

**Legacy Management's Weldon Spring and Fernald Preserve Sites
Prairie Maintenance - 10360**

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ABSTRACT

This paper describes the establishment and maintenance of tallgrass prairie communities at the Weldon Spring and Fernald Preserve sites. Prairie habitat can be an ideal community for the reclamation of disturbed land, but maintenance is required. This paper highlights the expanding use of prescribed burns for prairie management at both sites.

INTRODUCTION

Following the completion of large-scale soil remediation and waste disposal under the U.S. Department of Energy's (DOE) Office of Environmental Management, the Weldon Spring and Fernald Preserve sites successfully transitioned to the DOE Office of Legacy Management. Weldon Spring and Fernald Preserve served different purposes in the past, but now have similar paths forward.

The DOE Weldon Spring Site Remediation Action Project remediated a portion of a former trinitrotoluene and dinitrotoluene production plant that was operational from 1941 to 1945 and a former uranium refinery that was operational from 1957 to 1966. Surface remediation activities at the site, in St. Charles County, Missouri, were conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) beginning in 1986 and were concluded in 2001 with the completion of an 18-hectare (45-acre) on-site engineered disposal facility that contains 1.13 million cubic meters (1.48 million cubic yards) of waste materials. The 61 hectares (150 acres) surrounding the disposal facility have been planted and managed as a native prairie to provide effective erosion control and conservation benefits. Long-term surveillance and maintenance activities at the site were officially transferred to the Office of Legacy Management in 2003. The site is now open to the general public and has extensive community involvement through the operation of an on-site Interpretive Center and through other educational and recreational opportunities.

At Weldon Spring, the 61 hectares (151 acres) surrounding the disposal facility were established as a native Missouri prairie. This approach for site re-vegetation offered several

benefits. Once established, native grasses and forbs (non-grass herbs) act as an extremely effective and low-maintenance erosion control for the area surrounding the disposal cell. Because native prairie is considered an endangered ecosystem in Missouri, reestablishing a landscape that once existed in the area prior to European settlement not only ensures an environmentally ethical treatment of the land but also provides additional opportunities for beneficial community reuse, a key goal for the Office of Legacy Management and a part of the vision for the future of the site. The prairie was named Howell Prairie, in keeping with the history of the land. Francis Howell Sr. homesteaded the original prairie on the site in the early 1800's. An ad hoc group of prairie establishment experts and other interested stakeholders from throughout the state was formed to provide advice and feedback on site prairie management techniques.

To complement the prairie and to serve as an educational resource, the DOE remodeled one of the buildings at the Weldon Spring Site into an Interpretive Center. The center includes approximately 3.2 hectares (8 acres) of gardens containing plants native to Missouri, including perennials, shrubs, and trees.

The Fernald Preserve is situated on a 425-hectare (1,050-acre) tract of land approximately 30 kilometers (18 miles) northwest of Cincinnati, Ohio. The site is bordered by the unincorporated communities of Ross, Fernald, Shandon, and New Haven in Hamilton and Butler Counties. The site is a former uranium processing facility that shut down in 1991. Since then, the site has undergone extensive remediation pursuant to CERCLA. Remedial activities and subsequent ecological restoration have converted the site from an industrial production facility to an undeveloped park, comprised of a series of wetlands, prairies, and forested communities. Following the completion of large-scale soil remediation and waste disposition in the fall of 2006, the site was successfully transitioned to the Office of Legacy Management. The Fernald Closure Project was then renamed the Fernald Preserve.

For the Fernald Site, Natural Resource Trustees (representatives from DOE, Ohio Environmental Protection Agency (OEPA), and U.S. Department of Interior) developed a natural resource restoration plan, which presented a conceptual restoration design for the site and established goals for ecological restoration. The first goal was to establish ecological communities native to southwestern Ohio. The second goal was to promote wildlife's use of the site. Last, ecological restoration projects were to satisfy all compliance and legal mitigation requirements for the site. This plan, along with a great deal of stakeholder involvement and recommendations from the Fernald Citizens Advisory Board, resulted in the decision to develop the nature preserve final land use. Ecological restoration of the site resulted in the establishment of approximately 192 hectares (475 acres) of upland and wetland prairies as old fields were converted and barren subsoil was amended and seeded.

DOE reused a receiving warehouse at the Fernald Site to develop a Visitors Center, including a museum, to provide educational opportunities and a meeting space for community activities. A number of walking trails were opened through a variety of natural settings, providing visitors with an up-close view of the wetlands, forests, and prairies in either a recreational or educational setting.

At both the Weldon Spring and Fernald Preserve Sites, prairie establishment was a critical component of site ecological restoration. Large portions of the sites were restored to native wet

and upland tall-grass prairies using warm-season native grasses and forbs. Native species were ideal candidates for the harsh conditions present following remediation. These long-lived perennial plants establish deep root systems. Once the plants are established, they provide excellent erosion control and are very drought tolerant. Native grasses and forbs are also tolerant of very poor soil conditions, like those present following remediation. Additionally, the native grasses and forbs have lower long-term maintenance costs. Now, maintenance of grassland communities at each site is a major focus of the Office of Legacy Management.

ECOLOGICAL RESTORATION GOALS

Restoration objectives for Weldon Spring and the Fernald Preserve include the following: establish and promote the growth of healthy native grassland communities, control and reduce invasive plant species, control the influx of undesirable woody species into prairies, and reduce the potential for uncontrolled catastrophic fire on each site from the buildup of fuels. Strategies have been developed to ensure that each objective is met and that the integrity of restored areas is maintained. Strategies include mechanical and herbicidal control of undesirable and invasive species, mowing and baling prairies to promote plant growth and health, removing and chipping woody debris, and conducting prescribed burns in grasslands and savannas to promote stand health and control undesirable and invasive species.

The long-term goals and objectives are to continue monitoring the Weldon Spring Site and disposal cell for environmental concerns; maintain the landscape in a natural state that benefits birds, insects, and small mammals; and provide a publicly accessible area for recreational and educational uses.

Current objectives and goals at the Fernald Preserve include monitoring and continuing to clean up the aquifer under the site; monitoring and maintaining the 48-hectare (120-acre) on-site disposal facility, which is managed as prairie; monitoring and maintaining natural areas of the Fernald Preserve; and providing safe publically accessible areas for community outreach, recreation, and education.

PRAIRIE ESTABLISHMENT

The use of native grasses provides an ecological restoration remedy that benefits the soil, waterways, and wildlife of an area. The benefits to the soil can be seen in that, once established, warm-season native grasses provide excellent erosion control, slowing water and allowing it to penetrate and percolate into the soil. The extensive root systems of warm-season native grasses and forbs are very adept at holding the soil in place and reducing the amount of soil movement into waterways. The roots go out and deep into the soil to find available water which makes the plants able to survive through the hot dry summer seasons. This exceptional drought tolerance was necessary in the years between 1999 and 2006 due to prolonged drought.

Even though most prairie plants are bunch grasses and do not form sod mats across soil, their root systems compensate for the gaps in cover. The bunch-type habit also provides space for native forbs, which, in turn, provide additional food and cover for wildlife.

Prairies provide diverse habitat and food sources necessary for the reestablishment of native wildlife species. Migrant species of birds, mammals, and amphibians are drawn to these restored areas as temporary and long-term sources of food and shelter.

Prairie development is slow, and prairie grasses and forbs can take years to become established. Maintenance is essential during this time to ensure the establishment of a healthy prairie. The type of maintenance necessary is dependant on the soil conditions and the level of plant competition in the area. As stated above, the objective at these sites is to maintain the native grass communities. To accomplish this goal, each site has to do two things: control the species composition of the communities, and promote plant health.

“Control the species composition” means to limit or remove the undesirable, invasive, or noxious species in the prairies. Actions taken to control species composition include mowing to prevent weed seed maturation, manually or mechanically removing undesirable species, applying herbicides, tilling, and conducting prescribed burns.

As prairie species begin to establish, most of the growth is under the surface. The native species often spend the first and second year developing their root structure before developing the above ground portion of the plant. During this phase, weed seed in the soil will often sprout, filling the surface area, and overshadowing the native species. Continued dominance by the weed species can be detrimental to the health of the desired grasses and forbs. To limit these plants’ ability to reproduce, a field can be mowed prior to seed development and dispersal. Further growth of the weeds would then be limited to seed remaining in the seed bed.

Undesirable woody vegetation and invasive plants can be removed by using mechanical equipment or, when possible, by pulling them from the ground by hand. Diligence is needed to ensure that all root material is removed. Another successful method of control is to cut plants off at the ground level and apply appropriate herbicide to the stump. This combined method for treatment has been effective in preventing further growth of the undesirable plants.

Noxious, invasive species, such as several species of thistle, produce a large amount of seed. Also, mechanical methods of control are often ineffective in controlling invasive plants because the roots are left in place, only to resprout later. Herbicide application has been an effective way of controlling these undesirable species. The herbicide is absorbed by the plant and kills the roots. Herbicides used are selected based on time of application, composition of plant community, and the herbicide’s demonstrated effectiveness against the undesirable plant. For example, thistle rosettes are often still green and susceptible to herbicides after prairie grasses have gone dormant or before they break dormancy in the spring. Foliar application of glyphosate is effective in this range of time without injury to desirable plant species. Selective herbicides (e.g., 2, 4-D), which target broadleaf species and have limited effect on most prairie grasses, are available on the market and are effective when applied in accordance with the label. Boom sprayers attached to tractors and utility vehicles can be used to apply selective herbicides. Boom spray herbicide is applied evenly to a large area in a timely and efficient manner. Spot-spraying is another method used. Non-selective or less selective herbicides are applied precisely to individual plants and groupings so that susceptible desirable species would not be hit. Herbicide is applied to leaf surfaces by using a backpack sprayer or by pulling a hose from a fixed tank unit. Care must be taken to not leak herbicide down the hose as it is pulled through the vegetation. In one instance, a leaking line was found to result in more kill than

expected. It was determined that spot-spraying was best done before the affected desirable plants budded. A final method used on invasive and undesirable species is applying herbicide by gloved hand directly to the plant leaf and stem surface. This application method is slow but covers the plants very effectively.

Each of the methods described above has been used for controlling undesirable and invasive species on site, but prescribed burns, which is discussed later, is the most effective manner of controlling species composition.

MAINTENANCE ALTERNATIVES

Prairie plants must have a lot of sunlight and plenty of nutrients in the soil to be healthy. However, the accumulation of dead plant material above the ground surface often limits the availability of both nutrients and sunlight. Thatch from previous growing seasons will remain suspended above the ground surface, where it is slow to deteriorate. Valuable nutrients are locked in the leaves and stalks and not available for other plants. The suspended mass blocks sunlight penetration to the soil, which limits the germination of last year's seed crop and the growth of current and new plants. To improve plant vigor, the thatch buildup needs to be removed and the decomposed plant material needs to be returned to the soil. Three maintenance methods are used to help improve the health of the prairie communities: mowing and baling, tilling, and prescribed burning.

Mowing and baling helps plant vigor by cutting and removing the plant material. It is conducted either in autumn after the seed fall or in spring before new growth buds. The sunlight warms the soil and is instrumental in the germination of seed and the budding of new grass and forb stems. Plant material that is not picked up in the baling operation will fall to the soil surface, where it is broken down and where the nutrients can be returned to the soil.

Tilling disturbs the soil and pushes plant material into it. The plant material breaks down—due to its contact with the moist soil. The seed in the soil is exposed to sunlight to allow new plants to germinate, and undisturbed roots can send up new stems and leaves. This method is used on a limited basis. Tilling is also used in conjunction with placing amendments in the soil to increase organic matter and nutrients. In some cases, the newly amended soil is over-seeded, which resulted in quick coverage for the area.

USE OF PRESCRIBED BURNS

Prescribed burns have proven to be an effective management tool for promoting healthy prairie grasses and forbs. Warm-season grasses and forbs are well adapted to periodic fire. Burn managers use these adaptations to maximize the effectiveness of prescribed burns. Most prairie species are deep-rooted. They have an extensive root system that is developed before the stem and leaf clump form above the surface. The root system allows them to be burned, eliminating the above-surface plant clump, without harming the viability of the plant. After a burn, when prairie plants grow back from the roots, they are vibrant. The burns convert the plant material to ash, reducing the accumulation of thatch. The ash breaks down quickly, since it is in contact with the soil, and the nutrients in the ash become available in the soil. The blackened ash-

covered ground absorbs more heat from sunlight and warms the soil. As a result, the soil reaches a temperature conducive to germination and native plant growth earlier in the spring. The growing season for the grasses and forbs is increased, and the sunlight on the soil surface promotes the growth of new plants and increases the productivity of existing plants.

Prescribed burns not only promote the growth of native prairie grasses and forbs and improve plant health, but they also control competition from undesirable and invasive species. Many weed species and invasive plants bud or begin to grow sooner in the spring, and will remain green later into the fall burn seasons, than desirable prairie plants. When prescribed burns have been conducted during this time, the weeds and invasive plants are susceptible to scalding, and any seed held in the thatch is burned. Other undesirable plants have a shallow root system and cannot survive a fire the way most prairie species can. Undesirable woody stems within the burn are scorched and blistered from the intense heat; which kills them. If woody plants have a shallow root system, the roots are killed as well. Woody plants with deep-root systems have been known to sprout back from the roots, but continued burns eventually prevent this.

Prescribed burns are a cost-effective method for maintaining prairies, but they were the least used method under the Office of Legacy Management. After the 2001 fire season losses on DOE sites, the Secretary of Energy declared a moratorium on prescribed burns. The Secretary wanted burns conducted on DOE sites to be better controlled. Sites needed to demonstrate that the risks associated with a burn, and a fire's effects on all aspects of the urban/wildland interface, had been addressed before the moratorium could be lifted and a prescribed burn conducted. For sites to conduct prescribed burns, they would have to develop a wildland fire management plan.

Prescribed fire is an intricate component of the fire management plan for both the Weldon Spring and Fernald Preserve sites. The process required to conduct burns varied greatly at the two sites, depending on State regulations and stakeholder sentiment.

The Weldon Spring Site chose to pursue prescribed burns for spring 2009. Under State regulations, the Missouri Department of Natural Resources (MDNR) allows open burning in natural resource or land management operations, so no State permits were required. Additionally, St. Charles County did not require a burn permit. Due to several years of communication with the public regarding land management techniques at the site, as well as the prescribed burns frequently performed on adjacent Missouri Department of Conservation (MDC) lands, stakeholders were expected to accept the process. A wildland fire management plan, which addressed site-specific issues, was composed, and a subcontractor was hired to prepare the individual burn plans and perform burning activities at the appropriate time. This subcontractor was very experienced in performing controlled burns on other prairie installations throughout the St. Louis metropolitan area—several of which are located on corporate campuses near highly sensitive urban areas. Additionally, the subcontractor had performed many land management activities at the site in the past and was aware of the safety regulations and other practices that would be required to accomplish these tasks on a DOE site.

In April 2009, several days of ideal weather allowed approximately 30 hectares (74 acres) of the Weldon Spring Site prairie to be burned. Prior to the burning, organizations such as the Cottleville Fire Department, Francis Howell High School, MDNR, MDC, and the Army

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Reserve were notified of the burn, either due to their being a neighboring landowner or, as in the case of the fire department and MDNR, as a courtesy and best management practice.

Significant benefits to burning were seen throughout the 2009 growing season at the Weldon Spring Site. Native plant species' diversity and density markedly improved. Fewer invasive species were noted in the burned areas. Overall plant vigor appeared to increase.

The Fernald Preserve had set the 2009 spring season as a target for conducting the first prescribed burns on the site. In 2007, the State of Ohio's requirements for conducting prescribed burns were investigated. The Ohio Revised Code (ORC) 1503.18, *Kindled Fires*, requires that a Request for Waiver of ORC 1503.18 be submitted to the Ohio Department of Natural Resources' Division of Forestry for any fires kindled during the spring and fall fire seasons—the primary burn times for prairies in Ohio. To issue a waiver, the Division of Forestry requires that the burn be conducted by a certified prescribed fire manager, so the Fernald Preserve pursued certification for site personnel. In 2007 and 2008, site personnel attended courses through the Ohio Fire Academy to achieve certification. The coursework included nationally recognized courses in firefighter training, wildland fire behavior, smoke management, and the National Incident Management System.

Before they will issue a waiver, the Division of Forestry also requires that each area to be burned has a prescribed burn plan. Each plan has to contain certain listed information. In the fall of 2008, burn plans began to be developed. Areas to be burned were established, and the risks were identified. Methods for achieving requirements were created. Three burns, totaling approximately 13 hectares (32 acres), were planned for spring 2009.

Other requirements for the open burning were found in the Ohio Administrative Code (OAC) Chapter 3745-19, *Open Burning Standards*. The standard requires that individuals conducting open burns must submit an Open Burn Request form to the Ohio Environmental Protection Agency. The request must include a smoke management plan that demonstrates the burner's ability to meet the requirements of OAC 3745-19. A smoke management plan became a necessary component of the prescribed burn plan.

A search of Office of Legacy Management requirements for getting permission to conduct a prescribed burn identified DOE requirements to develop a wildland fire management plan in compliance with DOE Order 450.1, *Environmental Protection Program*. The plan would identify the risks associated with fire on sites that have a wildland/urban interface, develop processes for responding to fire on site, and establish ways to mitigate the risks to the environment, facilities, or personnel. In December 2008, this plan started to be developed.

To have personnel who could safely conduct the burns, a training plan was developed for personnel who would be assisting with the burns. The training included information on fire safety, fire command, fire control, and personal protective equipment. To ensure that personnel were fit for duty, they were scheduled for physicals and needed a physician's approval to be included on the burn team.

The greatest hurdle for achieving approval for prescribed burns was public acceptance of the wildland fire management plan and burning on site. Some members of the public strenuously opposed burning. Stakeholders didn't want the perceived threat of contaminated smoke

billowing through their community. The Fernald Preserve went through a long process to convince the stakeholders that prescribed burns are safe.

A relationship was developed with the local county park district, which does prescribed burns in the area, by volunteering for park prescribed burns. The park burn manager's help was crucial to assuring local residents that the burn plans could be completed without loss of control. The local responding fire department was also utilized to persuade the public. The fire chief helped develop the wildland fire management plan and guaranteed that his fire department would support any fires or burns on site.

A risk assessment was conducted to evaluate contaminated materials' potential to become airborne in the smoke and affect residents' physical well-being. The study used contaminant levels in the soil on site and nationally recognized models on material uptake in smoke from fires. The assessment showed that the potential for off-site travel of contaminants was negligible. By burning only within the parameters set down in the smoke management plan, local residents would not have to worry about contaminant uptake.

State site regulators recognized the benefits of using fire as a prairie-management tool and approved prescribed burns at the Fernald Preserve. The OEPA became a strong supporter of the use of burns on site. Additionally, the agency's approval of the smoke management plans and the Open Burn Request helped ease stakeholders' concerns.

Personnel attended meetings of local citizens to talk to them about how prescribed burns would benefit the health and composition of prairies. Charts and graphs showed the suspected contaminant levels from fires, to assure citizens that the burns would not threaten their health. Burn managers, fire chiefs, and regulators helped answer citizens' questions and address their concerns. Some attendees were not fully convinced but were willing to wait and see the results. As part of the process, DOE agreed to collect air samples during prescribed burns and evaluate the results.

With the acceptance of stakeholders and the approval of the wildland fire management plan, individual burn plans were completed. Concurrently, the Request for Waiver of ORC 1503.18 and the Open Burn Request were approved. Personnel began to monitor weather conditions to identify when burns could be conducted in compliance with the burn and smoke plans. Wind direction and speed, temperature, relative humidity, fuel moisture, and convection currents had to be within parameters set in the prescribed burn plan. Fire breaks and safety zones were prepared around areas. Personnel were briefed on the plans and their responsibilities. The local fire department was present as a backup. The Fernald Preserve was ready to decide whether to burn an area. On two occasions, the burns were ignited. One of the burns was completed. The other was halted after only half of the area had been burned, due to a change in conditions. A third area considered was not burned because winds were not consistent with the plan. For the rest of the spring, the weather did not comply with the parameters set in the prescribed burn plan, so no other areas were burned. However, the prescribed burns completed were a success.

Approximately 2.2 hectares (5.5 acres) were burned. The areas burned clean; excess plant material was consumed, but the root duff was intact. The burns were not severe enough to damage prairie grass roots. Only a few small islands of unburned stems remained. Most undesirable species were killed. Some invasive plant species sprang up quickly but were easily

found in the blackened area and sprayed with herbicide. The areas greened up early with abundant native vegetation. The burns' objectives were accomplished. The areas that could not be burned were mowed and baled, but the results were not as complete as they would have been with a burn.

PLANS FOR 2010

After successfully completing one season of using prescribed burns as a tool for managing native grass prairies, the Weldon Spring and Fernald Preserve site are ready to increase the areas that will undergo prescribed burns.

At the Weldon Spring Site, the remaining 30.3 hectares (75 acres) that were not burned in 2009 will be targeted for a spring 2010 burn using a similar approach. Possible burns in the fall of 2010 are being considered for areas that could benefit from the stimulation of forb species. Actual burn areas will depend on specific weather conditions.

The Fernald Preserve is planning for 10 prescribed burns in the spring and fall of 2010. Approximately 29 hectares (71 acres) of prairie and savanna will be included in the proposed burns. Spring burns will be designed to improve stand health, promote the growth of native grasses and forbs, control invasive and undesirable species, and promote early germination in the spring. Fall burns will be scheduled to favor forb species over grasses, convert from cool-season to warm-season grasses and forbs, and promote early germination in the spring. The grass seed would still be on the stalk. The plans include prioritizing burn areas to ensure the best results for the burn season.

CONCLUSION

Prairie establishment is a key component of ecological restoration at the Weldon Spring Site and the Fernald Preserve. Much care is needed to ensure the successful establishment and management of seeded areas. A combination of maintenance options are in use at each site. However, the use of prescribed burns provides several ecological and practical benefits. Despite some initial stakeholder skepticism, prescribed burns were successfully conducted at both Weldon Spring and the Fernald Preserve in 2009, leading to the expanded use of burns in 2010 and beyond.