



## Status and Importance of Prairie Ecosystems on Corps of Engineers Projects

*By Chester O. Martin and E. Paul Peloquin*

**PURPOSE:** This technical note is a product of the Ecosystem Management and Restoration Research Program (EMRRP) work unit titled “Prairie/Grassland Ecosystems on Corps Projects.” The objectives of the study were to: (1) establish the national importance of prairie/grassland ecosystems on Corps-administered operational projects and identify the approximate acreage on Corps lands, (2) outline the Corps’ potential role in prairie management and identify opportunities for further involvement, and (3) identify potential out-year research that

would benefit the Corps in prairie restoration and management. The purpose of this technical note is to define the value of prairie ecosystems to the nation and the Corps and present the findings of a Corps-wide survey of prairie/grassland habitats on water resources projects (Figure 1). Information was developed with the support and cooperation of the Corps of Engineers Stewardship Advisory Team (SAT).



Figure 1. Prairie/grassland habitats are significant features on Corps projects in many areas of the United States (photo courtesy of C. O. Martin)

**BACKGROUND:** The need to develop a work unit that specifically addressed prairie restoration on Corps of Engineers operational projects was first identified in 2002, and a proposed study entitled “Field Techniques for Establishing Native Prairies for Multiple Benefits on Corps Projects” was submitted for consideration as an EMRRP study. The original proposal was not accepted as a new work unit in the program, but members of the Corps SAT voiced strong support for the study and requested that it be resubmitted for out-year funding. Thus, in FY04 the original proposal was revised and resubmitted as part of the Environmental Stewardship focus area of the EMRRP. This resulted in approval of a one-year study that included the following components:

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- Literature review of prairie/grassland ecosystems.
- Coordination with Corps and other agency personnel.
- Data call to all Corps District and project offices to determine the status of prairie ecosystems under Corps administration.
- Presentations as part of SAT biannual meetings.
- Preparation of a technical note that addressed the importance of prairie restoration and management efforts on Corps projects.

Continued coordination was required in FY05 to obtain additional information on prairie/grassland habitats at selected projects. This technical note summarizes the results of FY04 and FY05 work unit tasks.

**PRAIRIE ECOSYSTEMS – STATUS AND NATIONAL IMPORTANCE:** From an ecological perspective, native grasslands are considered among the most important ecosystems in North America. The tallgrass, mixed, and shortgrass prairies of the mid-continent region are among our nation's most endangered ecosystems, and the tallgrass prairie is considered a globally endangered resource (Ricklets et al. 1999, Samson et al. 2004). Prairies represent rich and fertile landscapes that have long been known to provide humans with food, fiber, and energy. Prairie grasslands also provide human-valued resources such as erosion control, nutrient cycling, water purification and recharge, wildlife habitat, and abundant recreational activities (Bachand 2001). Miller and Nudds (1996) hypothesized that the increased magnitudes of floods in the Mississippi River Valley over the past several decades may partially be related to extensive changes in agricultural land use resulting in the reduction of natural upland vegetation, including prairies, and modified wetland drainage in the upper reaches of the watershed.

The National Wildlife Federation recently published an assessment of the status of the American prairie (Bachand 2001). Before European colonization, prairies covered approximately one-third of the land surface in the contiguous United States. Native prairies presently comprise less than 3 percent of their original acreage in the United States, and remaining patches are small, fragmented, and isolated. Widespread conversions to row-crop agriculture and improved grazing pasture have resulted in the greatest losses nationwide. Although the original tallgrass prairie covered 250 million acres across the Midwestern states, native prairie was nearly eliminated due to agricultural conversion by 1900 (Shirley 1994). Cully et al. (2003) reported that only 1 percent of the original tallgrass prairie remains due to extensive conversion to agriculture during the last century; thus, it is one of the most severely affected ecosystems in North America. Estimates of native grassland losses vary from state to state, but generally range from 30 to 99 percent, with the Midwestern tallgrass prairies suffering the greatest losses. For example, approximately 80 percent of native prairie has disappeared in North Dakota, with most of the remaining areas existing in the arid western part of the state (North Dakota Parks and Restoration Department, undated).

Although the initial loss of prairie habitat was primarily due to agricultural development, deterioration of native grasslands has resulted from a myriad of land use activities and conversion practices. Urban development, fire suppression, and the spread of invasive species also have contributed to the loss of native prairie. Recently, suburban encroachment has resulted

in significant reductions and fragmentation of grasslands in many regions. Invasion by non-native plant species has increasingly become a serious threat to the maintenance of native grasslands in many areas. Exotic plant species often directly compete with native plants and may result in changes in important ecosystem processes (Mack 1989, Christian and Wilson 1999).

Many of the wildlife species that depend on prairie habitats have experienced serious population declines due to the deterioration and fragmentation of prairie grasslands. Thus, prairie remnants suffer from isolation and restricted gene exchange, which affects genetic viability and biodiversity. Impacts of the loss of prairie ecosystems to native plants and wildlife have been described in numerous studies (e.g., Knopf 1994; Samson and Knopf 1994, 1996). Fragmentation, along with reduction in acreage, may result in species loss directly by eliminating habitats, and species numbers or richness may decline in fragments due to isolation and lack of immigration of propagules from neighboring communities (Culley et al. 2003).

## **IMPORTANCE TO THE CORPS OF ENGINEERS:**

The restoration and management of prairie ecosystems has emerged as an important consideration relevant to many Corps of Engineers Districts. Prairie grasslands contribute significantly to the control of non-point source pollution, and both groundwater and surface water systems that drain through prairie/grassland regions can affect the performance of flood control, navigation, and hydropower projects. Corps Districts are concerned with restoring degraded aquatic habitats by improving the quality and quantity of water reaching receiving streams and aquifers from the adjacent watershed.

Several Districts have promoted

grassland management on their projects as a means to support watershed management and aquifer protection (Figure 2). Functional prairie/grassland areas adjacent to stream systems are essential for erosion control and sediment management, especially in regions with limited riparian vegetation. The operation and maintenance of Civil Works projects may regionally affect the distribution and character of prairies; thus, the Corps shares stewardship responsibility of prairie ecosystems with other land management agencies.

Corps Districts have been involved in grassland restoration activities since the mid-1970s. For example, the Proceedings of the Sixth North American Prairie Conference contained a paper on establishment of native grasses in the Southwestern Division (Green et al. 1981). This article stated that the Corps encouraged establishment of native vegetation on its project lands primarily because native vegetation was more compatible with natural recreational facilities, and native plants were usually better adapted to harsh growing conditions. Also, several projects in the



Figure 2. Prairie ecosystems are important for watershed management and aquifer protection on Corps projects (photo courtesy of C. O. Martin)

Northwestern Division have historically managed grasslands to provide improved wildlife habitat, and the Kansas City District has had an active program to restore and manage prairie habitats on their operational projects since the 1980s.<sup>1</sup> Many other Districts are involved in prairie restoration to varying degrees and almost all Districts are involved in attempts to control invasive species that have affected the proper use of their lands.

Corps projects throughout the nation contain patches of native prairie, and the potential exists to restore or replicate additional sites that would provide a significant contribution to nationwide efforts to restore these unique ecosystems. Although prairie acreages on Corps projects are often limited, a recent study (Cully et al. 2003) indicated that small fragments of tallgrass prairie may be relatively intact and should not be overlooked as long-term refuges for prairie species, sources of genetic variability, and material for restoration. For example, a gene bank of disappearing local clones of prairie plants has been established at Granger Lake, Texas, resulting in one of the best prairie replication sites in the area.<sup>2</sup> The gene bank, initiated in 1991, is a collection of native species where the genetic material of relic plant species can be preserved for future environmental and educational uses. The success of this effort was highlighted in a 1998 article in the *Engineer Update* (Horky 1998).

**RESULTS OF DISTRICT SURVEY:** In July 2004 a request for information on prairie acreage was submitted to all Corps Natural Resource Management Offices via the SAT. The data call asked for information from each District and project regarding the extent (number of acres) and location (project and state) of the prairie/grassland types listed as follows: Mid-continent prairie (including tall-grass, mixed, and shortgrass prairie), coastal prairie, longleaf pine/bluestem/wiregrass savannah, sagebrush grasslands, rangeland (including open range sites with grassland/shrub mixtures), meadows (including wet meadows), and any other grassland type (e.g., pasture, miscellaneous open areas). Responses were received from 19 Districts and 151 projects. Results are summarized below and in Table 1.

## Northwestern Division

**Portland District:** The Portland District reported 303 acres of prairie habitat in the other category. All grassland sites in the District may be considered to have received some restoration treatment. Historical assessment by The Nature Conservancy suggests that over 99 percent of Willamette Valley Wet Prairie has been lost, and a substantial portion of what is left occurs on Corps land. These sites are characterized by winter inundation and summer drought, are dominated by tufted hairgrass (*Deschampsia cespitosa*), and support a diverse plant community that includes many rare, threatened, and endangered species.

**Seattle District:** The Seattle District reported 673 acres of rangeland and 20 acres of meadow habitat at the Chief Joseph project. An additional 92 acres of grassland at Albeni Falls Dam and Libby Dam were listed in the other category; 62 acres of grassland are managed as big game winter range.

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<sup>1</sup> Personal Communication. 2004. Mike Watkins, Wildlife Biologist, U.S. Army Engineer District, Kansas City, MO.

<sup>2</sup> Personal Communication. 2005. Carey Weber, Lake Manager, Lake Georgetown, TX.

**Table 1**  
**Summary of Prairie/Grassland Acreage on Corps of Engineers Projects**

Corps District/Division	Number of Projects Reporting Acreage	Acres of Prairie/Grassland
<b>Northwestern Division</b>		
Portland District	1	303 acres
Seattle District	3	785 acres
Walla Walla District	8	29,106 acres
Omaha District	9	539,425 acres
Kansas City District	16	33,797 acres
<b>TOTAL – NWD</b>	<b>37</b>	<b>603,416 acres</b>
<b>Southwestern Division</b>		
Fort Worth District	19	31,524 acres
Tulsa District	24	52,860 acres
Little Rock District	3	10,653 acres
<b>TOTAL – SWD</b>	<b>46</b>	<b>190,074 acres</b>
<b>South Pacific Division</b>		
Sacramento District	8	14,475 acres
San Francisco District	1	2,480 acres
Albuquerque District	2	4,340 acres
<b>TOTAL – SPD</b>	<b>11</b>	<b>21,295 acres</b>
<b>Great Lakes and Ohio River Division</b>		
Huntington District	3	499 acres
Louisville District	11	2,174 acres
Nashville District	2	148 acres
<b>TOTAL – ORD</b>	<b>16</b>	<b>2,821 acres</b>
<b>Mississippi Valley Division</b>		
Rock Island District	2	380 acres
Vicksburg District	6	21,825 acres
<b>TOTAL – MVD</b>	<b>8</b>	<b>22,205 acres</b>
<b>South Atlantic Division</b>		
Mobile District	4	2,100 acres
Wilmington District	3	948 acres
<b>TOTAL – SAD</b>	<b>7</b>	<b>3,048 acres</b>
<b>North Atlantic Division</b>		
New England District	26	790 acres
<b>TOTAL – NAD</b>	<b>26</b>	<b>790 acres</b>
<b>GRAND TOTAL</b>	<b>151</b>	<b>843,649 acres</b>

**Walla Walla District:** The Walla Walla District reported 29,106 acres of grassland habitat on eight projects in Washington, Idaho, and Oregon. Estimates included 8,246 acres of sagebrush grasslands, 16,822 acres of rangeland, 100 acres of meadows, and 3,938 acres included in the other grassland category. Most of the native rangeland is fenced off but is not conducive to restoration efforts due to the very steep, rugged terrain.

**Omaha District:** The Omaha District has extensive acreages of prairie grasslands throughout the upper Great Plains. Estimated prairie habitat for nine projects in South Dakota, North Dakota, and Montana included 3,000 acres of tallgrass prairie (Lewis and Clark Lake), 328,000 acres of mixed prairie, and 208,425 acres of shortgrass prairie.

**Kansas City District:** Current records show that 33,797 acres of broken and unbroken native prairie are managed on 16 projects in the Kansas City District. Individual tracts range from 50 to 5,520 acres, and include various mixtures of tallgrass, mixed, and shortgrass prairie. Over 19,000 acres of unbroken native prairie habitat occur on ten projects. Of these, 9,079 acres are managed by the District, 2,222 acres are managed by the Army, and 7,890 acres are managed by Kansas Department of Wildlife and Parks.

## Southwestern Division

### Fort Worth District:

The Fort Worth District reported a total of 31,524 acres of prairie/grassland on 19 projects. This estimate included tallgrass prairie (3,922 acres), mixed prairie (727 acres), shortgrass prairie (100 acres), coastal prairie (100 acres), pine/bluestem savannah (993 acres), rangeland (17,827 acres), meadow (10 acres), and other (7,845 acres). The District has championed attempts to replicate native prairie sites at Lake Georgetown and Granger Lake, Texas. At Granger Lake, the Texas Parks and Wildlife



Figure 3. Cooperative prairie restoration site at Granger Lake, Texas (photo courtesy of C. O. Martin)

Department, Native Prairies Association of Texas, and the Corps have cooperatively established a gene bank of disappearing local clones and created one of the best prairie replication sites in the area (Figure 3). The Fort Worth District is also investigating the application of brush management and prairie restoration for improving water quality in degraded streams.

**Tulsa District:** Every Corps reservoir project in the Tulsa District lies within the historic Prairie Ecoregion of the central United States, and virtually every project has retained areas where indicator species typical of native prairies can be found (including acreages of tallgrass, mixed, and shortgrass prairie).<sup>1</sup> Most lakes have noted areas of native grasslands in their Operational Management Plans (OMPs), but acreages have not been estimated for all projects. A preliminary estimate of prairie grassland areas includes 24 projects with the following acreages: tallgrass prairie (20,321 acres), midgrass/mixed prairie (10,193 acres), shortgrass prairie (410 acres),

<sup>1</sup> Personal Communication. 2005. Jim Harris, Biologist, U.S. Army Engineer District, Tulsa, OK.

rangeland (20,564 acres), meadow (640 acres), and sagebrush (732 acres), for a total of 52,860 acres. Approximately 1,100 acres have been restored to native tallgrass and midgrass habitat.

**Little Rock District:** Open landscapes in the Little Rock District include tallgrass prairie, oak savannah, and Ozark glades. Millwood Lake in southwestern Arkansas holds fee ownership to 309 acres of a nationally important Blackland Prairie community type (Figure 4). A contiguous 185-acre tract known as the Saratoga Blackland Prairie was cooperatively managed by the Corps and Arkansas Natural Heritage Commission from 1987 until 2003. Several sensitive plant species occur on the site. An estimated 10,350 acres of Ozark glades and savannah occur on Bull Shoals and Norfork Lake. Approximately 2,000 acres of glade and savannah habitat are being restored on these projects. Additionally, Mountain Home project on the White River has an ongoing landscape management initiative to manage the Ozark Glade community type for the benefit of sensitive species.<sup>1</sup>



Figure 4. Prairie wildflowers in bloom on Millwood Lake “blackland prairie” in southwestern Arkansas (photo courtesy of Douglas Zollner, The Nature Conservancy)

## South Pacific Division

**Sacramento District:** Grasslands totaling 14,475 acres were documented for eight projects in the Sacramento District. These included 1,000 acres of sagebrush and 500 acres of meadow on Martis Creek Lake, 2,052 acres of rangeland on New Hogan Lake, and 10,923 acres designated as other on seven projects, all located in California. The most extensive acreage was 7,000 acres reported for Pine Flat Lake.

**San Francisco District:** Warm Springs Dam/Lake Sonoma has 2,480 acres of grasslands, composed primarily of soft chess (*Bromus mollis*), foxtail chess (*B. rubens*), slender oats (*Avena barbata*), and little quaking grass (*Briza minor*). Most of this acreage is presently categorized as rangeland; after succession, those lands are projected to contain 1,207 acres of grassland. Grassland types and acreage have not been determined for Coyote Valley Dam, Lake Mendocino.

<sup>1</sup> Personal Communication. 2004. Randall Becker, District Forester, U.S. Army Engineer District, Little Rock, AR, and Mark Case, Resource Specialist, Bull Shoals Lake, AR.

**Albuquerque District:** The Albuquerque District reported 440 acres at Santa Rosa Dam, New Mexico, and 3,900 acres at John Martin Reservoir, Colorado. Grasslands at both projects were included in the other grassland category.

### **Great Lakes and Ohio River Division**

**Huntington District:** Approximately 475 acres of tallgrass prairie have been established on two projects (Deer Creek Lake and Delaware Lake) in the Huntington District. Additionally, 24 acres of mixed grasslands occur at Ohio River Lock and Dam sites.

**Louisville District:** The Louisville District reported prairie acreage on project lands in the tallgrass prairie, shortgrass prairie, meadow, and other grassland categories. A total of 2,023 acres of tallgrass prairie occur on 11 projects, 638 acres of which represent restored prairie. An additional 240 acres of tallgrass prairie, 20 acres of mixed prairie, and 20 acres of shortgrass prairie are planned for restoration. Thirty-six acres of meadow habitat can be found on six projects, five acres of which have been restored, and five acres of meadow are planned for future restoration. Approximately 115 acres of other grassland types were noted as occurring on four projects.

**Nashville District:** The Nashville District reported 120 acres of tallgrass prairie on two projects; 91.6 acres represent areas that have been restored on project lands. An additional 28 acres have been planted to switchgrass (*Panicum virgatum*).

### **Mississippi Valley Division**

**Rock Island District:** The Rock Island District is restoring prairie habitat at Red Rock and Saylorville projects. Red Rock has approximately 280 acres in restored prairie, mainly in 5-acre parcels. Saylorville has a 100-acre restoration effort.

**Vicksburg District:** The Vicksburg District reported 21,825 acres of grassland habitat on six projects in Mississippi, Louisiana, and Arkansas. Most are open lands (e.g., hay and pasture leases) managed for wildlife. Several are designated as quail and turkey management areas. Bayou Bodcau in western Louisiana contains 98 acres listed as calcareous prairie.

### **South Atlantic Division**

**Mobile District:** Approximately 2,000 acres of longleaf pine/wiregrass (*Pinus palustris/Aristida stricta*) savannah are found on Lake Seminole, Florida. The Apalache Management Area and the state of Florida initiated an 1135 project for restoring a longleaf pine/wiregrass system on the lake in the late 1990s. The Corps has been using fire management to reclaim an additional 1,000 acres outside of the management area. Approximately 100 acres of “blackland prairie” habitat occurs on three projects in Alabama, but these sites are in scattered pockets and have not been surveyed in detail. While the total acreage of prairie in these areas is small, all three have populations of globally rare plant species.

**Wilmington District:** The Wilmington District reported 948 acres of grassland habitat in the other category. The majority of this acreage is in native warm season grasses, 132 acres of which have been restored. An additional 174 acres are planned for restoration.

## North Atlantic Division

**New England District:** Twenty-six projects in the New England District have scattered tracts that were previously planted to row crops. Most of these are old fields ranging from 10 to 100 acres in size. A total of 790 acres of grassland were estimated for these projects. Approximately 70 acres on three projects have been converted to native warm season grass/legume mixtures and wet meadows.

**DISCUSSION:** Results of the survey show that at least 19 Corps Districts and 151 projects are involved to some extent in grassland restoration and management. Total acreages within each prairie/grassland type were: Mid-continent Prairie (tallgrass, mixed, and shortgrass combined because some Districts were not able to separate prairie types into the three categories) = 612,291 acres; pine/savannah = 2,993 acres; sagebrush grassland = 9,978 acres; rangeland = 60,418 acres; meadow = 1,309 acres; and other = 61,523 acres. The total acreage reported in all grassland types was 843,649 acres, which the authors consider to be considerably underestimated because adequate inventories have not been conducted to determine vegetation types and acreages on many projects. Nevertheless, the presence of nearly one million acres of predominantly grassland habitats documented for Corps projects suggests that these lands are important nationwide from an operational and management perspective.

Projects within the Northwestern Division contain the most extensive acreages of prairie/grassland habitat and presently support the most active management programs. The Omaha District reported approximately 540,000 acres of tallgrass, mixed, and shortgrass prairie, which dominate the landscape in South Dakota, North Dakota, and Idaho. The Kansas City District has had an active prairie restoration and management program for over 20 years, and now manages approximately 34,000 acres of warm season native grasslands on 16 projects in Kansas, Missouri, Iowa, and Nebraska. Project managers and natural resource specialists on these projects have conducted various planting experiments and have developed seed mixes most suitable for their sites. Projects in the Seattle, Portland, and Walla Walla Districts reported 8,246 acres of sagebrush grasslands, 17,495 acres of rangeland, 120 acres of meadow, and 4,333 acres combined into the miscellaneous other category. Grasslands in the Walla Walla District are fenced off and have primarily been managed as wildlife habitat and for protection of the native system. The major management problem is encroachment by cheatgrass (*Bromus tectorum*) and yellow star thistle (*Centaurea solstitialis*). There is some concern with losing stands of native sagebrush in certain areas.<sup>1</sup>

The Southwestern Division reported acreages from the Fort Worth District, Tulsa District, and Little Rock District. Estimates included tallgrass prairie (27,243 acres), mixed prairie (10,920 acres), shortgrass prairie (510 acres), coastal prairie (100 acres), pine-savannah (2,993 acres), rangeland (38,391 acres), meadow (653 acres), sagebrush (732 acres), and other (18,195 acres), for a total estimate of 95,037 acres. As previously mentioned, these figures are considered to

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<sup>1</sup> Personal communication. 2005. Al Sutlick, Wildlife Biologist, U.S. Army Engineer District, Walla Walla, WA.

represent an underestimate because inventory data were not available from some projects. Several projects in the Fort Worth District reported that they had developed plans for prairie management and were promoting restoration attempts as time and budget allowed. Excellent progress has been made to maintain and restore prairie habitat at Georgetown and Granger Lakes in the Fort Worth District. Some projects used volunteer support to assist with restoration efforts. For example, Bardwell Lake utilizes partnerships from neighboring cities, as well as local volunteers such as Boy Scouts, Girl Scouts, and other organizations. Inadequate funding was noted as a problem at some projects in the Fort Worth and Tulsa Districts. Several projects in the Division contain remnant populations of sensitive species that are considered ecologically important. Open habitats in mountainous regions of the Little Rock District consist primarily of Ozark glades and savannahs.

The South Pacific Division reported grasslands from three Districts and eleven projects, most of which were in the Sacramento District. Acreages included sagebrush (1,000 acres), rangeland (4,532 acres), meadow (500 acres), and other (15,263 acres), for a total of 21,295 acres. Grasslands on some projects were considered of low value and other sites included occasional oak and shrub regions. Estimates are considered low because inventories have not been conducted on many of the projects, and several projects reported grassland types and acreages as "not determined."

Three Districts in the Great Lakes and Ohio River Division reported grassland acreages on project lands. The Louisville, Huntington, and Nashville Districts have established 2,618 acres of tallgrass prairie, most of which occurs on 11 projects in the Louisville District. Additionally, these projects have 36 acres of meadow habitat and 167 acres included as other grasslands, which included recreational and wildlife plantings. A major undertaking has been the conversion of tall fescue (*Festuca arundinaceae*) pasture to native warm season grasses and legumes. The Louisville District also noted several projects where grasslands are being established adjacent to riparian corridors in urban areas. The District is planning future improvement of 400 acres of rangeland.

Other offices responding to the survey included the Rock Island and Vicksburg Districts (Mississippi Valley Division), Mobile District and Wilmington Districts (South Atlantic Division), and New England District (North Atlantic Division). The Rock Island District reported that restored prairie on their projects included 280 acres at Red Rock and approximately 100 acres at Saylorville. The Vicksburg District estimated 21,727 acres of open lands managed primarily for wildlife in Mississippi and Arkansas, and 98 acres of calcareous prairie on a project in Louisiana. The Mobile District reported approximately 1,000 acres of longleaf pine/wiregrass savannah and 100 acres of prairie, and the Wilmington District reported 948 acres of other grassland habitat. The New England District reported numerous projects with small acreages of grasslands. Old agricultural fields are being converted to native warm season grasses on several projects.

Management practices on restored grassland sites at Corps projects generally include a regimen of prescribed burning and mechanical treatments to maintain the desired successional stage and prevent encroachment of invasive species (Figure 5). Prairie uplands in the Portland District are

maintained by annual mowing, and wet prairie sites are managed under a prescribed fire regime with supplemental treatments. The management program at Millwood Lake, Little Rock District, consisted of prescribed burning, supplemented with hand removal of eastern redcedar (*Juniperus virginiana*). The Tulsa District felt that there was potential to restore or manage several thousand additional acres to native prairie on project lands with the provision of appropriate manpower and funding. The District has a fairly aggressive

prescribed burning program, but due to funding limitations, management units are burned only on a 3- to 4- year rotation, which was not considered frequent enough to prevent the encroachment of woody species. However, at projects in the Fort Worth District, burning every 3 to 5 years was effective in keeping woody species from invading sites; burning at this rate also recycled nutrients and released annual seeds suppressed by grass litter. Bardwell Lake management practices include prescribed burns, mowing, and re-seeding with Texas native grass mixtures to prevent encroachment of invasive species. The city of Grand Prairie, Texas, manages over 560 acres of prairie, 500 acres of which is part of the Wild Flower Project at Estes Peninsula on Joe Pool Lake.

Numerous sites previously planted to row crops and pasture are being converted to native grass/legume mixes to improve biodiversity and provide wildlife habitat. Watkins (1998) described a fish and wildlife mitigation project that included a mixture of riparian and upland plantings at Benedictine Bottoms along the Missouri River. Approximately 750 acres were planted to native grasses and legumes, including big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), eastern gamagrass (*Tripsacum dactyloides*), and switchgrass, along with various wildflowers and legumes. The resulting wetland prairie habitat is expected to provide valuable nesting and escape cover, as well as a source of food for many species (Watkins 1998). The Wilmington District noted that grassland plantings at John H. Kerr project were primarily intended to improve wildlife habitat, and rangeland improvement areas at Libby Dam, Seattle District, were designed to provide big game winter range.

Several management concerns were noted by project personnel in the Fort Worth District. The following comments are summarized from input by Carey Weber.<sup>1</sup> A major problem with prairie replication in Texas has been the availability of seed from the locale where it is needed. For example, most little bluestem (*Schizachyrium scoparium*) grown in Texas comes from the Texas Panhandle, and currently no locally grown big bluestem is available. Also, out of the hundreds of herbaceous plants that occur on prairies, only a handful are available in the



Figure 5. Prescribed burning is used for prairie restoration on Kanopolis Lake, Kansas (photo courtesy of Mike Watkins)

<sup>1</sup> Personal Communication. 2004. Cary Weber, Lake Manager, Lake Georgetown, TX.

quantities needed for large acreage plantings. While herbaceous plant seed is available from commercial producers and suppliers, most native prairie plants must be obtained from roadsides and private property. The availability of proper planting equipment is also a problem. It should also be noted that planting techniques that work at one project may not be suitable at another.

Prairie restoration and management often include the protection and maintenance of sensitive species. For example, several threatened and endangered plants and animals occur on Corps projects in the Willamette Valley Wet Prairie region. A very significant rare species, *Festuca roemeri*, occurs on less than 1 acre of project land in the Willamette Valley, but this may be the largest stand south of Olympia, Washington. The Saratoga Blackland Prairie tract at Millwood Lake, Little Rock District, supports at least seven sensitive plant species and ranks among the best of blackland prairies evaluated as part of the Arkansas Coastal Plain Inventory. In the Mobile District, several globally rare plant species have also been documented on project sites in Alabama.

Fragmentation is a major concern on prairie restoration sites. The Kansas City District has emphasized establishment of unbroken native prairie, and currently manages ten unbroken tracts ranging in size from 98 to 5,585 acres. Several Districts reported that fragmentation and encroachment by invasive species were serious problems when attempting to restore or manage prairie habitat. Major species noted as invasive on native grasslands in the Tulsa District are eastern redcedar and sericea lespedeza (*Lespedeza cuneata*). Woody natives, exotic shrubs, and other invasive weeds threaten all wetland prairie sites in the Portland District. Prairie restoration efforts in the Fort Worth District often require the removal of invasive phreatophytes such as honey mesquite (*Prosopis glandulosa*), Ashey juniper (*Juniperus ashei*), and salt cedar (*Tamarix* spp.). Many other introduced species threaten the quality and continued existence of remaining tracts of native grasslands on Corps projects.

**RESEARCH ELEMENTS:** Potential research elements of a Corps prairie restoration work unit were discussed at FY04 SAT meetings. Topics identified as pertinent to Corps projects included the following (not listed in any priority order):

- Prairie establishment related to water quality and quantity, sediment control, and water retention.
- Planting techniques and maintenance requirements.
- Regional availability of plant materials.
- Restoring unique prairie types such as wet prairies, meadows, and riparian pastures.
- Fire management in various prairie/grassland ecosystems.
- Control of noxious vegetation and invasive species.
- Minimum size requirements for sustaining functional prairies.

Other research concerns proposed by District and project personnel included fragmentation issues, a need for guidelines for site evaluation and preparation, protection and maintenance of populations of rare plant species, and managing prairies to improve regional biodiversity (e.g., to provide habitat for grassland birds identified as Partners in Flight priority species).

**CONCLUSIONS:** Native prairies have been reduced to a small fraction of their original acreage and are considered among the most endangered ecosystems in North America. The initial loss of prairie habitat was primarily due to agriculture, but the deterioration of native grasslands has also resulted from urban development, fire suppression, and the spread of invasive species. Remaining prairie patches are small, fragmented, and isolated, and prairie remnants are often functionally limited and in danger of further degradation. As a consequence, prairie-dependent species, especially plants, suffer from isolation and limited gene exchange. Prairie grasslands are considered to be extremely important from a national perspective and are recognized for their role in erosion control, nutrient cycling, water purification and recharge, and provision of wildlife habitat.

Prairie ecosystems have been shown to contribute significantly to natural resource stewardship objectives on Corps operating projects. Benefits of prairie restoration noted by District and project personnel include erosion control, sediment management, control of non-point source pollution, improvement of water quality, and restoration of degraded aquatic habitats (especially where grasslands are located adjacent to riparian areas), protection of rare species, and improvement of wildlife habitat. The 2004-05 survey of Corps projects showed that at least 19 Districts and 151 projects are involved in prairie/grassland management efforts to some extent. Although prairie restoration and management activities are concentrated in the Midwest, Great Plains, and southwestern regions, it is important that many projects in the eastern United States have begun to convert open lands to warm season grass/legume/forb plantings.

Development of appropriate grassland management practices on project lands provides the Corps an opportunity to make a major contribution to restoring prairie communities throughout the United States, which will create additional habitat required by numerous plant and animal species that depend on these systems for survival. Information is needed to promote prairie restoration from a national perspective on Corps lands, and regional guidelines are needed for the technical aspects of planning, operation, and maintenance of prairie ecosystems. It is apparent from the 2004-05 project survey that an EMRRP work unit dedicated specifically to prairie/grassland ecosystems would provide numerous benefits to the Corps' natural resources management program.

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**SUMMARY:** This technical note is provided as a product of the EMRRP work unit “Prairie/Grassland Ecosystems on Corps Projects.” Its purpose is to define the value of prairie ecosystems to the nation and the Corps and present the results of a Corps-wide survey of prairie/grassland ecosystems on water resources projects. Information was developed with the support of the Corps Stewardship Advisory Team. Native grasslands were determined to be an important resource on Corps projects throughout the United States. They were considered to be especially critical for providing erosion control, sediment management, nutrient cycling, water purification and recharge, and wildlife habitat. Results of the Corps-wide survey revealed that at least 19 Districts and 151 projects are involved to some extent in prairie/grassland management, and prairie restoration is an important land management activity at many sites. Based on District and project input, more than 840,000 acres of prairie/grassland habitat were estimated to occur on Corps project lands. Potential out-year prairie research and management needs were identified through coordination with the Stewardship Advisory Team.

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