

# Natural Resource Restoration in Southeast Missouri Lead Mining District: Feral Hog Removal for Ecological Restoration within Iron, Reynolds, Washington, and St Francois Counties Draft Restoration Plan

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**MISSOURI**  
DEPARTMENT OF  
NATURAL RESOURCES

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# 1. Introduction

The U.S. Fish and Wildlife Service, the U.S. Forest Service, and the Missouri Department of Natural Resources, (the Trustees) have prepared a Draft Restoration Plan and Environmental Assessment (RP/EA) to address ecological impacts to natural resources in the Viburnum Trend Mining District (Trend) of southeast Missouri. The RP/EA identifies proposed projects that will restore natural resources injured and ecological services lost due to releases of hazardous substances, including heavy metals from mines, mills, smelters, and tailings impoundments in this area. Specifically, this RP/EA addresses the control of nuisance feral hog populations in the Trend area. Feral hogs are destructive invaders who destroy sensitive plant and animal communities, out-compete native wildlife for food resources, and depredate nests of ground nesting birds. The agencies, in their roles as Natural Resource Trustees (Trustees) are soliciting public input on the restoration projects proposed within this restoration plan. The public comment period for the RP/EA will be open for 30 days from publication. Descriptions of the three alternatives proposed to remove feral hogs under this RP/EA begins on page 8.

For decades, heavy metals, including but not limited to lead, zinc, copper, and silver, were mined, milled, and smelted in the Trend. Currently, five active mines and four associated milling and tailings disposal operations remain. Primary lead smelting no longer occurs in the Trend, however, the Buick Resource Recovery Facility continues to conduct secondary smelting operations. Releases of hazardous substances into nearby soils, sediments, and surrounding waters, including tributaries within the Black, Meramec, and St. Francis River watersheds, have led to natural resource injuries. A number of natural resources, including surface water, sediments, fish, and migratory birds, have been exposed to and adversely affected by hazardous substances released from the mining associated facilities in the Trend.

Currently, the response actions proposed and implemented by the U.S. Environmental Protection Agency (EPA) and the United States Forest Service (USFS) have focused on the reduction of threats to human health including the removal and disposal of contaminated yard soils by the EPA. These response actions are not intended to address ecological risks or to compensate the public for the ecological services lost in the interim under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As a result, the Trustees undertook restoration planning activities described in this Draft RP /EA.

The Trustees developed this Draft RP /EA in accordance with CERCLA and its implementing regulations at 43 C.F.R. § 11.93, in addition to the National Environmental Policy Act (NEPA, 42 U.S.C. § 4321, *et seq.*) to inform the public as to the types and scale of restoration to be undertaken towards compensating for injuries to natural resources. The Trustees will address public comments within the finalized RP /EA and will identify the selected Preferred Restoration Alternative(s).

## **A. Relationship to the Southeast Missouri Regional Restoration Plan**

In 2014, the Trustees finalized the Southeast Missouri Ozarks Regional Restoration Plan (SEMORRP), which provides a process framework governing the approach for restoration project identification, evaluation, selection, and implementation. In the SEMORRP, the Trustees selected Alternative D as the Preferred Alternative (see Section 3.5, pages 23 and 24 of SEMORRP for a description), where the Trustees will consider a combination of restoration actions and projects to accomplish restoration goals at or near the site(s) of injury.

The purpose of this Draft RP/EA, in accordance with the analysis contained in the SEMORRP, is to address injured natural resources and services lost due to release of hazardous substances, including heavy metals. The need for this Draft RP/EA is to describe the restoration actions or projects that have been proposed by the Trustees to address the release of hazardous substances associated with mining activities in the Trend. Specifically, the goal of this Draft RP/EA is to improve or protect water quality, the quality of terrestrial and riparian habitats, and the species and communities dependent on those habitats in the headwaters of Big River and Black River Basin watersheds. This Draft RP /EA identifies the Trustees' proposed actions to reduce or prevent wildlife damages and protect natural resources, including terrestrial and aquatic resources and the services those resources provide, to replace those that have been injured from releases of hazardous substances. This Draft RP/EA includes references to and incorporates portions of the SEMORRP for expediency and efficiency, as appropriate. Specific sections of the SEMORRP are identified, including a summary of the incorporated material. The proposed activities associated with this Draft RP/EA are in alignment with the goals of the SEMORRP, and compliant with the Preferred Alternative selected in the SEMORRP.

## **B. Natural Resource Trustee Authority**

Under federal law, the Trustees are authorized to act on behalf of the public to assess injuries to natural resources and services resulting from the release of hazardous substances into the environment. The Natural Resource Damage Assessment and Restoration (NRDAR) process allows Trustees to pursue claims against responsible parties for monetary damages based on these injuries in order to compensate the public. Pursuant to CERCLA, the goal of this process is to plan and implement actions to restore, replace, acquire, or rehabilitate the natural resources that were injured or lost as a result of the release of a hazardous substance, or to acquire the equivalent resources or their services (42 U.S.C. § 9601, *et seq.*; 43 C.F.R. Part 11). The Trustees for the Viburnum Trend NRDAR are the State of Missouri, represented by the Missouri Department of Natural Resources (MoDNR), the U.S. Department of Agriculture, represented by the USFS, and Department of the Interior, represented by the U.S. Fish and Wildlife Service (USFWS). See also the National Contingency Plan 40 C.F.R. §§ 300.600 *et seq.*

## **C. Summary of NRDAR Settlement**

The natural resource Trustees recovered monetary damages from Cyprus Amax in 2014 to settle certain legal claims concerning injuries to natural resources and their services associated with releases of hazardous substances from the Buick Mine, Mill, and Smelter. Similarly, the natural resource Trustees recovered monetary damages from Teck American Inc. in 2013 to settle certain legal claims concerning injuries to natural resources and their services associated with releases of hazardous substances from the Magmont Mine and Mill Site. Restoration funds have been expended to restore injured natural resources from the associated settlement funds. Currently there is approximately \$5.5 million in funds between these two settlements. The Trustees propose to fund the restoration projects described in this Draft RP/EA from these settlement funds.

#### **D. Public Participation**

Public participation and review is an integral part of the restoration planning process, and is specifically required in the CERCLA NRDAR regulations (*e.g.*, 43 C.F.R. §11.81(d) (2)). This Draft RP/EA will be open for public comment for 30 days from the date of publication on the Mark Twain National Forest website at <https://www.fs.usda.gov/mtnf>. The Trustees will address public comments and will document responses to those comments as part of the Final RP/EA. After consideration of public comments, the Trustees will implement the selected alternatives described herein. Interested individuals, organizations, and agencies may submit comments by writing or emailing:

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As restoration progresses, the Trustees may amend the Final RP/EA if significant changes are made to the types, scope, or impact of the projects. In the event of a significant modification to the Final RP/EA, the Trustees will provide the public with an opportunity to comment, as appropriate.

## **2. Affected Environment and Summary of Injury to Natural Resources**

Mining in the Trend is ongoing, and the district remains a major producer of metals. Missouri's mines have yielded much of the United States' national production of lead (*e.g.*, USGS 2018), and since 1997, all metals currently produced in Missouri originated in The Doe Run Company's Viburnum Trend mines (MoDNR 2004). In addition to lead, the mines produce substantial amounts of zinc and lesser quantities of copper and silver.

The Trustees completed a Damage Assessment Plan for the Southeast Missouri Lead Mining District (SEMOLMD) in 2009, summarizing existing information on natural resource injuries and describing proposed studies to evaluate past, current, and future impacts to natural resources and the services they provide. In addition, the Damage

Assessment Plan outlined how information gathered from the studies would be used to determine the types and scale of restoration needed to address these injuries. Since 2009, the Trustees have conducted a series of site-specific studies assessing the exposure of natural resources, such as songbirds, sediments, plant communities, and mammals, to hazardous substances and potential effects resulting from that exposure. These studies indicate that releases of heavy metals may have caused injuries to geologic resources (sediment and soil), aquatic resources (crayfish, macro invertebrates, and benthic fish), and terrestrial resources and services (songbirds and floristic quality).

Please see Section 2.2 of the SEMORRP for further information related to the history of lead mining and natural resource injury in the SEMOLMD. For more information on Trustee initiated Natural Resource Damage Assessments and other studies that have demonstrated injury to natural resources, please see our websites at:

[Missouri Department of Natural Resources Natural Resource Damage Assessment and Restoration Website](#)

or

[U.S. Fish and Wildlife Service Natural Resource Damage Assessment and Restoration Website](#)

or

[U.S. Forest Service Land Management Projects Website](#)

This Draft RP/EA proposes to protect natural resources substantially similar to those injured, including terrestrial resources (floristic quality and vegetative communities that provides habitat supportive of migratory birds and other terrestrial fauna) and aquatic resources (stream, riparian, and wetland habitats that support aquatic fauna) and are protective of water quality through a cost share with U.S. Department of Agriculture (USDA) Animal, Plant, and Health Inspection Service (APHIS) Wildlife Services for feral hog removal within Washington, Iron, Reynolds, and St. Francois counties. Within this proposed restoration area, releases of hazardous substances from multiple mining operations impacted aquatic and terrestrial trust resources. This Draft RP/EA seeks to protect and maintain critical habitats similar and adjacent to those injured areas, through the reduction of feral hog populations in the project area (Figure 1). If the proposed alternative in this Draft RP/EA is selected for implementation, the resulting reduction in feral hog populations would benefit ongoing and planned restoration work in the Trend. This includes a multiagency effort to protect and recover habitat critical to the threatened Mead's milkweed (*Asclepias meadii*) and will restore and preserve habitat for the endangered Hine's emerald dragonfly (*Somatochlora hineana*).

The proposed alternative within this Draft RP/EA, as depicted in Figure 1, covers a portion of Mark Twain National Forest's (MTNF) Salem Ranger District, Potosi-Fredericktown Ranger District, Johnson's Shut-ins and Taum Sauk Mountain State Parks, and private landowners in the delineated area who elect to participate. Figure 1 represents the Trustees' priority restoration area for this Draft RP/EA, which conforms with areas identified in Alternative D of the SEMORRP.

Summary information about Southeast Missouri Ozarks' physical, biological, and socioeconomic resources are contained in Section 4 of the SEMORRP. Summary information about the Southeast Missouri Ozarks, including physical resources (geology, topography, soil, surface water, and groundwater), aquatic habitat, and biological resources, including sensitive species, is contained in Appendix D of the SEMORRP (see pages 14 – 17, 22, 25, 26, 27, and 32). These sections of the SEMORRP are incorporated by reference herein.

The Trend is part of the Ozark Highlands, specifically, the St. Francois Knobs and Basin and the Current River Hills. The area is characterized by rolling plains and steep hills of dolomite, sandstone, and limestone. There are abundant springs, seeps, and caves within the karst topography. The project area crosses the Big, Upper Black and Upper St. Francois watersheds. Dominant vegetation includes oak-hickory and pine-oak woodlands, oak savannahs, prairies, glades, and bottomland forests. These vegetative communities have been reduced from their historical levels. They also support unique plant and animal communities. Within the proposed project area are species of both state and federal concern, including the Hine's emerald dragonfly, Mead's milkweed, and multiple bat species, including gray bat (*Myotis grisescens*), Indiana bat (*M. sodalis*), and Northern long-eared bats (*M. septentrionalis*). The Hine's emerald dragonfly lives exclusively in fens and Mead's milkweed is found predominantly in glades. Both species are sensitive to disturbance and changes in landscape. Bats require intact forest and riparian habitats for foraging and roosting opportunities.

The feral hog (*Sus scrofa*) population epicenter in Missouri is located within Washington, Reynolds, and Iron counties. Landscape conditions in the Trend are ideal for feral hog population growth, with large tracts of remote terrain and unlimited access to water. Population groups or sounders are typically small, isolated, and found in remote and rugged terrain. Feral hogs require abundant water and spend much time near seeps, ponds, and in streams and riparian habitats. They have a keen sense of smell and are opportunistic feeders, foraging heavily on acorns. Their foraging can cause extensive and permanent damage to sensitive plant communities.

Direct impacts to fen and glade habitats due to feral hogs have been seen in the MTNF (Figure 3, 4, 5 & 7). Designated critical habitat for Hine's emerald dragonfly in the Neal's Creek watershed was disturbed by feral hogs in 2004. Since that time, efforts have been made to exclude hogs from portions of the critical fen habitat (Figure 2). However, hog damage adjacent to excluded fens and in other areas of the MTNF continue to be observed (Figures 3 and 4).

Glade habitat supportive of Mead's milkweed is actively being destroyed by feral hog rooting and foraging. The only known occurrence of Mead's milkweed in Bell Mountain Wilderness was decimated by feral hogs and populations at Taum Sauk Mountain State Park have been severely impacted (Figures 5 & 6). Mead's milkweed Surveys conducted by the Missouri Department of Natural Resources (MoDNR) feral hog rooting disturbances of 15-40% were documented at three sites (Colaskie 2018, Colaskie 2019).



Feral hogs are opportunistic omnivores and will consume salamanders, frogs, fish, crabs, snakes, turtles, rodents, muskrats, eggs and chicks of ground nesting birds, and white-tailed deer fawns (Hellgren 1993). A study of northern bobwhite quail (*Colinus virginianus*) simulated nest predation in Texas, showed that feral hogs accounted for 23.5% loss of simulated nests (Timmons et al. 2011). Similarly, Sanders et al. (2020), found that feral hogs depredated 29% of simulated Turkey nests. While there have been no direct studies on impacts to ground nesting migratory birds such as the state listed Bachman's sparrow (*Peucaea aestivalis*), impacts could be expected in areas where nesting habitat occurs within a feral hog sounder home range.

Female hogs become reproductively mature by 4-5 months of age and can have litters of one to twelve piglets (averaging six piglets) every 4 to 6 months, essentially doubling a population every 4 months. At this rate, approximately 66% of the population will need to be removed annually on a long-term basis (i.e., five years or more) to reach a stable population. (Timmons et al. 2012).

By executive order in 2007, Governor Blunt of Missouri created the Feral Swine Task Force. This statewide task force combines the efforts of state, federal, private, public, and industry landowners and stakeholders in an effort to eliminate feral hog populations in Missouri. This task force has now become the Missouri Feral Swine Elimination Partnership (since 2017) that includes federal and state agencies whose collective goal is the elimination of feral hogs from the state of Missouri. The combined effort shares financial, material, educational, and intellectual resources and is working diligently across the state to strategically eliminate the feral hog population and protect native flora and fauna. As a part of this partnership USDA APHIS has developed a removal strategy that was implemented in 2016. From this time until 2021 the agency has eliminated hogs in nearly one half of the identified drainages with hog impacts. In 2016 hogs were known to be present in 459 drainages comprising 11,239,778 acres. In mid-2021 that was reduced to 219 drainages and 5,351,368 acres. Overall reduction of hog populations in 240 drainages total 5,890,315 acres statewide.

### **3. Proposed Restoration Alternatives**

To compensate the public for injuries to natural resources resulting from releases of heavy metals from facilities in the Trend, the Trustees are required to develop alternatives for the "restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the natural resources and the services those resources provide" (42 C.F.R. §11.82 (a)). The Trustees developed the SEMORRP and identified broad categories of restoration types. As described in Alternative D of the SEMORRP, the Trustees presented a suite of restoration project types that would be considered for implementation, including upland, riparian corridor and aquatic restoration or enhancement. Except for Alternative A, the No Action Alternative, all restoration alternatives proposed by the Trustees in this Draft RP /EA are consistent with the preferred alternative in the SEMORRP and fall into categories of upland and wetland enhancement or surface water quality and aquatic resource improvement.

## **A. Restoration Evaluation Criteria**

To ensure the appropriateness and acceptability of restoration options addressing ecological losses, the Trustees evaluated each option against restoration evaluation criteria.

The criteria used to evaluate the potential restoration projects are described in the CERCLA NRDAR Regulations, 43 C.F.R. § 11.82(d)(1-10). The Trustees have considered the following additional factors as part of their evaluation of the Preferred Alternatives in this Draft RP/EA:

- i. Relationship to the Injured Resource and Services
- ii. Consistency with the Trustees Restoration Goals
- iii. Time to Provide Benefits
- iv. Duration of Benefits

## **B. Alternative 1-No Action Alternative (No targeted Feral Hog removal)**

Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for interim lost natural resource services. This alternative would include the continuance of ongoing hog removal and monitoring efforts currently being conducted by MDC, Forest Service, and USDA APHIS but would not include increased targeted removal efforts of feral hog populations in the project area. Under this alternative, no compensation would be provided for interim losses in resource services.

Feral hogs are destructive invaders who destroy sensitive plant and animal communities, out-compete native wildlife for food resources, and depredate nests of ground nesting birds. Their feeding behavior consists of rooting for food items on the ground causing extensive damage to natural habitats. Their tendency to root and wallow in wet areas can impact water quality, destroy riparian habitats, and impair tree regeneration. Under this alternative, the existing feral hog population would continue to grow, and sensitive habitats would continue to be negatively impacted.

- Under the No Action Alternative, no habitats would be restored, or enhanced beyond what agencies and organizations are already doing in the area with limited existing resources. Crucial fen, glade, and riparian habitats would continue to be degraded and water and sediment quality would continue to be impaired. Native fauna, including migratory bird eggs and young would continue to be adversely impacted by depredation, as well as degradation of resting, foraging, and nesting habitat. This alternative does not satisfy the criteria in the CERCLA NRDAR Regulations.

## **C. Alternative 2- Removal of Feral Hogs -3 Years Funded through NRDAR and 2 Years Funded through Alternative Sources (Preferred)**

### **i. Project Description**

This alternative focuses on the protection of streams, glades, riparian forest, wilderness, and critical habitat within the MTNF in Southeast Missouri (Figure 1). It intends to protect those resources, the services they provide, and to replace natural resources injured from releases of hazardous substances. The primary goal of the project is to ensure long lasting protection for existing high-quality habitats substantially similar to those injured by releases of hazardous substances through the reduction of feral hog populations in priority watersheds, as identified in the SEMORRP, on MoDNR State Parks, Mark Twain National Forest and willing landowner property in the Trend. Through the reduction or elimination of feral hog populations, we hope to protect the resources listed above and alleviate the impacts on threatened, endangered and sensitive species. The management and long-term stewardship goals and objectives for the project include but are not limited to:

- Completely eliminate or significantly reduce hog numbers within the delineated watershed areas covered under this Draft RP /EA. These watersheds include public (MoDNR State Parks and Mark Twain National Forest) and outlined private lands with willing landowners;
- Protect existing private, State, and Federal lands within the project area from further feral hog damage, including sensitive watersheds and important aquatic features;
- Safeguard native plant habitats that are being impacted by feral hogs; and,
- Protect the habitat of migratory birds and threatened and endangered species.

### **ii. Project Partners**

In 2017, eleven federal and state agencies created a Memorandum of Understanding to eliminate feral hogs from Missouri.

<b>Agency</b>	<b>Moniker</b>
Animal and Plant Health Inspection Service, Wildlife Services	APHIS-WS
Animal and Plant Health Inspection Service, Veterinary Services	APHIS-VS
Forest Service, Mark Twain National Forest	MTNF
Fish and Wildlife Service	USFWS
National Park Service, Ozark National Scenic Riverways	ONSR
Army Corps of Engineers	USACE
Fort Leonard Wood	FLW
Department of Natural Resources	MoDNR
Department of Conservation	MDC
Department of Agriculture	MDA
Department of Health and Senior Services	DHSS

### **iii. Project Benefits**

This project provides conservation and restoration opportunities directly

related to the injuries from which the proposed restoration project funds are derived. Specific benefits provided by these projects include:

- Improve habitat and ecosystem processes at a landscape scale in areas with natural resources substantially similar to those injured by releases of hazardous substances;
- Increase floristic quality and site conditions (both terrestrial and aquatic) in areas degraded or destroyed by the presence of feral hogs;
- Reduce destruction of migratory birds and their habitats;
- Reduce degradation to aquatic and riparian ecosystems;
- Complements existing conservation agriculture and restoration practices within the watersheds and protects existing blocks of high-quality Ozark habitat, which are important to trust resources including migratory birds and bats, from further degradation due to feral hog activity;
- Improve habitat for federally threatened and endangered species. The project area contains both the Hine's emerald dragonfly and Mead's milkweed populations and both are threatened by feral hogs.

In addition to these projected benefits, removal and reductions of feral hogs can have positive impacts on natural resources, agriculture, human health and safety, and property.

The funding for this project will go to USDA APHIS Wildlife Services for feral hog removal. APHIS will implement any funded alternative for this project.

#### **iv. Restoration Methods**

The methods used in the proposed project will remove or substantially reduce hogs in the targeted watersheds. This will eliminate additional destruction to these sensitive habitats and allow impacted areas to regenerate without additional disturbance. The specific methods used will be:

- (a) Survey of selected watersheds to identify hog sounders and establish active bait sites;
- (b) Installation of Missouri drop or corral traps, and removal of sounders;
- (c) Aerial operations to augment elimination efforts and identify areas of remaining hogs;
- (d) Utilization of unmanned aerial systems technologies and night operations to identify and remove remaining individuals following trapping efforts.

#### **v. Timeline**

This project is assuming a five-year time frame for survey of current damage by feral hogs, mapping of additional feral hog activity, and trapping and killing of hogs. In

addition to planned APHIS, Forest Service, and State Parks contributions, the five-year project will be supported with three-years of funding from NRDAR settlement funds, and two-years of additional funding from USFS timber sales or alternative sources. It is not reasonable to assume that all feral hog populations within the boundaries will be completely eliminated within five years. Feral hog elimination is an ongoing challenge that is complicated by time, budget, and various other factors. MoDNR State Parks and MTNF will continue to make feral hog elimination a priority in the designated project geography and work will continue beyond the scope of this project. As strategic feral hog elimination continues, it will be more feasible to focus on habitat restoration and restoring ecosystems.

**vi. Proposed Budget**

The Trustees anticipate the NRDAR funding required for this project will not exceed **\$1,437,000** and will generally follow the budget categories below. This proposal is to fund up to 2 Full Time Employees (FTE) employed by USDA APHIS Wildlife Services and provide funding for up to 7 weeks of aerial operations to eliminate or substantially reduce feral hogs from the areas delineated in Figure 1.

Currently the Missouri Feral Hog Elimination Partnership is providing additional staffing for feral hog elimination efforts on the periphery of the proposed project area. Additionally, USDA APHIS Wildlife Services is providing scouting, trapping, and monitoring services within the proposed project area as well as aerial operations for approximately 2 weeks each year. The total value of APHIS’ contribution is \$436,000 per year. MoDNR State Parks has allocated \$75,000 in the 2022 fiscal year budget to support USDA APHIS efforts. They have also expressed their intent of financial commitment for future years at unknown funding levels. The Forest Service has also committed \$130,000 in their 2022 budget for cost share with USDA APHIS and other supporting funding. The Forest Service also intends to commit future year funding at unknown levels.

This totals approximately \$641,000 in FY 2022, and at least \$436,000 in annual matching funds thereafter (\$1,513,000 over 3 years) from the Missouri Feral Hog Partnership to further augment the elimination efforts proposed in this alternative. In addition to funds provided by the Trustees and matching funds outlined above, qualifying cost share programs, grants, staff time, and equipment will be provided by the partnering agencies and organizations.

<b>Cost Element</b>	<b>Annual Cost</b>	<b>3 Year Total</b>
Personnel Compensation	\$210,217	<b>\$630,651</b>
Travel	\$8,509	<b>\$25,527</b>
Other Services (Aviation Flat Rate Charge)	\$105,000	<b>\$315,000</b>

Supplies and Materials (ammo, trap parts, aviation fuel, etc.)	\$52,995	<b>\$158,985</b>
<b>Subtotal (Direct Charges)</b>	<b>\$376,721</b>	<b>\$1,130,163</b>
Pooled Job Costs* (11%)	\$41,439	<b>\$124,317</b>
Indirect Costs (16%)	\$60,840	<b>\$182,520</b>
<b>Agreement Total</b>	<b>\$479,000</b>	<b>\$1,437,000</b>

\* cost that APHIS does not get receipts for and can't direct bill cooperators for. This includes cost for cell phone/telecom charges, vehicle amortization (replacement of trucks and UTV's), and vehicle maintenance.

The distribution of the budget from this Financial Plan may vary as necessary to accomplish the purpose of this agreement but may not exceed \$1,437,000 over 3 years.

This Alternative has been documented as technically feasible and cost effective as part of the several efforts across the country. This Alternative would not cause additional injury to resources or services and would decrease the recovery time of services compared to natural recovery. Because additional funds separate from the recovered funds will be used, this Alternative is more cost effective than Alternative 3 below. Incidents of diseases spread by feral hogs to humans will decrease and the number of vehicular accidents caused by feral hogs will decrease. This Alternative is consistent and compliant with applicable federal, State, and tribal laws.

## **D. Alternative 3 –Removal of Feral Hogs – 5 Years Funded through NRDAR**

### **i. Project Description**

This project alternative includes all of the components identified in Alternative 2, but would be fully funded for the 5 year timeframe using NRDAR settlement funds and would not include matching funds provided by the USFS through stewardship timber sale proceeds.

Under Alternative 3, an additional \$958,000 of NRDAR settlement funds would be used to fund the remaining 2 years of feral hog removal and would not be available for additional ecological restoration projects envisioned by the Trustees to restore injured natural resources in the Trend. As outlined in the SEMORRP, restoration projects that include additional sources of funding are prioritized over those that do not include other sources of project funding.

The project benefits, partners and timeline of Alternative 3 are identical to those described in Alternative 2 (preferred alternative) above. Alternative 3 would use more NRDAR settlement funds to implement the proposed projects and would not include matching funds provided by the USFS through stewardship timber sale proceeds and therefore would not be cost effective as defined in the CERCLA NRDAR Regulations.

## ii. Proposed Budget

The Trustees anticipate the NRDA funding required for feral hog removal for the full 5-year timeframe would not exceed **\$2,395,000** and would generally follow the budget in Alternative 2. The table below depicts the budget for this alternative.

<b>Cost Element</b>	<b>First Year Cost</b>	<b>5 Year Total</b>
Personnel Compensation	\$210,217	<b>\$1,051,085</b>
Travel	\$8,509	<b>\$42,545</b>
Other Services (Aviation Flat Rate Charge)	\$105,000	<b>\$525,000</b>
Supplies and Materials (ammo, trap parts, aviation fuel, etc.)	\$52,995	<b>\$264,975</b>
<b>Subtotal (Direct Charges)</b>	<b>\$376,721</b>	<b>\$1,883,605</b>
Pooled Job Costs* (11%)	\$41,439	<b>\$207,195</b>
Indirect Costs (16%)	\$60,840	<b>\$304,200</b>
<b>Agreement Total</b>	<b>\$479,000</b>	<b>\$2,395,000</b>

The distribution of the budget from this Financial Plan may vary as necessary to accomplish the purpose of this agreement but may not exceed \$2,395,000 over 5 years.

Alternative 3 would use more NRDAR settlement funds to implement the proposed projects and would not include matching funds provided by the USFS through stewardship timber sale proceeds. The Trustees found that while Alternative 3 meets most of the Restoration Evaluation Criteria, it is less cost effective than projects that include additional sources of funding as match. Therefore, Alternative 3 is not a preferred restoration alternative when evaluated against the NRDAR evaluation criteria.

## 4. Environmental Consequences

In general, actions undertaken by a federal agency that may have a significant effect on the environment are subject to the NEPA (42 U.S.C. § 4321 *et seq.*) and other federal laws. APHIS led a group of federal agencies, including USFWS and US Forest Service, in producing a national EIS for Feral Hog Damage Management, available at the following website:

[APHIS' Final Environmental Impact Statement and Record of Decision entitled, "Feral Hog Damage Management: A National Approach"](#)

The performance of wildlife damage management actions by APHIS-WS under this proposal are in compliance with the National Environmental Policy Act, Endangered Species Act, and other applicable federal statutes as cited in our *2017 Mammal Damage Management in Missouri Environmental Assessment* and associated Finding of No Significant Impact.

[https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/NEPA\\_by\\_State?st=MO:Missouri](https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/NEPA_by_State?st=MO:Missouri)

In this section, the Trustees analyze the environmental consequences of Alternatives 1, 2, and 3 to determine whether implementation of any of these alternatives may significantly affect the quality of the human environment, particularly with respect to the physical, biological, socio-economic, or cultural environments. This section also identifies the Preferred Alternative.

### **A. Evaluation of Alternative 1: No Action (No targeted Feral Hog Removal)**

The No Action Alternative in this Draft RP/EA (Alternative 1) is similar to the No Action Alternative from the SEMORRP (see SEMORRP p. 16, 25, and 26). Environmental consequences of the No Action Alternative are described on pages 35 and 36 of the SEMORRP, incorporated by reference herein.

### **B. Evaluation of Alternative 2: Removal of Feral Hogs - 3 Years Funded through NRDAR and 2 Years Funded through Alternative Sources (Preferred)**

The APHIS EIS analyzed five alternatives: (1) Current APHIS Feral Swine Damage Management Program (FSDM)/No Action Alternative; (2) Integrated Feral Swine Damage Management Program—Preferred; (3) Baseline APHIS FSDM Program; (4) National and Strategic Local Projects Program; and (5) Federal FSDM Grant Program.

APHIS EIS Alternative 1: **Current Feral Swine Damage Management (FSDM) Program**. In this case, the No Action Alternative refers to APHIS FSDM actions prior to the appropriation of additional funds by Congress. It serves as a starting point for comparison with the other alternatives and can be defined as “no change” from the status quo. Congress has acknowledged that feral hogs are a harmful and destructive species, and that a federal response to feral hog damage is warranted. Consequently, this No Action Alternative cannot be selected for implementation unless Congress determines that a national FSDM program is no longer a priority. Under the current program, APHIS-WS state programs provide technical assistance (advice, training, loan of equipment), and, when appropriate and funding is available, operational assistance with lethal and non-lethal FSDM. An Integrated Wildlife Damage Management (IWDM) approach is used which incorporates the use or recommendation of a range of nonlethal and lethal techniques, singly or in combination, to meet the needs of each cooperator. APHIS-WS personnel opportunistically collect biological samples from some feral hogs killed during operational control activities and from other sources (e.g., hunter-killed animals) for disease monitoring. Research, modeling and risk



assessment projects are conducted on an array of issues related to feral hogs but are limited by available funding. Most APHIS outreach and education efforts are conducted by personnel at the state and territory level. Work with Canada and Mexico on FSDM has been primarily limited to interactions between individual APHIS-WS state programs and their Canadian or Mexican counterparts.

APHIS EIS Alternative 2: Integrated Feral Swine Damage Management Program—Preferred. APHIS selected Integrated FSDM Program as the preferred alternative. Under this alternative, APHIS would serve as the lead agency in a nationally coordinated cooperative effort with other agency partners, tribes, organizations, and local entities. In states, territories, and tribal lands where management authorities wish to eliminate feral hogs (generally areas with low or moderate feral hog populations), APHIS would form partnerships to meet their management objectives and reduce the size and range of the U.S. feral hog population. In states, territories, and tribal lands where management authorities have chosen to retain some feral hogs for cultural or recreational purposes (usually areas with large or well-established feral hog populations); APHIS would form partnerships to meet locally determined management objectives. These objectives may include reducing statewide populations or eliminating hogs from specific locations. Key program components are threefold:

1. Improved baseline operational capacity to respond including improved infrastructure (e.g. personnel, equipment) and increased cost-share opportunities with partner agencies, tribes and private entities.
2. National projects including strategic allocation of resources to reduce the range and size of the national feral hog population, increased research, modeling and risk analysis, national outreach and education program, and national coordination with Canada and Mexico.
3. Strategic projects at the local level to address specific vulnerable areas.

The Trustees have conducted an independent review of the EIS and have determined that the Final EIS adequately discusses and discloses the impacts of the preferred FSDM alternative. There are no major negative impacts on feral hog removal to the environment. Consequently, the Trustees incorporate by reference the relevant portions of the APHIS EIS and its analyses of environmental consequences associated with the implementation of FSDM Alternative 2

**i. Natural Resource Impacts**

Feral hogs can cause substantial adverse impacts on natural resources, individual native species and ecosystems. In areas where feral hogs cause adverse impacts, measures that reduce or eliminate feral hog populations are generally expected to have beneficial impacts. For example, in Florida, one year of a feral hog damage management program reduced damage to the last remnant of a basin marsh ecosystem in the state, with 91% of transects showing damage prior to the start of the program and only 31% of transects showing damage after the first year of feral hog damage management (Engeman et al. 2004). Both hunting and professional feral hog removal helped to reduce damage to endangered seepage slope habitats in Florida, with professional feral hog removal activities also having peripheral benefits on adjacent areas with hunting but no professional hog removal program (Engeman et al. 2007).

Both plant and animal species can benefit from FSDM feral hog removal. Removal of feral hogs would include elimination of their damaging effects on vegetation from: direct browsing and rooting, spreading weed seeds in their feces, and disturbing soils, all of which can facilitate invasions of introduced plant species that can out-compete native plants. Removal of feral hogs has the potential to reduce competition for available resources; reduce predation on the nests of ground-nesting birds, small mammals, reptiles, and amphibians; reduce habitat damage and changes in successional stage and composition of plant communities; and reduce risk of disease transmission to native wildlife.

**ii. Agriculture Impacts**

Feral hogs impact agriculture by damaging crops and interacting with livestock. Feral hogs contribute to crop damage by engaging in direct consumption and other behaviors, such as rooting, trampling, and wallowing, which can destroy fields or reduce productivity. Removing feral hogs will help reduce the crop damage caused by their behaviors. Limiting the interaction between feral hogs and livestock through reduction or elimination efforts will reduce the introduction and dissemination of pests and disease which may compromise the health and safety of livestock. Elimination of feral hogs from some areas may also reduce management costs for transitional and back-yard producers by eliminating the need for additional fencing or other structures to prevent contact between feral and domestic hogs.

**iii. Human Health and Safety Impacts**

Feral hogs pose a notable threat to human health and safety. As the numbers of feral hogs have increased, the frequency of feral hog-vehicle collisions has increased concurrently (Mayer and Brisbin 2009, Burns 2009, Mildenburg 2012). Additionally, sudden encounters with feral hogs

in suburban areas have resulted in attacks of humans and their pets. Effective FSDM programs are anticipated to result in reduced feral hog damage to property and threats to pets. They also are known to carry at least 30 viral and bacterial diseases, and nearly 40 parasites that may affect humans, domestic livestock, and wildlife species.

In addition to these issues rising from direct encounters with feral hogs, there may also be concerns in recreational areas where feral hogs are present. Removal of feral hogs may reduce safety concerns for individuals who choose to recreate in areas where feral hogs occur and may increase their willingness to use these locations.

#### **iv. Cultural and Human Use**

Human encounters with feral hogs may lead to significant costs due to property damage. When considering vehicle collisions, the projected costs damages due to feral hogs in the United States could be as high as \$36 million annually (Mayer and Johns 2007). It is also important to consider damage to culturally significant sites. Removal and reductions in feral hog populations and implementation of nonlethal FSDM feral hog removal techniques are expected to reduce feral hog damage to historic resources, culturally significant resources and sites, and native species. This reduction will also increase hunting and wildlife viewing opportunities and decrease adverse aesthetic impacts on parks and natural areas.

#### **v. Wildlife**

Feral hogs compete with native wildlife for multiple resources, specifically food, habitat, and water. Feral hog activity will often deter other species from living in an area, resulting in competition over prime habitat. Feral hogs wallow in mud to maintain proper body temperature which can be particularly problematic during dry seasons when they monopolize and contaminate limited water sources. Feral hogs also prey directly on the nests, eggs, and young of native ground nesting birds and reptiles, including threatened or endangered species. Feral hogs have even been documented killing and eating deer fawns, and actively hunting small mammals, frogs, lizards, and snakes.

Feral hog wallows are prime mosquito habitat which contributes to the prevalence of various mosquito-borne diseases. Wallows can also be a place of transmission for bacteria and parasites from feral hogs to native wildlife that come to drink.

#### **vi. Soil and water quality**

Feral hog rooting and wallowing activity increases erosion, especially along waterways and in wetlands. Rooting and trampling can limit water infiltration and nutrient cycling. Large groups of feral hogs can deposit

significant amounts of fecal material in concentrated areas, contaminating water sources, resulting in increased disease risks for humans, wildlife, and livestock.

**vii. Forest regeneration**

Feral hogs can alter the understory growth of forests through rooting and foraging, ultimately shifting the tree species diversity and density in a forest by interfering with seed dispersal since they are huge consumers of mast crops (i.e., acorns, hickory nuts, beech nuts, and tupelo).

Consumption of mast not only depletes food sources for native wildlife such as deer and turkey, but this behavior can also alter the forest composition by decreasing the number of large seed-producing trees.

**C. Evaluation of Alternative 3: Removal of Feral Hogs – 5 Years Funded through NRDAR**

The scope and environmental consequences of Alternative 3 are identical to those described in Alternative 2 (preferred alternative) above.

**5. Monitoring**

To monitor feral hog elimination success across the landscape, the partnership uses watershed basin boundaries at the USGS 12-digit hydrologic unit (HU) for establishing a geographical measure of presence/absence and relative capture density within each elimination area outlined in the Missouri Feral Hog Elimination Strategic Plan. The use of 12-digit HUs provides the basis for implementing a systematic approach to feral hog elimination and provides field staff a means to geographically focus elimination and monitoring efforts. Feral Hog absence from a watershed is assumed when monitoring efforts, including damage complaints, and field camera imagery indicate an absence of feral hogs over a two-year period. The proposed project area (Figure 1) comprises approximately 622,251 acres and 26 watersheds. Initial elimination efforts will focus on the “core watershed areas” and as success is achieved in these areas, focus will be shifted to the periphery watershed areas. Annual progress reports will be prepared for each watershed for the duration of the project, or until watersheds have been documented to be hog free for two years.

**6. Agencies, Organizations, and Parties Consulted for Information**

U.S. Fish and Wildlife Service

Columbia Ecological Services Field Office  
101 Park DeVille Drive, Suite A  
Columbia, MO 65203

Missouri Department of Natural Resources  
Environmental Remediation Program  
P.O. Box 176  
Jefferson City, MO 65102

U.S. Forest Service  
Mark Twain National Forest  
401 Fairgrounds Road  
Rolla, MO 65401

USDA APHIS – Wildlife Services  
State Director MO/IA  
1714 Commerce Court, Suite C  
Columbia, MO 65202

Missouri Feral Hog Elimination Partnership

## 7. Literature Cited

Burns, R. 2009. Feral hog/vehicle collisions up. AgriLife News. February 17, 2009.  
<http://agnews.tamu.edu/showstory.php?id=1040>.

Colatskie, R. 2019. Missouri State Parks, Mead's Milkweed Survey Report, Taum Sauk Mountain State Park

Colatskie, R. 2018. Missouri State Parks, Mead's Milkweed Survey Brief, Taum Sauk Mountain State Park

Engeman, R. M., A. Stevens, J. Allen, J. Dunlap, M. Daniel, D. Teague and B. Constantin. 2007. Feral swine management for conservation of an imperiled wetland habitat: Florida's vanishing seepage slopes. *Biological Conservation* 134:440-446.

Engeman, R. M., H. T. Smith, R. Severson, M. A. Severson, S. A. Shwiff, B. Constantin and D. Griffin. 2004. The amount and economic cost of feral swine damage to the last remnant of a basin marsh system in Florida. *Journal for Nature Conservation* 12:143-147.

Hellgren, E. C. 1993. Biology of feral hogs (*Sus scrofa*) in Texas. Pages 50- 58 in C. W. Hanselka and J. F. Cadenhead, editors. *Feral swine: A compendium for resource managers*. Texas Agricultural Extension Service, Kerrville, TX, USA.

Mayer, J. J., and I. L. Brisbin, Jr. (eds.). 2009. Wild Pigs: Biology, damage, control techniques and management. SRNLRP-2009-00869. Savannah River National Laboratory, Aiken, SC. 400 pp.

Mayer, J. J. and P. E. Johns. 2007. Characterization of wild pig-vehicle collisions. Washington Savannah River Company, Aiken S.C. and Carolina Wildlife Consultants, New Ellentown, SC.

Mildenburg, D. 2012. Texas drivers, beware feral foe: 'Those hogs are built solid'. Bloomberg News. Published November 28, 2012. <http://businessweek.com/news/2012-11-28/texasferal-hog-wrecks-mark-losing-battle-with-animals#p2>.

Missouri Department of Natural Resources (MoDNR), Land Reclamation Program. 2004. Biennial Report: Jefferson City, Missouri. 30 pages.

Sanders, H.N., Hewitt, D.G., Perotto-Baldivieso, H.L., Vercauteren, K.C. and Snow, N.P. (2020), Opportunistic Predation of Wild Turkey Nests by Wild Pigs. Jour. Wild. Mgmt., 84: 293-300. <https://doi.org/10.1002/jwmg.21797>

Timmons J. B., Cathey J.C., Rollins D., Dictson N., and McFarland M. 2011. Feral Hogs Impact Ground-nesting Birds, Texas AgriLife Extension Service, The Texas A&M University System.

Timmons, Jared B., Higginbotham B., Lopez R., Cathey J.C., Mellish J., Griffin J., Sumrall A. 2012. Feral hog population growth, density and harvest in Texas. Texas A&M AgriLife Extension Service Report

U.S. Geological Survey (USGS), 2018, Mineral commodity summary, accessed January 28, 2019, at URL <https://minerals.usgs.gov/minerals/pubs/mcs/2018/mcs2018.pdf>

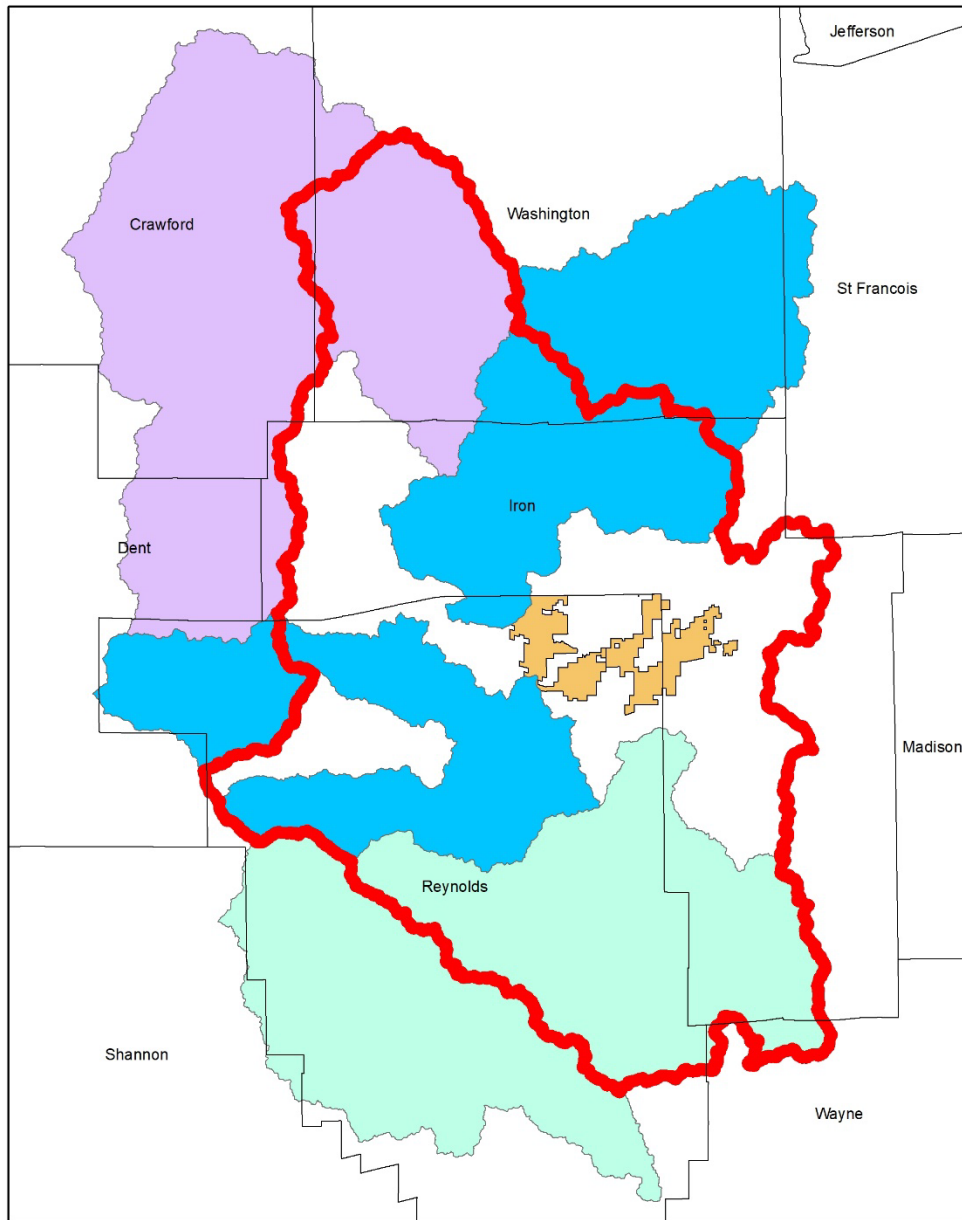
USDA. 2019. Economics Project of the National Wildlife Research Center. Valuation of Feral Swine Damage Mitigation Efforts in Missouri

USDA (U.S. Department of Agriculture). 2017. Environmental Assessment: Mammal Damage Management in the State of Missouri. USDA, APHIS, WS, Columbia, MO.

USDA (U.S. Department of Agriculture). 2017. Decision/FONSI: Mammal Damage Management in the State of Missouri. USDA, APHIS, WS, Columbia, MO; signed November 11, 2017.

Figure 1:

## NRDAR PROJECT AREA PROPOSAL



### Legend







- |   |                                      |   |                          |
|---|--------------------------------------|---|--------------------------|
|  | NRDAR PROJECT AREA PROPOSAL BOUNDARY |  | NRDAR TIER 3 RESTORATION |
|  | NRDAR TIER 1 RESTORATION             |  | JSI & TAUM SAUK SP       |
|  | NRDAR TIER 2 RESTORATION             |  | MTNF                     |



Figure 2: Fenced area at Barton fen.



Figure 3: Hog damage in wetlands adjacent to Barton fen.



Figure 4: Forested fen impacted by hog rooting



Figure 5: Mead's milkweed flowering head trampled next to hog rooting



Figure 6: Hog rooting adjacent to Mead's milkweed population



Figure 7: Hog rooting damage on dolomite glade