstrom Reserve are encouraged to contact the authors to discuss potential collaborations.

COMPARISON OF SEEDLING GERMINATION OF THREE MILKWEED SPECIES

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Milkweeds (genus *Asclepias*) are widespread, with 108 species in North America and the Caribbean. Some of these species (e.g., *A. tuberosa, A. verticillata*) are components of tallgrass prairie. Previous studies stated *A. tuberosa* are difficult to raise from seed. We conducted a study of seedling germination and survival of three species of milkweed common to the Oklahoma-North Texas area. One species, *A. viridis* is considered weedy and results from overgrazing. The other species, *A. tuberosa* and *A. asperula*, are more typical prairie species. Seeds were obtained from wild populations and commercial sources. We tested germination and seedling survival of these species under three different treatments: scarification, outdoor winter exposure, and cold-moist stratification. We also compared heights of seedlings three weeks after germination. We did not experience problems with *A. tuberosa* germination. Most germination took place between seven and 21 days after planting. Percent germination of *A. tuberosa* and *A. asperula* averaged 70%, and germination of *A. viridis* averaged 51%. However, these differences were only marginally significant. Treatment had no significant effect on germination. We believe that high variability in germination of *A. viridis* contributed lack of significance. Many seeds of *A. viridis* were not filled out or were otherwise inviable. Among seedlings, there was a significant difference ($F = 56.5$, $P < .001$) in plant height, with the seedlings of *A. viridis* having an average height of 6.76 cm, *A. asperula* of 5.19 cm, and *A. tuberosa* of 4.05 cm. We believe that this difference in height is related to the life habit of these plants, with the weedy species growing taller faster to compete for light.

REDUCED DEPENDENCE ON MYCORRHIZAL FUNGI BY INVASIVE PLANT SPECIES

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Invasive plant species are a major threat to plant biodiversity of grasslands and other ecosystems. Introduced species are successful in new habitats due to traits of the species themselves and properties of the environment in which they invade. One of the species traits of successful introduced plants may be a lower dependence on mutualistic mycorrhizal fungi. We surveyed a midwestern United States regional flora to examine whether successfully introduced plant species are generally less dependent than native species on mycorrhizal fungi. In the flora of the Chicago region, we find a greater proportion of introduced species than native species in families that are characteristically non-mycorrhizal in upland habitats. These results suggest that reduced dependence on mycorrhizal fungi may be an important aspect of success of some introduced species.

USING ECOREGIONAL PLANNING METHODOLOGY FOR IDENTIFYING HIGH-QUALITY TALLGRASS PRAIRIES AT FORT RILEY MILITARY RESERVATION IN KANSAS

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In 2002, the Kansas Biological Survey initiated a two-year project examining the vegetation of the Fort Riley Military Reservation in northeast Kansas. We mapped all vegetation communities and assessed the conservation value of 116 prairie tracts using the ecoregional conservation planning framework developed by The Nature Conservancy and its partners. Each site was assigned a grade for the categories of landscape context, size, and condition. An objective assessment of condition was made using Floristic Quality Assessment, a tool that is based on calculating an average coefficient of conservatism and a floristic quality index for each site. After ranks were assigned in each of the three categories an evaluation matrix was used to determine each site's overall conservation grade. Data on the location of high-quality tallgrass prairies can help resource managers at the installation protect these important reservoirs of native biodiversity.

AN HISTORICAL APPROACH TO THE ORIGIN OF CATSTEPS IN THE LOESS HILLS OF IOWA

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Catsteps are the ubiquitous staircase-like structures seen in the Loess Hills of Iowa. Three hypotheses for the origin of catsteps are (1) they are a result of overgrazing, (2) they are remnants of Indian agricultural practices, and (3) they are a natural phenomenon unrelated to human activities. The objective of this study was to use the historical record to decide among the three hypotheses. Catsteps are not mentioned in the journals of Lewis and Clark and cannot be seen in George Caitlin's 1832 paintings "Grassy Bluffs on the Upper Missouri," "River Bluffs, 1320 Miles above St. Louis," and "Floyd's Grave, Where Lewis and Clark Buried Sergeant Floyd in 1804." On the other hand, catsteps can be clearly seen in the sketches accompanying the 1870 Report of the Geological Survey of the State of Iowa. The earliest known photograph of the Loess Hills, taken in 1906 by U.G. Cornell and published in a geography textbook, also clearly shows the presence of catsteps. The intensive grazing of the Loess Hills did not begin until the 1920s. Based on the current evidence, the most likely hypothesis is that catsteps are a natural phenomenon that may be due to the same climate changes of the mid-nineteenth century that promoted the formation of gullies. Further results will be reported at the meeting.

GULF COAST PRAIRIE RESTORATION IN LOUISIANA

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Coastal prairie once covered 1.1 million ha in southwest Louisiana and 2.8 million ha in Texas. Today, less than 0.1% remains due to intensive agricultural practices and loss to urban sprawl. In Louisiana, less than 100 ha remain primarily as narrow, fragmented strips between highways and railroad rights-of-way. In an attempt to restore prairie and document the practical aspects of prairie restoration, 98 ha near Gueydan, Louisiana have been enrolled in the USDA NRCS Wetlands Reserve Program. In 2002, 45 ha were restored to pre-cultivation hydrology by removing levees and pimple mounds were constructed to mimic historic topographic features. The restoration plan includes large-scale demonstrations comparing spring and fall planting (April and October 2003) at 3.4, 6.7 and 11.2 PLS kg ha^{-1} using a prairie seed mixture consisting primarily a little bluestem (*Schizachyrium scoparium* (Michx.) Nash). The following species were interseeded into the spring and fall planted areas: switchgrass (*Panicum virgatum*), Florida paspalum (*Paspalum floridanum*), Kansas gay feather (*Liatris pycnostachya*), yellow wild indigo (*Baptisia bracteata*), black-eyed Susan (*Rudbeckia hirta*), bur marigold (*Bidens aristosa*), plains coreopsis (*Coreopsis tinctoria*), partridge pea (*Chamaecrista fasciculate*), and wooly rose mallow (*Hibiscus moscheutos*). To increase diversity, 1,500 pieces of prairie sod from a remnant area scheduled for destruction were transplanted on the restoration site by a volunteer group of 275 people on February 1, 2003. This project is a multiple partner and agency effort that will evaluate success, assist in future restoration attempts, and foster the importance of this endangered ecosystem. Demonstration results pending.

OBSERVING THE ABILITY OF LITTLE BLUESTEM, *SCHYZACHARIUM SCOPARIUM*, ROOTS TO PENETRATE AND MORPHOLOGICALLY ADAPT TO VARIOUS SUBSTRATES OF AN ON-SITE DISPOSAL FACILITY CAP

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A clear plexiglass rhizotron system was used as a non-invasive method for monitoring prairie grass root growth, morphology and penetration through adverse soil substrates. Successful restoration on a closed landfill must overcome the challenges of high soil compaction, unfavorable soil types, low soil stability and limited water availability. Performance was evaluated by observing grass roots growing progressively through topsoil, sand, crushed rock, large rock and compacted clay in an aboveground rhizotron unit that simulated the layers of the landfill cap. Little bluestem, a native prairie grass well adapted to growing in poor soil, was chosen as the representative plant to test the system. Examination revealed root expansion to be rapid, exceeding 4 feet of growth in a single growing season, with noticeable differences observed in the types of growth strategies as the roots encountered the different substrates of the heterogenous cap. Destructive analysis after two seasons of growth further revealed substantial changes in root shape, thickness and amount of branching as the plant presumably responded to the different substrate materials and moisture levels within the soil. Although genetics likely plays a predominant role in root development, this study demonstrates how the dynamic processes of root growth and degradation proceed simultaneously to significantly alter root morphology in varying subsurface conditions. Results of the rhizotron studies display the importance of using non-destructive methods as an indicator for designing disposal cap tallgrass prairies that help augment native grassland habitat thereby increasing ecosystem diversity.

REVERSE FERTILIZATION REDUCES SOIL NITRATE, DOES NOT AFFECT SPECIES COMPOSITION IN TALLGRASS PRAIRIE

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Atmospheric nitrogen deposition is suspected to promote the growth of invasive, non-native plants in natural systems. A procedure termed "reverse fertilization" adds organic carbon to the soil to stimulate growth and utilization of available nitrogen by microbes. Reverse fertilization has been previously tested in artificial systems with mixed results. The objective of this study was to apply three procedures to reduce nitrogen to a high-quality, native tallgrass prairie and determine their effects on soil nitrogen and plant species composition. Meter square plots in the James Woodworth Prairie (Glenview, IL) were subjected to applications of sugar, vegetable oil, and water (to leach out nitrogen) during three periods of the 2003 growing season. Soil cores from the plots were analyzed for available nitrogen and vegetation surveys were conducted after each treatment period. The only significant soil effect was reduction of nitrate by sugar immediately after the treatment period, but the reduction faded as time after treatment increased. Plant species richness (mean, all plots: 13, 13 and 10 species per 0.25 m^2 in May, July and September, respectively) and mean conservatism (5.9, 5.8 and 5.7) were not significantly affected by treatments except for reduction in plant cover in oil treated plots. Due to this effect, oil is not considered a treatment worth exploring further. Experiments in the 2004 growing season will determine whether repeated treatments are effective in further reducing soil nitrogen or increasing vegetation quality. Plant tissue samples from the 2003 and 2004 seasons will be analyzed for total nitrogen content to provide a more integrated measure of nitrogen availability over the course of the treatments. These methods, if proven effective, could be used for management purposes in preserving biodiversity of natural areas.

THE MIDWEST INVASIVE PLANT NETWORK: A FORUM FOR REGION-WIDE EFFORTS

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The Midwest Invasive Plant Network (MIPN) is a diverse group of organizations dedicated to addressing the threat of invasive plants in the Midwest. The group's mission is to address the problem of invasive plants and their threat to the Midwest region's economy, environment, and human health by providing leadership, facilitating information development and exchange, and coordinating regional efforts. Currently, a lack of coordination among groups working on invasive plant species projects in the Midwest has led to duplication of effort and missed opportunities for collaboration at the regional level. The MIPN proposes to facilitate that collaboration and information sharing and help to energize the local projects going on throughout the Midwest. The poster will describe the goals of the MIPN, which include: producing a list of invasive plant species mapping and inventory projects in the Midwest (including information on associated early detection-rapid response projects) and a recommended data standard to be followed that will be communicated to all involved in such projects; producing a database of regional educational materials and developing additional materials to raise awareness regarding invasive plant species in the Midwest; surveying for recent and ongoing research efforts in the region; creating a website dedicated to invasive plant species issues in the Midwest, which will feature the products mentioned above as well as

information on legislative efforts, funding opportunities, control techniques, current research, and other information specific to the Midwest; and regular communication between invasive species researchers, managers, and others interested in or affected by this topic through a listserve, conference calls, workshops, and meetings.

OLD-FIELD SUCCESSION AT AN IOWA SAND PRAIRIE

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The Cedar Hills Sand Prairie, located in northeast Iowa, incorporates a managed remnant sand prairie and an adjoining old-field. The remnant prairie was grazed (never plowed) through 1965 while the old-field was plowed and grazed until 1977. During 2000 and 2001 field season, data on the existing vegetation, seed rain and seed bank was collected for analysis. It was predicted the old-field community composition would become more dissimilar to the remnant with distance. In addition, the quality and quantity of native species would decrease in the old-field with distance from the remnant while non-natives would increase. More native species and fewer non-native species were present in the remnant vegetation and seed rain than in the old-field. However, the remnant seed bank contained fewer native and more non-native species than the old-field. The overall species quality and number of native species in the vegetation decreased in the old-field with distance from the remnant prairie though no distinct pattern with distance was found for the seed bank and seed rain data. After 23 years, differences between the remnant and old-field can be seen, especially in the vegetation.

INSIGHTS INTO SOME ECOLOGICAL ASPECTS OF GRAZING ON GRASSLAND ANIMALS

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This presentation portrays highlights of a series of three articles that originally appeared in the Retzer Nature Center's *Center Line* 2004 newsletter. These were written as fabled, first-person narratives as if the local birds and mammals could speak for themselves, as to how grassland structure affects their daily lives and activities. While the mammal species were only slightly more in favor of a shorter, moderately-grazed type of cover, the grassland birds were overwhelmingly in favor of such cover, which interestingly, also has roughly, about the same average height as old-fields in our region (ca. 12–24" cover height in southeastern Wisconsin). The concept of seeking to achieve a desirable, shorter and more patchy structure by means other than grazing per se was also explored.

MONITORING AND CONTROL OF SERICEA LESPEDEZA (*LESPEDEZA CUNEATA*) 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). Management includes prescribed burns (spring, summer, fall, winter), grazing (bison and elk), exotic species and woody plant control. In 1994, monitoring transects were established in representative units throughout the park to assess vegetation change associated with management. That year sericea lespedeza was observed in six transects (31 plots). From 2000 to 2003, it was observed in 15 transects (a total of 126 plots). Beginning in 2000, aggressive measures were initiated to control it using integrated methods including mowing, summer burns, spot and broadcast herbicide treatments (Ally and Remedy). To assess its distribution in a high-quality prairie remnant (Regal Prairie Natural Area, 240 acres) a modified adaptive cluster sampling design was employed to assess presence or absence within a 25-acre subunit. The sampling grid consists of 10-m by 10-m plots in which presence or absent is recorded. When a positive is recorded, adjacent grid units are monitored. The results suggest that large herbivores may have a role in the spread of sericea lespedeza in a high-quality prairie remnant.

SCREENING *FESTUCA PARADOXA* AND OTHER NATIVE COOL SEASON GRASSES FOR NATIVE PLANTINGS

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Festuca paradoxa Desv. and other native, cool-season grasses (NCSG) could be used in soil conservation, wildlife habitat, and agroforestry because they would provide forage during the fall and spring months and many are adapted to a wide range of habitats and environmental conditions. Although there is interest in adding these grasses to native plantings, seed of some species is not readily available. Our main goals are to determine the best management techniques to establish *Festuca paradoxa* and other NCSG for seed production and to learn about their physiology, ecology, and propagation. Early findings for *F. paradoxa* show that seed germination after 24 days at 70°C varies from 10 to 90% for seed from different sources. A study to determine how planting time and shade affect growth and development of *F. paradoxa*, *F.*

subverticillata, *Elymus* spp., *Koeleria macrantha*, and *Glyceria striata* was established at the University of Missouri. First year results of seed harvested early summer, show that seedlings planted in the fall, 30 cm apart within rows and 1 m between rows, performed better than spring-planted seedlings. Fall-planted seedlings produced an average of 66 kg/ha seed compared to only 33 kg/ha for spring-planted seedlings. The same species were established in summer 2003 under 0, 30, and 55% shade to quantify persistence, forage yield, and seed production. First year results show that all these species grow well under all shade levels suggesting that these grasses could be grown as companion crops under the shade of trees in native plantings and agroforestry practices.

DEVELOPING A MANAGEMENT PLAN TO RESTORE WOODLAND COMMUNITIES AT PRAIRIE FORK CONSERVATION AREA IN MISSOURI

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Prairie Fork Conservation Area (PFCA) is located in both the Glaciated Plains and the Ozark Border Divisions in Missouri. Our goal is to develop a management plan to restore woodlands at PFCA to enhance habitat for rare birds such as upland sandpiper, Henslow's sparrow, loggerhead shrike, and Bell's vireo to accomplish one of the original objectives of PFCA. Four plots, 1-ha each, two with characteristics of savanna and two with characteristics of woodland remnants, were selected as parameters to restore other remnants. Plots were established the first year in the summer and a plan inventory of the understory and canopy vegetation was conducted in the fall. Savanna and woodland indicator species were observed in all plots including some native cool-season grasses, sedges, forbs, and shrubs. Introduced shrubs, such as multiflora rose, autumn olive and bush honeysuckle, are also growing in all plots. We started mechanical removal of honeysuckle in the winter followed by the first spring prescribed burn to control brambles and to reduce leaf litter. Different treatments will be developed during the second year based on the first year plant inventory, vegetation density, and canopy cover of each stand. To understand how management is affecting the restoration of these savanna or woodland communities a monitoring program will be conducted for several consecutive years. We expect to see native plants to get re-established after reduction of introduced species and the removal of heavy shade. However, if the number of native species is still limited, other indicator species of high quality savannas and woodlands will be reintroduced.

REVISITING ROBEL

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Many grassland wildlife studies utilize a Robel pole or similar equipment to quantify vegetation structure and density. Robel (1970) showed that standing biomass in a Kansas prairie was directly related to the amount of visual obstruction of a graduated pole. This relationship provided a means by which to physically quantify habitat quality for grassland wildlife species. We repeated Robel's original experiment comparing visual obstruction measurements to harvested biomass. An alternative herbaceous biomass estimation device is known as a *plate meter*–a square sheet of plexiglass that is lowered onto the herbaceous canopy thereby compressing the vegetation differentially depending on the amount of biomass present. The compressed height is measured and a correlation with biomass quantity determined. When properly calibrated, the plate meter has been shown to provide an accurate measurement of vegetation biomass in cool season grasslands. Our study was conducted on a 12-ha field planted in single species strips of big bluestem (BBS), little bluestem (LBS), Indiangrass (IND), switchgrass (SWG), and side-oats grama (SOG), plus a mixed strip of BBS, LBS, IND, and SOG. We compared Robel pole and plate meter readings to harvested biomass within a 1-m^2 area. We found low correlation between harvested biomass and visual obstruction (R^2 = 0.139) and harvested biomass and plate meter measurements (R^2 = 0.103). Robel and plate meter measurements were more closely correlated with each other (R^2 = 0.485). Since the development of visual obstruction measurement in grasslands, a large number of studies have utilized this method to provide insights into habitat preferences of grassland wildlife species. Although there appears to be no consistent relationship between standing biomass and visual obstruction, relationships between visual obstruction measurements and species habitat preferences remain valid.

THE SOUTHERN PLAINS INVENTORY AND MONITORING NETWORK: PROGRESS AND FUTURE PLANS

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The goal of the National Park Service's Inventory and Monitoring Program is to conduct baseline natural resource inventories and develop long-term monitoring using ecological indicators, or Vital Signs, to assist with the management of natural resources. To further this goal, the National Park Service has grouped National Parks by their ecological characteristics into 32 networks. The Southern Plains Inventory and Monitoring Network (SOPN) consists of eleven National Parks in Colorado, Kansas, Oklahoma, Texas, and

New Mexico. The SOPN is located in the mixed-grass and short-grass prairie that is habitat for several rare species including black-tailed prairie dogs (*Cyonomys ludovicianus*), burrowing owls (*Athene cunicularia*), mountain plovers (*Charadrius montanus*), swift foxes (*Vulpes velox*), black-footed ferrets (*Mustella nigripes*), Arkansas river shiners (*Notropis girardi*), bald eagles (*Haliaeetus leucocephalus*), and lesser prairie chickens (*Tympanuchus pallidicinctus*). To accomplish the goals of the Inventory and Monitoring Program, the SOPN is conducting inventories of vascular plants and vertebrates, and is in the process of developing a Vital Signs monitoring program. To develop the monitoring program the SOPN is consulting with park personnel and subject matter experts, identifying priority natural resources and their stressors, and developing conceptual models. An overview of conceptual models, important network-wide natural resources and their stressors, a summary of research needs, and plans for short-grass prairie restoration at nine sites in five states will be presented. The SOPN is looking to extend our knowledge base by partnering with other agencies and research entities that are conducting work in grassland systems.

INVENTORY, MAPPING AND QUALITY ASSESSMENT OF REMNANT PRAIRIES IN RINGGOLD COUNTY, IOWA

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The Grand River Grasslands is a cooperative effort towards conserving native grasslands in the Central Tallgrass Prairie Ecoregion by the Missouri and Iowa Nature Conservancy Chapters, the Iowa Department of Natural Resources, and the Missouri Department of Conservation. Implementation of conservation action on the Iowa side of the Grand River Grasslands necessitated field work to locate, map and assess quality of prairie remnants in about 37,000 acres of south-eastern Ringgold County. Permission was obtained to conduct field surveys on 97% of the project area between August and October of 2003. Field surveys were focused on privately owned pasture and CRP land, which amounted to approximately 19,000 acres (about 51% of the project area). Prairie remnants were defined as the co-occurrence of five or more prairie indicator plant species, which were selected as the field surveys progressed. The boundaries of remnants were mapped, a species inventory collected, ecological notes on land use, persistence factors, and general environment recorded, and a subjective quality assessment made. When prairie indicator species were observed but did not qualify as a remnant community, they were mapped as prairie populations (prairie elements). The field survey resulted in the mapping of 115 prairie remnants ranging in size from 0.04 to 14.5 acres and totaling 135 acres (0.4% of the area accessible for surveying). There were also 3,125 prairie elements mapped. Location along a fence line or field edge and poor accessibility were the two most important factors explaining persistence of remnants. A large majority of the remnants (60%) were associated with CRP land. Prairie remnants and elements together contained 83 prairie indicator species. Eleven indicators were observed on at least 25% of the remnants; the most common of these were tall dropseed (*Sporobolus asper*), narrow-leaf mountain mint (*Pycnanthemum tenuifolium*), big bluestem (*Andropogon gerardii*), and grey-headed coneflower (*Ratibida pinnata*).

THE SHORT-TERM IMPACTS OF PRESCRIBED BURNING ON THE SOIL CHEMISTRY OF A RESTORED GRASSLAND ON THE MID-ATLANTIC COASTAL PLAIN

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In order to restore habitat for grassland birds on the Eastern Shore of Maryland, roughly 200 acres of agricultural land was entered into the Conservation Reserve Program. Low-production fields on the scale of 20–30 acres were seeded to various mixtures of warm-season grasses in 1999. Prescribed burning of the fields is conducted every three years. One objective of the study is to determine the impact of the prescribed burns on the soil chemistry of the highly weathered, nutrient-poor soils in this region. In 2002, soil cores were collected at 25 sites in a 1-acre plot the day before and ten days after the first spring burn in one of the fields. Each core was sectioned at 2.5- or 5-cm intervals to a depth of 20 cm from the soil surface. The soils were analyzed for total organic matter, pH and exchangeable cations. An increase in organic matter was found in all soil layers in the post-burn soil samples, as well as an increase in soil pH. Exchangeable calcium, magnesium and potassium also increased in the post-burn samples. The increase in organic matter likely reflects the incorporation of ash material produced from the burned vegetation, as a significant increase in root growth or microbial biomass due to the altered microclimate is unlikely on the short time scale. The increase in pH and exchangeable cations in the post-burn samples supports this, as hydrolysis of the soluble salts in the ash can raise the soil pH and release cations into solution, which then can move onto soil exchange sites. The spring burn, therefore, significantly impacted the soil chemistry in this restored grassland in the weeks early in the growing season by the deposition, infiltration and reaction of the ash.

LIFE-FORMS: A NOVEL MEASURE OF PRAIRIE DIVERSITY

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Monitoring the species diversity of prairie restorations is a common way to evaluate the establishment and relative success of many restoration projects. However, there are several factors that can skew traditional diversity indices, such as including weed species in the analysis, sampling techniques, and misidentification of the plants. While researching the establishment of a tallgrass prairie restoration it was evident that species diversity alone was not capturing the essence of how the prairie was developing. Areas dominated by weeds tended to have fewer distinct shapes of plants than areas of native species, even though the species diversity may be equivalent. Using this observation, I created a life-form key for grassland species. This method can be used to evaluate the prairie's morphological diversity, and is related more to the diversity of allocation patterns within a given community than to species identity. With the help of a sophomore biology class at the University of Wisconsin, I was able to test the usefulness of the life-form key for distinguishing among six types of prairies. Averaging the number of life-forms per quadrat was an effective way to distinguish among a range of prairie communities from highly disturbed to never plowed. In addition, it may be useful to managers who rely on volunteers to monitor their grasslands because it is not based on taxonomic species identification and is relatively easy for anyone to use.

RESTORING NATIVE PRAIRIE TO THE 'EMPIRE PRAIRIE' OF SOUTHCENTRAL WISCONSIN

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Prairie restorations on prime agricultural soils are rare, both because the soils are economically valuable as cropland and because the history of agricultural use can make the restoration process difficult. This project had two objectives: 1) to learn how to reestablish prairie on rich agricultural soils; and 2) to establish a natural "check" for environment variables. The experimental variables for prairie establishment were low diversity (LD; six species at $450/acre) and high diversity (HD; 25 species at $1,200/acre) seed mixes. The plots were treated with glyphosate and chisel plowed before planting. Seeds were hand-broadcasted in two passes of opposite direction onto the prepared soil, then cultipacked. Weeds (primarily annual broadleaf) were clipped/removed several times to allow some prairie seed germination. The plots were burned in the spring of the fourth year (2003). Already during the 1999 sampling, all six species were observed in the LD treatment. In the HD mix, the grasses came in immediately, and by year 2 there were 18 species identified. By year 3, 21 of the 25 species planted in the HD mix had emerged. Fall nitrates beneath the prairie have been drawn down to 20–40 lbs/acre of nitrogen in the top 3 feet compared to 120 lbs/acre of nitrogen remaining after corn harvest. After four years, the prairie restoration on this rich soil has developed nicely. Very few annual weeds exist and it appears that some soil processes (i.e., nitrate leaching) are returning to the levels associated with undisturbed prairie soils. Nearly all of the 25 species in the HD mix have been established. There is no longer a difference in weed cover between the treatments. The species differences between HD and LD will likely disappear as the plants and seeds spread over the years. The plots will continue to be monitored to chronicle the changing species mix.

DOES AN INTERSTATE HIGHWAY FORM A DISPERAL BARRIER TO SMALL MAMMALS?

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We trapped small mammals along U. S. Interstate 80 in central Nebraska to test the theory that an interstate acts as a barrier to dispersal. Trapping was done from July 2003 through April 2004. Traps were set at six different sites along the interstate: 20 traps were set at each site with ten traps on the north side and ten traps on the south side of the interstate. Captured mice were marked with a permanent marker on the inside of the ear and released to see if they would ever be recaptured on the other side of the highway. During this period, 281 small mammals were caught at least once, and 85 were recaptured: a recapture rate of 30.2%. During the final trapping period (15–24 April 2004), all mice captured were released on the opposite side of I–80. During this final period 16.0% of those were recaptured, including one deer mouse (*Peromyscus maniculatus*) that crossed back over I–80 after two days. This was the only animal of the to have crossed the interstate.

SIX HUNDRED AND FIFTY ACRES OF REMNANT WISCONSIN PRAIRIE RESTORED BY NONPROFIT ORGANIZATION THROUGH U.S. FISH & WILDLIFE SERVICE GRANT

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The Prairie Enthusiasts (TPE) is a private nonprofit land trust committed to the protection and management of native prairie and savanna in the Upper Midwest, representing over 1,100 people in Illinois, Iowa, Minnesota and Wisconsin.

The U.S. Fish & Wildlife Service's Private Stewardship Grant Program awarded almost $200,000 to TPE in 2003–2004 for the restoration and maintenance of remnant prairie and savanna on 24 sites throughout southern Wisconsin. The primary goal: Provide critical habitat for two federally listed and 27 state-listed species, as well as dozens of other species that are candidates for future listing. The project also involved the Wisconsin Field Office of The Nature Conservancy and 17 private landowners. The Prairie Enthusiasts hired seven local private contractors to conduct various restoration activities, including tree/brush clearing and herbaceous weed control. Dedicated volunteers have already exceeded the 10% matching funds requirement by providing $24,000 of in-kind labor through prescribed burns, seed collecting, tree/brush clearing and weed control. The Prairie Enthusiasts will create detailed management plans for most sites, and explore the possibility of long-term management agreements and conservation easements with landowners.

MONITORING THE SUCCESS OF A PRAIRIE RESTORATION: SPIRIT MOUND HISTORIC PRAIRIE

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On August 25, 1804, Captain William Clark wrote "... from the top of the Mound we beheld a most butifull landscape; numerous herds of buffalow were Seen feeding in various directions; the Plain to North N.W. and N.E. extends without interruption as far as Can be seen." Spirit Mound, in southeastern South Dakota, is one of the few specific locations that Lewis and Clark were known to have visited on their journey west. Since that time, the area has been converted to agricultural fields, building sites, and a feedlot. In 2001, the 320-acre site was purchased by the state with funds from the U.S. Congress and is now managed by the South Dakota Department of Game, Fish, and Parks. A prairie restoration effort quickly began with site clean-up and seeding in fall 2001. In summer 2003, we began a study to evaluate the success of the restoration effort and factors influencing the establishment and success of prairie and non-prairie species. Our first-year results indicate that the biomass, species richness, and percent cover of prairie species increased during the summer, but dramatic differences existed among different parts of the site. In an effort to evaluate these differences, we tested soil quality and examined previous-use histories. Soil-nutrient levels were associated with the density and diversity of prairie and non-prairie plant species. Soils in an area that was formerly a feedlot and an adjacent site were infested by non-native forbs and had high levels of organics, nitrogen, phosphorus, potassium, and salts. In contrast, areas with more suitable soils but that were under cultivation as recently as summer 2001, showed generally good establishment of planted prairie species. Based on these results, we are developing a plan to mitigate poor soil quality and will continue to monitor this significant prairie-restoration effort.