Endangered Species
Section 6 Grant
E-10-R-1

Delineation and Control of Invasive Feral Hog Threat to the Mead's Milkweed Population at St. Francois Mountains Natural Area

01 March 2008 – 28 February 2009

Missouri Department of Conservation

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Date Prepared:
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Region 3 Endangered Species Section 6 Project

Delineation and Control of Invasive Feral Hog Threat to the Mead's Milkweed Population at St. Francois Mountains Natural Area
E-10-R-1
WORK PLAN

Date Prepared: January 25, 2008

Segment Duration: 01 March 2008 – 28 February 2009

I. Planned Activities:

1) Construct and maintain protective solar-charged electric fences around the two largest subpopulations of Mead's milkweed at St. Francois Mountains Natural Area.

- Coordinate staff to assist with fencing installation in remote, rugged topography.
- Purchase equipment and supplies.
- Construct fencing.
- Monitor at least twice weekly the integrity of the fence throughout the project duration.
- Maintain and repair fence as needed during project duration.

2) Establish and maintain five feral hog bait and trap stations to reduce the feral hog population within the natural area to the maximum extent possible.

- Coordinate staff to assist with installation of stations in remote, rugged topography.
- Purchase equipment and supplies.
- Daily monitoring of hog traps.
- Kill and properly dispose of hogs.
- Record demographics of hogs killed (sex, weight and approximate age).
- Identify feral hog high concentration or use areas for strategic placement of traps by ground surveys of feral hog sign and activity.
- Blood will be sampled from every tenth adult trapped and killed hog and sent off for analysis of swine diseases.

3) Collect data on feral hog daily and seasonal movements and habitat utilization using radio/geographic positioning system (GPS) collars and telemetry to assist in feral hog population control.

- Coordinate staff to assist with training on using radio/GPS collars and telemetry.
- Purchase equipment and supplies.
- Trap feral hogs to utilize for radio/GPS collars.
- Anesthetize select trapped feral hogs; install radio/GPS collars on them; and release back onto the area.
- Track released radio-collared feral hogs to: a) obtain observations on habitat use and feeding behavior; and b) further facilitate the eradication of additional

animals. Assess hog locations and movements using GPS/geographic information system (GIS) mapping equipment.

4) Provide final report. Final report will include:

- An assessment of feral hog population densities, habitat impacts, and behavior within the natural area.
- Demographics of hogs killed as well as hogs observed on the area.
- A population estimate of hogs that used the area during the project duration.
- An assessment of potential impact of hog use on Mead's milkweed populations within the study area.
- An assessment of the presence or absence of swine diseases in the feral hog population on the natural area.

Work Schedule:

Tasks/Month	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**
Protective Fence Establishment	X	X										
Feral Hog Sign Survey	X	X	X	X	X	X	X	X	X			
Feral Hog Telemetry Tracking		X	X	X	X	X	X					
Trap Establishment	X											
Feral Hog Control	X	X	X	X	X	X	X	X	X			
Report Writing									X	X	X	X

Grant period is 01 March, 2008 to 28 February, 2009.

II. Estimated Costs

Estimated Costs	**Totals**
Salaries for 2 hourly employees (975 hours ea. @ $10.73/hr)	**$20,924**
Fringe (8.91%)	**$1,864**
Salaries Subtotal	**$22,788**
Expenses	**$7,000**
Base for Indirect Cost	**$29,788**
Indirect Cost (33.25%)	**$9,905**
Total Costs	**$39,693**
MDC share (50%)	**$19,846.50**
USFWS share (50%)	**$19,846.50**
FAIMS Activity Code – 3440 (ES Research – Habitat)	

GPS, collars, etc. fencing materials

PROJECT STATEMENT

Principal Investigator: Mike Leahy, Natural Areas Coordinator,
Wildlife Division, Missouri Department of Conservation,
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Project Duration: 01 March, 2008 – 28 February, 2009

I. INTRODUCTION

The integrity of the most viable Missouri population of the federally threatened species, Mead's milkweed, is threatened by a burgeoning invasive, feral hog population at St. Francois Mountains Natural Area. Protection of the Mead's milkweed and control and eradication of feral hogs is needed at this site. An integrated control effort needs to be undertaken at the site to abate this novel threat to Mead's milkweed recovery.

II. DEPARTMENT MANDATE, MISSION, ORGANIZATION

Department Mandate

The Missouri State Constitution, Sections 40-46 addresses the overall authority and responsibility of the Conservation Commission. Key language is found in Section 40(a):

Section 40(a). Conservation commission, members, qualifications, terms, how appointed-duties of commission-expenses of members.-*The control, management, restoration, conservation and regulation of the bird, fish, game, forestry and all wildlife resources of the state, including hatcheries, sanctuaries, refuges, reservations and all other property owned, acquired or used for such purposes and the acquisition and establishment thereof, and the administration of all laws pertaining thereto, shall be vested in a conservation commission...*

Department Mission

To protect and manage the fish, forest, and wildlife resources of the state; to serve the public and facilitate their participation in resource management activities; and to provide opportunity for all citizens to use, enjoy, and learn about fish, forest, and wildlife resources.

Department Organizational Structure

The Department is responsible for the conservation and management of all wildlife of the state, including species of conservation concern (SOCC) and plants and animals listed as endangered in the *Wildlife Code of Missouri*. The Constitution of Missouri gives the four-member Conservation Commission authority over "...the control, management, restoration, conservation and regulation of the bird, fish, game, forestry and all wildlife resources of the state...." The Commission, through its appointed Director, oversees the operation of the Missouri Department of Conservation. The Department is organized into nine major divisions (Fisheries, Forestry, Wildlife, Outreach & Education, Private Land

Services, Protection, Resource Science, Administrative Services & Human Resources, and Design and Development). Although the Wildlife Division will administer this Grant, the Forestry, Private Land Services, Protection, and Resource Science Divisions will contribute significantly to the implementation of programs and projects identified herein.

III. NEED

Mead's milkweed (*Asclepias meadii*) populations have declined with the conversion of native prairie and glade natural communities to agriculture and development. Due to this decline, Mead's milkweed is listed as federally threatened and state endangered in Missouri. The federal recovery priority for Mead's milkweed is 8 (regional rank of 19). There are approximately 56 sites in Missouri with extant populations, the majority found in the Osage Plains and St. Francois Mountains physiographic regions. Observation and monitoring over the past two decades have shown numbers, particularly of flowering stems, steadily declining on existing remnant populations within the prairie populations while remaining stable on the rhyolite glades associated with the St. Francois Mountains.

The most viable population of Mead's milkweed in Missouri (Horner 2007, McKenzie 2007) and one of only two large sexually reproducing populations for the specie range-wide occurs at St. Francois Mountains Natural Area in Iron and Reynolds Counties (Bowles et al. 1998, U.S. Fish & Wildlife Service 2003). St. Francois Mountains Natural Area is a 7,028 acre state-designated natural area owned and managed by the Missouri Department of Conservation, Forestry Division, and the Missouri Department of Natural Resources, Division of State Parks. Data (2000-2007) for this site indicate a population size of at least 118 sterile stems and 76 fertile stems.

Designated state natural areas are considered the highest and best use of Missouri conservation areas and parks. St. Francois Mountains Natural Area conserves Missouri's best, highest-quality example of an Ozark igneous glade and woodland landscape and also Taum Sauk Creek, an Outstanding State Resource Waters as designated by the Missouri Clean Water Commission. It occurs in very rough, nearly mountainous terrain and is one of the wildest landscapes owned by either agency. The natural area also contains six other species of conservation concern for Missouri.

Unfortunately, invasive, exotic hogs (feral hogs) have become established in the natural area due to illegal releases in the vicinity over the last decade. Feral hog sign is abundant in the drainages and lower slopes of the natural area. In the spring of 2007 feral hog damage was noted perilously close to the largest Mead's milkweed subpopulation on Proffit Mountain within the natural area. In December 2007 Conservation Department and State Park field staff noted continued abundant feral hog sign in the natural area and near (< ½ mile) the rhyolite glades supporting the Mead's milkweed population. Recently a dozen feral hogs were seen within a mile of the large Mead's milkweed subpopulation on Proffit Mountain. The feral hog population on the natural area could easily decimate the most viable Mead's milkweed site in Missouri due to rooting and grubbing activity.

One of the most critical Mead's milkweed populations for recovery of the species is imminently threatened by a burgeoning feral hog population. This threat must be abated to insure the viability of the St. Francois Mountains Natural Area population of Mead's milkweed.

IV. PROJECT OBJECTIVES

1) Construct and maintain protective solar-charged electric fences around the two largest subpopulations of Mead's milkweed at St. Francois Mountains Natural Area.
2) Establish and maintain five feral hog bait and trap stations to reduce the feral hog population within the natural area to the maximum extent possible, preferably 70% (Mayer 2007, Martensen 2008).
3) Collect data on feral hog daily and seasonal movements and habitat utilization using radio/GPS collars and telemetry to assist in feral hog population control.

Priority 1 Task

- Construct protective electric fences around the two largest subpopulations of Mead's milkweed at St. Francois Mountains Natural Area (Proffit Mountain and Weimer Hill sites).
- Determine the best locations for feral hog bait and trap stations utilizing field surveys.
- Establish at least five feral hog bait and trap stations within/adjacent to St. Francois Mountains Natural Area.

Priority 2 Task

- Maintain protective electric fences through the growing season.
- Maintain feral hog traps, moving them as needed, and properly killing and disposing of feral hogs.

Priority 3 Task

- Utilizing trapped feral hogs, attach radio/GPS collars to trapped hogs and release to learn more about feral hog behavior in this landscape and to locate feral hog high concentration or use areas for strategic placement of traps and hunting efforts.

V. EXPECTED RESULTS AND BENEFITS

The objectives outlined in this project will benefit Mead's milkweed by eliminating a serious threat to the viability of the best population of the species currently known in Missouri. By monitoring, tracking and eliminating the feral hog threat to Mead's milkweed on St. Francis Mountains Natural Area, the project will ensure the continued ability of this site to be a highly viable site (U.S. Fish & Wildlife Service 2003) for meeting Mead's milkweed recovery criteria. Additionally the site will hopefully continue to provide genetically diverse seeds for further Mead's milkweed restoration projects.

VI. APPROACH

This will be a 12 month project, undertaken during the growing season of this year to protect Missouri's best known Mead's milkweed population from an imminent threat of feral hogs. Protection of this population of Mead's milkweed will include 1) a stopgap measure of establishing protective electric fencing around the two largest Mead's

milkweed subpopulations on the St. Francois Mountains Natural Area; 2) feral hog eradication via baiting and trapping; and 3) feral hog eradication utilizing radio/GPS collar and telemetry technology. In order to focus the necessary attention on activities outlined in this proposal, it will be necessary to hire two temporary staff members to undertake these efforts. The work can not be done with existing MDC staff due to time constraints and staff reductions.

Two temporary staff Wildlife Management Assistants will work as a crew to complete the work items described above and detailed below. The Wildlife Management Assistants will be housed in the MDC Piedmont Office and supervised by David Hasenbeck, MDC Private Lands Services Division. MDC will provide housing to the Wildlife Management Assistants if needed at MDC housing in Ellington, Missouri. This will be a multi-divisional project with overall project oversight conducted by Mike Leahy, Natural Areas Coordinator, Wildlife Division.

Electric Fencing
Two electric fence arrays will be constructed around the two largest subpopulations of Mead's milkweed (see maps in Part VII). Electric fencing to inhibit feral hog movements has been successfully demonstrated by the U.S. Department of Agriculture - Animal and Plant Health Inspection Service (USDA-APHIS) – Wildlife Services. The National Wildlife Research Center (2006) utilized two strands of electric fencing at 8 and 18 inches in both captive and field settings with wild-caught feral hogs. In the field trial this fencing reduced movement of adult feral hogs by 88% and all feral hogs, including piglets, by 64%. Voltages for both trials averaged 7,000 volts and were maintained by either solar or battery chargers. See http://www.aphis.usda.gov/ws/nwrc/ for details. Electric fencing will be installed as per the USDA-APHIS recommendations. The Georgia Department of Natural Resources – Wildlife Resources Division also reports that electric fencing can be used to prevent feral hog movements (Kammermeyer 2003). We will install two arrays of electric fencing, one around the Proffit Mountain subpopulation (approximately 3,400 linear feet, six acres) and the other around the Weimer Hill subpopulation (approximately 600 linear feet, ½ acre). Fencing will be installed in April and will be checked at least twice weekly for integrity and any needed repairs. Power will be supplied by solar chargers. Fencing materials will be delivered by MDC off-road vehicles to near the installation site.

Feral Hog Sign Inventory
We will check for feral hog tracks, scats and rubs (following Hartin 2006) along the major riparian areas of the natural area (see maps in Part VII) and the glades supporting Mead's milkweed on a weekly basis to locate and document feral hog use to aid in trapping efforts. Transects will be walked and feral hog sign noted. Locations of fresh feral hog sign will be documented in writing and mapped utilizing a GPS unit and aerial and topographic maps. Visual sightings of hogs will also be geo-referenced and reported.

Live-Trapping

Live-trapping is an effective method of control of feral hogs (Kammermeyer 2003, Wilcox et al. 2004, Hartin 2006). Five live-traps will be utilized on the natural area and surrounding lands owned by cooperating landowners (AmerenUE and Terry Jones, see maps in Part VII). Traps will be constructed utilizing the methods, materials and specifications outlined in Hartin (2006). Both Corral Type and Cage Type traps will be used to maximize effectiveness. Trap plans are available in Hartin (2006) and have been field tested by MDC and USDA-APHIS Wildlife Services personnel. Pre-baiting of traps is essential (Kammermeyer 2003). Corn or fermented corn are effective baits and will be used. Traps will be strategically placed in sites with active hog sign. Because hogs have a keen sense of smell, traps should be set upwind of known hog activity areas. Once the hogs are feeding regularly at the pre-baited sites, live-capture traps will be placed over the bait. Traps will be monitored daily by field visits and noted from a distance (if bait is still present) so as not to disturb or disrupt hog use of the pre-baited traps. Two traps will be equipped with remote cameras to better document time and numbers of hogs using the pre-baited traps. Once hogs are consistently using a pre-baited trap, the trap will be set. The traps utilized for the project are designed such that multiple pigs can be captured. Field staff may want to keep a live hog in the trap for a few days to act as a decoy. This hog will be fed and provided with water. Traps will be located in shady places to avoid heat stress to trapped hogs. Trap materials will be delivered by MDC off-road vehicles to near installation sites.

Killing and Disposal of Live-Trapped Hogs

Live-trapped pigs will be killed as humanely and efficiently as possible with rifle or pistol shots to the head. Firearms use will be restricted to safe shots only and will be done onsite at remote locations with effective firing backdrops provided by the terrain. Firearms use will be guided by safe hunting practices as outlined in MDC's Hunter Education Program. Dead hogs will be disposed of as per Missouri Department of Agriculture regulations (Missouri Revised Statutes Section 269.020). Dead hogs will be buried as per these regulations. Handling of dead hogs will require wearing elbow-length nitrile gloves, long sleeves, pants and leather boots. Contaminated clothing will be washed with a 10% bleach and water solution. Dead hogs will be weighed with a sling-scale, sexed and age estimated based on tooth wear and eruption patterns (Matschke 1967) prior to disposal. Every tenth adult killed hog will have a blood sample taken using USDA – APHIS blood collection kits which contain necessary supplies to collect, preserve and ship blood samples to the Missouri Department of Agriculture Diagnostic Lab in Jefferson City. Serological samples will be analyzed for Pseudorabies virus and swine brucellosis.

Telemetry Techniques and the "Judas Pig" Technique

Staff will initially hone their skills at radio telemetry using radio collars-only in the study site terrain. After staff show skill in quickly relocating radio collars then a live-trapped pig will be fitted with one. Installing radio collars and tracking feral hogs with radio telemetry has been successfully utilized (Wilcox et al. 2004, Wyckoff et al. 2005). Selected female adults (sows) will be utilized for radio collaring. Sows form the nucleus of feral hog social structure (Hartin 2006). Trained MDC staff and or USDA-APHIS

staff will assist with anesthetizing the selected sows. The pig will be lassoed and anesthetized with a single-dart injection of Telazol and xylazine hydrochloride combination (Sweitzer at al. 1997). Initially a brightly colored radio collar will be fitted to a sow's neck and the sow released. Staff will track the movements of this pig for several days to learn about feral hog behavior and habitat utilization and to gain skill in radio telemetry tracking. The radio collar will be a VHF wildlife radio collar and tracked using standard radio telemetry techniques (Millspaugh and Marzluff 2001). If telemetry tracking becomes difficult, a day or two of MDC aircraft time (fixed wing or helicopter) may be utilized to get better location data. Staff will need to drive and walk to highpoints in the rugged terrain of the study site to receive good telemetry data.

Once field staff demonstrate competency in radio telemetry tracking, firearms trained MDC staff (e.g., conservation agents) will accompany them in hunting down a collared pig and associated pigs. This technique, known as the "Judas pig" technique, involves using a radio collared pig to locate: 1) groups of pigs for killing by shooting (hunting) and 2) prime live-trap locations. The Judas pig technique has been successfully used as part of a feral hog eradication program in other places (McIlroy and Gifford 1997, Wilcox et al. 2004). As an adjunct tool partnered with trapping, normal hunting, and hunting dogs this can be an effective technique, particularly in locating the last few animals of a population. It is assumed (and hoped) that radio collars will be retrieved from pigs either trapped or hunted. Hunting of Judas pigs may also utilize a pack of trained hog hunting dogs and an MDC contracted hog hunter.

At least three sows will be radio collared during the project and their daily and seasonal movements tracked and mapped on topographic maps. One radio collar will be a radio/GPS collar. Retrieval of this collar will allow for detailed GIS maps to be constructed of feral hog home range and habitat utilization. Using radio telemetry data and GPS data, a model of feral hog life-history in rugged Ozark terrain will be developed, including home ranges.

Daily work schedule for staff (daily time budget)
Once the fencing and traps are established; staff are trained in radio telemetry, and a pig is radio collared, the staff will follow a regular routine. Each day staff will check the traps in the first part of the morning. Trapped pigs will be killed, measured and disposed of as needed. Staff will inventory for feral hog use along riparian corridors and around the Mead's milkweed populations. The electric fencing will be checked and repaired as needed. Radio collared pigs will be checked for their location. Staff will work with other MDC staff and the contract dog handler/hog hunter 3-5 days a month to hunt groups of pigs.

Deliverables
A report will document the behavior and demographics of the feral hog population at St. Francois Mountains Natural Area. Mead's milkweed subpopulations will be protected

during the growing season of 2008. The feral hog population on the natural area will be reduced substantially, aiming for >70% eradication.

VII. LOCATION AND KEY PERSONNEL:
The project will occur on the St. Francis Mountains Natural Area (Iron and Reynolds Counties) jointly managed by the Missouri Department of Conservation, Forestry Division and the Missouri Department of Natural Resources, State Parks Division. Lands comprising the natural area include Taum Sauk Mountain State Park, Johnson's Shut-Ins State Park and Ketcherside Mountain Conservation Area.

This work will be in cooperation and partnership between the Missouri Department of Conservation and the Missouri Department of Natural Resources (MoDNR). Coordination will occur between MDC, MoDNR, the U.S. Fish & Wildlife Service, USDA – APHIS, and cooperative private landowners (notably the AmerenUE utility company that has significant landownership adjacent to St. Francois Mountains Natural Area).

Key Personnel:

- Mike Leahy, MDC Wildlife Division, Natural Areas Coordinator
- Rex Martensen, MDC Private Land Services Division, Private Lands Field Programs Supervisor
- Matt Jones, MDC Forestry Division, Resource Forester
- David Hasenbeck, MDC Private Land Services Division, Private Land Conservationist
- Mike Currier, DNR State Parks Division
- Tim Turpin, DNR State Parks Division
- Kim Burfield, DNR State Parks Division, Johnson's Shut-Ins SP Superintendent

Key Partnerships:
- Cooperative agreement with MoDNR
- Access agreement with AmerenUE

Figures

Figure 1: Locator Map and Mead's Subpopulations
Figure 2: Fencing Locations
Figure 3: Hog Trapping Zones

IX. COSTS

Estimated Costs	Totals
Salaries for 2 hourly employees (975 hours ea. @ $10.73/hr)	**$20,924**
Fringe (8.91%)	**$1,864**
Salaries Subtotal	**$22,788**
Expenses	**$7,000**
Base for Indirect Cost	**$29,788**
Indirect Cost (33.25%)	**$9,905**
Total Costs	**$39,693**
MDC share (50%)	**$19,846.50**
FWS share (50%)	**$19,846.50**
FAIMS Activity Code – 3440 (ES Research – Habitat)	

X. LITERATURE CITED

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