Cottonwood Creek Restoration Project  
Statement of Work and Request for Proposals  
Lyndon B. Johnson National Grassland, National Forests and Grasslands in Texas

**Background and Statement of Work:** The National Forest Foundation (NFF) seeks a contractor to take responsibility for delivering a project (design and build) for restoring stream functions within the Cottonwood Creek Watershed on the Lyndon B. Johnson (LBJ) National Grassland. The Cottonwood Creek Watershed includes all upstream areas that flow into Cottonwood Lake and Little Cottonwood Lake on the LBJ National Grassland in Wise County, Texas.

The Cottonwood Creek Watershed is approximately 5,700 acres and spans across an ecotone of rare and threatened tallgrass prairie and oak savanna ecosystems. The Watershed includes 4,000 acres of National Forest System lands and 1,700 acres of private land, as well as 29 miles of mapped streams and unmapped ephemeral streams and areas of erosion concern. Streams within the watershed are degraded and have been deeply incised due to historic farming practices, the presence of highly erodible soils, and the lack of firm stream channel substrates.

The complete project includes areas identified for priority stream restoration in phased projects. Over multiple phases, the NFF and USDA Forest Service (USFS) aim to partner to restore 21 delineated stream reaches; 850 total acres; and 12.4 miles of primary stream channel. The NFF is seeking contractor(s) to complete (design/build) phase 1 of the project, which includes two delineated stream reaches totaling 80.0 acres and 1.3 miles of the total primary stream channel. The area is situated towards the outlet of the watershed. The NFF is also seeking optional bids from contractors to design and build future phases of the project.

The purpose of this project is to accomplish the following goals for the project area:

1. Stream incisions and headcuts are mitigated.
2. Stream functions are trending, and reasonably expected to continue trending, towards natural/historic reference conditions for the foreseeable long-term future with minimal structural maintenance requirements.
3. Forest Service infrastructure, such as roads, trails, fences, and erosion-control structures, are properly aligned with previously listed goals.
4. Invasive Eastern redcedar populations are mitigated and their materials are used to efficaciously accomplish previously listed goals.

Methods of restoration should focus on low-complexity and low-cost stream modification features, such as weirs, baffles, vanes, and filter dams made from natural, local materials such as rock and timber. Examples can be found in Clothier and Zeedyk’s book *Let the Water Do the Work: Induced Meandering, an Evolving Method for Restoring Incised Channels* (2014).

Stream functions are the physical, chemical biological processes that occur in stream ecosystems. Specific function-based parameters should be developed during the design phase. See *A Function-Based Framework for Stream Assessments and Restoration Projects* (Harman et al. 2012).

Eastern redcedar (cedar) populations should be controlled with mechanical and/or hand methods and used for stream modification materials where feasible.
General Specifications

(a) Description of Work – This Request for Proposals is for designing/building stream restoration activities related to the Cottonwood Creek Restoration Project.

(b) The NFF is seeking contractor(s) to complete (design/build) phase 1 of the project, which includes two delineated stream reaches totaling 80.0 acres and 1.3 miles of the total primary stream channel. The area is situated towards the outlet of the watershed. The NFF is also seeking optional bids from contractors to design and build future phases of the project.

(c) The Contractor is responsible for developing all stream restoration plans, designs, studies, and reports in accordance with this Request for Proposals, best available science, best management practices, project-level NEPA, the National Forests and Grasslands of Texas Land and Resource Management Plan (1996), and applicable Forest Service directives.

(d) Contractor shall provide expert consultation and services on stream restoration sciences and applied methods, such as from the professional fields of stream hydrology and stream geomorphology.

(e) Contractor shall implement approved plan activities to deliver project deliverables. Activities include providing project management services, including coordination, scheduling, and facilitation of meetings, reports, decision checkpoints, mid-season reviews, end-season reviews, and accomplishment reports.

(f) The Contractor shall identify which efforts and materials they can supply in terms of materials, labor, equipment, supplies, supervision, quality control, and incidentals required to complete the work described. The Contractor shall perform all work in a safe and conscientious manner.

(g) Staff from the NFF will advertise, award, and administer a contract with a qualified engineering/construction firm, directly manage and oversee the contract through the design and build phase, actively participate in stakeholder meetings, provide project monitoring, and oversight, and assist with coordination with the USFS to ensure the NFF, USFS, and Contractor are moving forward efficiently.

(h) Staff from the USFS will provide necessary information to the NFF and NFF’s contractor, actively participate in stakeholder meetings, provide decisions and approvals by serving as the authorizing official at determined checkpoints, assisting with project monitoring and oversight, and providing expert consultation on the local area and local issues.

(i) Specific contractor tasks, divided by phases, include:

1. Coordinate, facilitate, and provide staffing support and services for the project design process, including the submission and approval of a project management plan, which includes:
   i. Project Vision – developed in close coordination with USFS and NFF staff.
   ii. The Problem – Assess current stream conditions, including stream functions assessments. Define why stream degradation occurred and/or is still occurring.
   iii. Project Resources – Who will be needed to execute the project, what resource management tools are required, where will the work be done, when will the project start and end, and why are these resources needed?
   iv. Project Goals – The desired outcomes at the end of the project that are both observable and measurable.
   v. Project Strategy – The process to reach goals within project constraints, such as resources, schedule, budget, etc.
   vi. Activities – actions that will be taken to achieve the set objectives. Activities are designed according to the project’s strategy.
   vii. Timeline – the basic chronologic order of events that are planned in the project. It is not a work plan, but a quick way to present an overview of planned activities.
viii. Workplan – a description of the sequence of the project activities in time. Includes information about responsibilities and objectives.

ix. Engineering drawings, specifications, and schedule of items.

x. Budget estimates – an estimate of expenditures for each financial year and phase of the project.

xi. Sustainability – what it will take to continue the beneficial effects of the project far into the future.

xii. Monitoring and Evaluation Strategies – how the success of the project will be measured and assessed.

2. In close coordination with the NFF and USFS, review and gain approval of each item included in the project design process and project management plan. Note that engineering drawings, specifications, and the schedule of items may require more than one review from the NFF and USFS and more than one level of approval within the USFS.

3. Construct (build) stream modification features as specified in the project design plan.

4. Control cedar populations with mechanical (e.g., mulching, shear, and pile) and/or hand methods (e.g., chainsaw, loppers) wherever present. Felled cedar material should be used as material for stream modification features (e.g., baffles, vanes) wherever feasible.

(j) Project Location – The project area is mapped locations (see project map) of the Cottonwood Creek watershed upstream of Cottonwood Lake and Little Cottonwood Lake, on the LBJ National Grassland in Wise County, Texas.

(k) Proposed Work Schedule – The following schedule is proposed for the first phase of work.

<table>
<thead>
<tr>
<th>Date</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 2023</td>
<td>• Initiate project, recruit, and award initial design/build contract.</td>
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<tr>
<td></td>
<td>• Draft project management plan (contractor)</td>
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<tr>
<td>September 2023</td>
<td>• Initial stakeholder meeting coordinated and facilitated by the contractor.</td>
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<td></td>
<td>• Finalize project management plan (contractor)</td>
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<td></td>
<td>• Field assessment by engineers/scientists (contractor)</td>
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<tr>
<td>October 2023</td>
<td>• Engineering/science report of initial findings and recommendations (contractor)</td>
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<tr>
<td></td>
<td>• Stakeholder meetings coordinated and facilitated by the contractor.</td>
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<td></td>
<td>• Deciding official (District Ranger) checkpoint for build-phase 1 project implementation plan</td>
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<tr>
<td></td>
<td>• Begin build-phase</td>
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<tr>
<td>November 2023</td>
<td>• Build-phase 1 stakeholder mid-season review/meeting coordinated and facilitated by the contractor</td>
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<tr>
<td>December 2023</td>
<td>• Build-phase 1 project implementation complete and inspected.</td>
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<tr>
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<td>• Final accomplishment report submitted by the contractor</td>
</tr>
<tr>
<td>January-February 2023</td>
<td>• Stakeholder meeting, review, and planning for next phases coordinated and facilitated by the contractor.</td>
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</tbody>
</table>
Pricing Schedule

Contractor shall price work according to the schedule below. Prevailing wages are required per conditions of funding sources.

As described previously, the NFF seeks a contractor to design and build phase 1 of the project, which includes two delineated stream reaches totaling 80.0 acres and 1.3 miles of the total primary stream channel.

The NFF is also seeking optional bids from contractors to design and build future phases of the project. Please provide pricing below, indicating if unit costs will change based on the scale of the work. Please clearly state if the pricing provided in the bid applies to future phases beyond phase 1.

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Quantity</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and build stream modification features and control cedar populations for stream reaches ranging from 0.5 – 1.0 miles of primary channel length</td>
<td>Mile</td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Design and build stream modification features and control cedar populations for stream reaches ranging from 1.0 – 5.0 miles of primary channel length</td>
<td>Mile</td>
<td></td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Design and build stream modification features and control cedar populations for stream reaches ranging from 5.0 – 10.0 miles of primary channel length</td>
<td>Mile</td>
<td></td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Design and build stream modification features and control cedar populations for stream reaches ranging from 10.0 – 15.0 miles of primary channel length</td>
<td>Mile</td>
<td></td>
<td>15.0</td>
<td></td>
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</table>

Other Project Requirements and Specifications

(a) Utilities – In many locations there will be no or limited sanitation, water, electrical or housing services available. The Contractor shall make its own arrangements for temporary facilities if needed.

(b) Specifications – Project work shall be accomplished in accordance with the following appendices:
   a. APPENDIX A: Cottonwood Creek Watershed Project Standards and Specifications
   b. APPENDIX B: Cottonwood Creek Watershed Project Area Map
   c. APPENDIX C: Cottonwood Creek Watershed Project Design Map
   d. APPENDIX D: USFS Environmental Assessment – LBJ Prairie Savanna Restoration Project

Information Requested

If interested in this project, please provide a bid for the above statement of work by providing the approach, work experience, and cost. Please also include your capacity for this project and efficiency in similar stream restoration projects in the past, if any.

This is a request for proposals only and bids furnished are not offers. This request does not commit the National Forest Foundation to pay any costs incurred in the preparation or the submission of the
Proposal or to contract for supplies or services.

Proposal Requirements and Contractor Qualifications

(a) **Approach** – Please describe the proposed approach, including a timeline and written description.

(b) **Previous work experience** – Please describe your capacity for this project and efficiency in similar stream restoration projects in the past, if any. Please describe any previous work on National Forest System or other federal or state lands.

(c) **References** – Please provide three references.

(d) **Bid** – Please provide a bid using the pricing schedule described above.

Insurance Requirements

Upon selection of the winning bid, chosen contractor will be asked to affirm that it has and shall maintain State minimum workers’ compensation insurance coverage for its employees, if any. The selected contractor shall also maintain broad form general liability, property damage, and automotive liability insurance in the minimum amount of $1,000,000 for bodily injury, death, or damage to property of any person and $2,000,000 for bodily injury, death, or damage to property of more than one person. The Contractor shall name NFF an Additional Named Insured and provide NFF with documentation evidencing such coverages.

Prohibited Telecommunications Services and Equipment

The Contractor is responsible for compliance with the prohibition on certain telecommunications and video surveillance services or equipment identified in 2 CFR 200.216.

Performance Security

Chosen contractor shall post cash, a letter of credit, bond, or other financial security that is easily convertible into cash in a form acceptable to the NFF in its sole determination in the amount of 5% of the amount due to contractor, not to exceed $250,000 dollars, to assure completion of the work required under this Agreement and payment of all amounts lawfully due to all persons supplying or furnishing to the Contractor or Contractor’s subcontractors with labor, laborers, materials, rental machinery, tools or equipment used or to perform the work. As work is completed in integrated component parts, inspected, approved and, if applicable, conveyed to NFF, the Performance Security shall be released in a proportional amount, unless a lesser amount of release is necessary to maintain 5% Performance Security.

Bid Submission

Submit bids via email to Evan Ritzinger at eritzinger@nationalforests.org by Friday, July 28, 2023.

Contractor Selection Process

The NFF will use the Evaluation Factors below to review each submitted bid. Based on the outcomes of that selection process, the NFF will notify successful and unsuccessful bidders by Friday, August 25 and will prepare a separate contract document.
Point of Contact
For questions about the details of producing the bid, please contact:

Evan Ritzinger  
National Forest Foundation  
530.204.7252  
eritzinger@nationalforests.org

Carina Bracer  
National Forest Foundation  
540.718.2895  
cbracer@nationalforests.org

Pre-Bid Tour
If you are interested in a pre-bid site visit or tour, please contact Evan Ritzinger, eritzinger@nationalforests.org to make arrangements with the USFS.

Evaluation Factors and Relative Importance

<table>
<thead>
<tr>
<th>Level 3 Criteria</th>
<th>Level 2 Criteria</th>
<th>Level 1 Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Price / cost</td>
<td>• Technical proposal / proposed approach to project</td>
<td>• Benefits to the local community</td>
</tr>
<tr>
<td>• Equipment and contractor capability</td>
<td>• Overall strategic benefits to meeting NFF goals and grant needs, requirements, and timelines</td>
<td>• Relationship to local community</td>
</tr>
<tr>
<td>• Timing of when contractor can begin and/or finish the project</td>
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<tr>
<td>• Past performance, references, and USFS feedback</td>
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</table>

Equal Opportunity Provider
In accordance with Federal law and U.S. Department of Agriculture policy, the National Forest Foundation is prohibited from discriminating on the basis of race, color, national origin, sex, age, religion, political beliefs, or disability.
APPENDIX A: Cottonwood Creek Watershed Project Standards and Specifications

The Contractor must follow and adhere to the following standards and specifications when completing the Cottonwood Creek Watershed Project.

Quality Control
Contractor, the NFF, and the U.S. Forest Service (USFS) will have a pre-work meeting before any project commences. Together, the parties will review operations plans and coordinate timelines. The NFF will inform the USFS prior to beginning all work. Together, the parties will ensure that operations on-the-ground are conducted in accordance with the standards and specifications for all project locations. It is anticipated that a representative project location will require visits on the order of twice per week. A daily record will be kept by the NFF to document visits and any recordable observations or issues encountered with the Contractor. The record will be made available to designated USFS representatives as a component of reporting.

Ongoing administration by the NFF will help ensure successful implementation and compliance. Once work items are complete and have been reviewed and accepted as complete by the NFF and NFF’s Contractor, a USFS representative will be notified and may conduct a final inspection. Any unsatisfactory work will be corrected by the NFF and NFF’s Contractor. Once the work is documented as acceptable by the designated USFS resource area representative, Contractor invoices for will be approved for payment by the NFF.

Scope of Work for Contractor
1. Coordinate, facilitate and provide professional project management and consulting staffing support and services throughout the full life of this project, including the project design process (which includes development of a project management plan). All designs and plans shall be approved and accepted by the Forest Service authorizing official before implementation.
2. Design and build stream restoration features in accordance with approved designs and plans.
3. Control cedar populations with mechanical (e.g., mulching, shear and pile) and/or hand methods (e.g., chainsaw, loppers) wherever present. Felled cedar material should be used as material for stream modification features (e.g., baffles, vanes) wherever feasible.
4. Design and build modifications to Forest Service infrastructure effected (anticipated or actual) by the implementation of this project in accordance with approved designs and plans.

Other Requirements and Specifications
1. The Contractor shall identify which efforts and materials they can supply in terms of materials, labor, equipment, supplies, supervision, quality control, and incidentals required to complete the work described. The Contractor shall perform all work in a safe and conscientious manner.
2. Utilities. In many locations there will be no or limited sanitation, water, electrical or housing services available. The Contractor shall make its own arrangements for temporary facilities if needed.
3. Project Management Plan. The Forest Service District Ranger shall approve the project management plan submitted by the contractor before the build phase begins. The project management plan may be amended at any time throughout the duration of the contract with
consent and written approval by the District Ranger. The project management plan shall include:

- Well-defined goals and objectives that are realistic, clear, and measurable.
- Resource plan that includes financial, human, physical, sub-vendor, and conflict planning.
- Task plan that defines deliverables, steps, tasks, priorities, and dependencies.
- Risk identification which defines risks to successful project implementation.
- Communication plan.
- Schedules.
- Quality control, including specifications, standards, and guidelines.

4. Build Phase. The build phase shall be implemented in accordance with the approved project management plan, which shall include specifications for building activities.

5. Other activities outside the scope of the build phase shall also be in accordance with the approved project management plan.

Guidelines specified in NFF/USFS Stewardship Agreement

The following guidelines are included in the NFF/USFS Stewardship Agreement and must be followed by the NFF Contractor. The Contractor has the responsibility for ensuring all relevant guidelines are met.

1. **Use of Roads by the Partner.** The NFF is/are authorized to use existing National Forest system roads and specified roads. The Parties will determine that such use will not cause damage to the roads or National Forest resources.

2. **Plan of Operations for Roads.** Annually, prior to start of operations, the NFF will prepare a supplement to the Technical Proposal that shall include a schedule of proposed maintenance and construction progress and a description of planned measures to be taken to provide erosion control for work in progress, including special measures to be taken on any segments of construction not substantially completed prior to periods of seasonal precipitation or runoff. The NFF shall submit a revised schedule when they propose a significant deviation from the progress schedule. Prior to beginning construction on any portion of specified roads identified as sensitive on plans, the parties shall agree on the proposed method of construction and maintenance.

3. **Protection of Residual Trees.** The NFF’s operations shall not unnecessarily damage young growth or other trees to be reserved.

4. **Safety.** The NFF’s operations shall facilitate the Forest Service’s safe and practical inspection of the NFF’s operations and conduct of other official duties on the Stewardship Project Area. The NFF has/have all responsibility for compliance with safety requirements for the NFF's employees.

When operations are in progress adjacent or on Forest Service controlled roads and trails open to public travel, the NFF shall furnish, install, and maintain all temporary traffic controls that provide the user with adequate warning of hazardous or potentially hazardous conditions associated with operations occurring in the area. The parties shall agree to a specific traffic control plan prior to commencement of work. Devices shall be appropriate to current conditions and shall be covered or removed when not needed.
During periods of general recreation activity within Stewardship Project Area or vicinity, the Forest Service may restrict road construction, timber cutting, yarding, and other harvesting operations to days other than Saturdays, Sundays, and holidays.

LOGGING AND MAINTENANCE OPERATIONS SIGNING STANDARDS

All signs must be manufactured & installed as specified in the FHWA "Manual on Uniform Traffic Control Devices" (MUTCD) & FS publication "Standards for Forest Service Signs & Posters"( EM 7100-15).

SIGN STANDARDS

SHAPE & COLOR: Generally, signs for logging and maintenance operations are either diamond-shaped or rectangular. All signs are **reflective orange background with black legend and border** unless shown otherwise. Handpainted, homemade signs are not legal. Fluorescent paint is not reflectorized.

SUBSTRATE: Sign substrate material may be High Density Overlay (HDO) Plywood, Aluminum, Fiberglass Reinforced Plastic, Corrugated Plastic or Roll-up Fabrics.

SIGN SIZE: Sign size is a factor of speed and MUTCD & FS standards. Where conditions of speed, volume, or special hazard require greater visibility or emphasis, larger signs should be used. Minimum sizes for the most common signs can be found in Figure 4. Refer to the EM-7100-15 for additional sign sizes.

LEGEND: All lettering shall be Series "C" alphabet, conforming to Standard Alphabets for Highway Signs. Letter size is also a function of speed - use letter size and word messages as specified in MUTCD and EM-7100-15.

SIGN PLACEMENT

Signs are to be installed in locations as agreed to in the traffic control plan. All signs are to be removed, covered, or folded when operations are not in progress or the sign message is not applicable. Signs should generally be located on the right-hand side of the roadway. When special emphasis is needed, signs may be placed on both the left and right sides of the road. Sign message shall be clearly visible to road users, mounted on posts or portable sign stands.
**LATERAL CLEARANCE**
From the edge of the road - 2 foot minimum, where slope limits to less than 6 feet. 6-12 foot preferred.

**HEIGHT**
Minimum of 7 feet, measured from the bottom of the sign to the near edge of the travelway. The height to the bottom of a supplemental sign mounted below the primary sign will be 6 feet.

Dimensions

**PLACEENT DISTANCE**
Signs must be located 100-500 feet prior to the activity, (both ends if a through road) and maintained at that distance. This distance is based on speed. Refer to Figure 2, Table II-1, MUTCD, a portion of which is reproduced here, to determine correct placement distance.

**SIGN SUPPORTS**

**POSTS:** Signs are to be mounted on separate posts. Supplemental signs such as Speed Advisory plates are to be mounted on the same post as the primary sign. **Do not mount signs on trees or other signs.** Posts may be wood, metal, carsonite or similar material. Where sign supports cannot be sufficiently offset from the road edge, supports will meet breakaway standards. Single wood posts with less than 24 square inches do not require breakaway design.

**TEMPORARY/PORTABLE SUPPORTS:** Portable supports may be used for short-term, short-duration, and mobile conditions. MUTCD defines this time period as one work shift, 12 hours or less. All portable supports must meet MUTCD standards, including breakaway. These must be a minimum of 1 foot above the road surface or more if visibility requires it.
SIGNS

The following signs meet the intent of the Safety standard. *This is not a complete listing of signs that may be needed.*

- FG20-1-48*
- FG20-2-48
- FG20-3-42*
- FG20-3a-42
- FW22-3-30
- W21-3-30*
- FW21-4a-30
- FW11-7-24
- W22-1-36*
5. **Accident and Injury Notification.** The NFF shall notify Forest Service of any lost time personal injury accident or any accident or vandalism resulting in personal property damage over $400 in value that occurs as a result of or is associated with the NFF’s Operations.

The NFF shall notify Forest Service within 8 hours of any personal injury accident. For vandalism and personal property accidents, the NFF shall notify Forest Service at the same time notification is given to the state and local law enforcement authorities.

The NFF shall take all reasonable measures after an accident or vandalism event to preserve the scene of the incident and provide information to facilitate a Forest Service investigation.

6. **Sanitation and Servicing.** The NFF shall take all reasonable precautions to prevent pollution of air, soil, and water by the NFF’s operations. Precautions shall include if facilities for employees are established on the Stewardship Project Area, they shall be operated in a sanitary manner. The parties shall agree to the cleanup and restoration of a polluted site. The NFF shall maintain all equipment operating on Stewardship Project Area in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid. The NFF shall not service tractors, trucks, or other equipment on National Forest lands where servicing is likely to result in pollution to soil or water. The NFF shall furnish oil-absorbing mats for use under all stationary equipment or equipment being serviced to prevent leaking or spilled
petroleum-based products from contaminating soil and water resources. the NFF shall remove from National Forest lands all contaminated soil, vegetation, debris, vehicle oil filters (drained of free-flowing oil), batteries, oily rags, and waste oil resulting from use, servicing, repair, or abandonment of equipment.

7. **Prevention of Oil Spills.** If the NFF maintain(s) storage facilities for oil or oil products on the Stewardship Project Area, the NFF shall take appropriate preventive measures to ensure that any spill of such oil or oil products does not enter any stream or other waters of the United States or any of the individual States. If the total oil or oil products storage exceeds 1,320 gallons in containers of 55 gallons or greater, the NFF shall prepare a Spill Prevention Control and Countermeasures Plan. Such plan shall meet applicable EPA requirements (40 CFR 112), including certification by a registered professional engineer. The NFF shall notify the Forest Service and appropriate agencies of all reportable (40 CFR 110) spills of oil or oil products on or in the vicinity of the Stewardship Project Area that are caused by the NFF’s employees, agents, contractors or their employees or agents, directly or indirectly, as a result of the NFF’s operations. The NFF will take whatever initial action may be safely accomplished to contain all spills.

8. **Hazardous Substances.** The NFF shall notify the National Response Center and Forest Service principal contact of all releases of reportable quantities of hazardous substances on or in the vicinity of the Stewardship Project Area that are caused by the NFF’s employees, agents, contractors or their employees or agents, directly or indirectly, as a result of the NFF’s operations, in accordance with 40 CFR 302.

9. **Washing Equipment.** In order to prevent the spread of noxious weeds into the Stewardship Project Area, the NFF shall be required to clean all off-road logging and construction equipment prior to entry on to the Stewardship Project Area. This cleaning shall remove all soil, plant parts, seeds, vegetative matter, or other debris that could contain or hold seeds. Only logging and construction equipment so cleaned and inspected by the NFF will be allowed to operate within the Stewardship Project Area. All subsequent move-ins of equipment to the Stewardship Project Area shall be treated in the same manner as the initial move in. “Off-road equipment” includes all logging and construction machinery, except for log trucks, chip vans, service vehicles, water trucks, pickup trucks, cars, and similar vehicles.

The NFF shall employ whatever cleaning methods are necessary to ensure that off-road equipment is free of noxious weeds. Equipment shall be considered free of soil, seed, and other such debris when a visual inspection does not disclose such material. Disassembly of equipment components or specialized inspection tools is not required.

As agreed upon, the NFF shall inspect equipment at cleaning location, and provide documentation of inspection to the Forest Service.

New infestations of noxious weeds, of concern to Forest Service and identified by either the NFF or Forest Service, on the Stewardship Project Area or on the haul route, shall be promptly reported to the other party. The NFF and Forest Service shall agree on treatment methods to reduce or stop the spread of noxious weeds when new infestations are found. A current list of noxious weeds of concern to Forest Service is available at each Forest Service office.
10. **Conduct of Logging.** Unless otherwise specifically provided herein, the NFF shall fell trees designated for cutting and shall remove the portions that meet Utilization Standards, prior to acceptance of work for completion of logging and stewardship projects. Forest Service may make exceptions for occasional trees inadvertently not cut or trees or pieces not removed for good reason, including possible damage to forest resources or gross economic impracticability at the time of removal of other timber.

11. **Felling and Bucking.** Felling shall be done to minimize breakage of included timber and damage to residual timber. Unless agreed otherwise, felling shall be done by saws or shears. Bucking shall be done to permit removal of all minimum pieces. The NFF may buck out cull material when necessary to produce pieces meeting utilization standards. Such bucked out material shall contain a minimum amount of sound wood, not in excess of the net scale in percentage of gross scale, or based on the merchantability factor. If necessary to assess extent of defect, the NFF shall make sample saw cuts or wedges.

12. **Felling in Clearings.** Insofar as ground conditions, tree lean, and shape of clearings permit, trees shall be felled so that their tops do not extend outside clearcutting units, construction clearings, and areas of regeneration cutting.

13. **Stump Heights.** Stumps shall not exceed, on the side adjacent to the highest ground, the maximum heights set forth in Appendix E except that occasional stumps of greater heights are acceptable when the NFF determine(s) that they are necessary for safe and efficient conduct of logging. Unless otherwise agreed, the NFF shall re-cut high stumps so they will not exceed heights specified in F-14 and shall dispose of severed portions in the same manner as other logging debris. The stump heights shown in Appendix F were selected with the objective of maximum reasonable utilization of the timber, unless the Map shows special areas where stump heights are lower for aesthetic, land treatment, or silvicultural reasons.

14. **Bucking Lengths.** Trees shall be bucked in various lengths to obtain the greatest utilization of material meeting utilization standards.

15. **Limbing.** The NFF shall cut exposed limbs from products prior to skidding, as necessary to minimize damage to the residual stand during skidding. The NFF may leave uncut those limbs that cannot be cut with reasonable safety.

16. **Skidding and Yarding.** Methods of skidding or yarding specified for particular areas, if any, are indicated on the Map. Outside clearcutting units and construction clearings, insofar as ground conditions permit, products shall not be skidded against reserve trees or groups of reproduction and tractors shall be equipped with a winch to facilitate skidding.

17. **Rigging.** Insofar as practicable, needed rigging shall be slung on stumps or trees designated for cutting.

18. **Landings and Skid Trails.** Location of all landings, tractor roads, and skid trails shall be agreed upon prior to their construction. The cleared or excavated size of landings shall not exceed that needed for efficient skidding and loading operations.

19. **Arches and Dozer Blades.** Skidding tractors equipped with pull-type arches or dozer blades wider than tractor width or C-frame width, whichever is greater, shall not be used in residual timber outside clearcutting units and other authorized clearings, except on
constructed tractor roads or landings, unless there is written agreement that residual timber will not be damaged materially by such use.

20. **Protection of Streamcourses.** The NFF’s Operations shall be conducted to prevent debris from entering streamcourses, except as may be authorized under paragraph (d). In event the NFF cause(s) debris to enter streamcourses in amounts that may adversely affect the natural flow of the stream, water quality, or fishery resource, the NFF shall remove such debris as soon as practicable, but not to exceed 2 days, and in an agreed manner that will cause the least disturbance to streamcourses.

   a) Culverts or bridges shall be required on Temporary Roads at all points where it is necessary to cross Streamcourses. Such facilities shall be of sufficient size and design and installed in a manner to provide unobstructed flow of water and to minimize damage to streamcourses. Trees or products shall not be otherwise hauled or yarded across streamcourses unless fully suspended.

   b) Wheeled or track-laying equipment shall not be operated in streamcourses, except at crossings agreed to by the NFF and the Forest Service or as essential to construction or removal of culverts and bridges.

   c) Flow in streamcourses may be temporarily diverted only if such diversion is necessary for the NFF’s planned construction and Forest Service gives written authorization. Such flow shall be restored to the natural course as soon as practicable and, in any event, prior to a major storm runoff period or runoff season.

21. **Erosion Prevention and Control.** The NFF’s operations shall be conducted reasonably to minimize soil erosion. Equipment shall not be operated when ground conditions are such that excessive damage will result. The NFF shall adjust the kinds and intensity of erosion control work done, to ground conditions and weather conditions and the need for controlling runoff. Erosion control work shall be kept current immediately preceding expected seasonal periods of precipitation or runoff.

   Prior to periods of accelerated water runoff, especially during the spring runoff and periods of heavy rainfall, the NFF shall inspect and open culverts and drainage structures, construct special cross ditches for road runoff, and take other reasonable measures needed to prevent soil erosion and siltation of streams. Unless otherwise agreed in writing, the NFF shall complete erosion prevention and control work, including streamcourse protection, within 15 calendar days after completion of skidding and/or yarding operations for each landing.

   Designation of on the ground work shall be done as promptly as feasible unless it is agreed that the location of such work can be established without marking on the ground. During periods of accelerated water runoff, especially during the spring runoff and periods of heavy rainfall, the NFF shall inspect and open culverts and drainage structures, construct special cross ditches for road runoff, and take other reasonable measures needed to prevent soil erosion and siltation of streams. When operations are active, erosion control work will be kept current and will be completed as soon as practicable.

22. **Protection of Improvements.** So far as practicable, the NFF shall protect specified roads and other improvements (such as roads, trails, telephone lines, ditches, and fences):

   a) Existing in the operating area,

   b) Determined to have a continuing need or use, and

   c) Designated on the Map.
The NFF shall keep roads and trails needed for fire protection or other purposes and designated on the Map reasonably free of equipment and products, slash, and debris resulting from the NFF’s operations. The NFF shall make timely restoration of any such improvements damaged by the NFF’s operations and, when necessary because of such operations, shall move such improvements.

23. **Meadow Protection.** Reasonable care shall be taken to avoid damage to the cover, soil, and water in meadows shown on the Map. Vehicular or skidding equipment shall not be used on meadows, except where roads, landings, and tractor roads are approved. Unless otherwise agreed, trees felled into meadows shall be removed by endlining. Resulting logging slash shall be removed where necessary to protect cover, soil, and water.

24. **Wetlands Protection.** Wetlands requiring protection under Executive Order 11990 are shown on the Map. Vehicular or skidding equipment shall not be used in such wetlands, except where roads, landings, and tractor roads are approved.

25. **Temporary Roads.** As necessary to attain stabilization of roadbed and fill slopes of temporary roads, the NFF shall employ such measures as outsloping, drainage dips, and water-spreading ditches. After a temporary road has served the NFF’s purpose, the NFF shall give notice to the Forest Service and shall remove bridges and culverts, eliminate ditches, outslope roadbed, remove ruts and berms, effectively block the road to normal vehicular traffic where feasible under existing terrain conditions, and build cross ditches and water bars, as staked or otherwise agreed to. When bridges and culverts are removed, associated fills shall also be removed to the extent necessary to permit normal maximum flow of water.

26. **Temporary Roads to Remain Open.** All bridges and culverts shall remain in place and ditches shall not be eliminated on Temporary Roads, shown as “Remained Open on the Map. All drainage structures shall be left in functional condition.

27. **Landings.** After landings have served the NFF’s purpose, the NFF shall ditch and slope them to permit water to drain or spread. Unless agreed to otherwise, cut and fill banks around landings shall be sloped to remove overhangs and otherwise minimize erosion.

28. **Skid Trails and Fire Lines.** The NFF shall construct cross ditches and water-spreading ditches on tractor roads and skid trails, where needed to prevent erosion. By agreement, the NFF may use other comparable erosion control measures, such as backblading skid trails, in lieu of cross ditching.

29. **Current Operating Areas.** Where logging, road construction, or other stewardship project work is in progress but not completed, unless agreed to otherwise, the NFF shall, before operations cease annually, remove all temporary log culverts and construct temporary cross drains, drainage ditches, dips, berms, culverts, or other facilities needed to control erosion. Such protection shall be provided, for all disturbed, unprotected ground that is not to be disturbed further prior to end of operations each year, including roads and associated fills, tractor roads, skid trails, and fire lines. When weather permits operations, the NFF shall keep such work on any additional disturbed areas as up to date as practicable.

30. **Erosion Control Structure Maintenance.** During the period of this Stewardship Agreement, the NFF shall provide maintenance of soil erosion control structures constructed
by the NFF until they become stabilized, but not for more than one year after their construction.

31. Slash Disposal. The NFF’s timing of product removal and preparatory work shall not unnecessarily delay slash disposal. Specific slash disposal measures to be employed by the NFF are stated in Appendix E.

32. Fire Precautions and Control.
   a) Plans. Prior to initiating the NFF’s operations during Fire Precautionary Period, the NFF shall file with Forest Service a Fire Prevention and Control Plan providing for the prevention and control of fires on the Stewardship Project Area and other areas of the NFF’s Operations. Such plan shall include a detailed list of personnel and equipment at the NFF disposal for implementing the plan.

   b) Fire Precautions. Specific fire precautionary measures listed in this Appendix shall be applicable during the NFF’s Operations in “Fire Precautionary Period” described. The dates of Fire Precautionary Period may be changed by agreement, if justified by unusual weather or other conditions. Required tools and equipment shall be kept in serviceable condition and immediately available for fire fighting at all times during the NFF’s operations in Fire Precautionary Period.

   c) Substitute Precautions. The Forest Service may authorize substitute measures or equipment, or waive specific requirements by written notice, if substitute measures or equipment will afford equal protection or some of the required measures and equipment are unnecessary.

   d) Emergency Precautions. The Forest Service may require the necessary shutting down of equipment on portions of the NFF’s Operations, as specified by the emergency fire precautions schedule. Under such conditions, after the NFF cease(s) active operations, the NFF shall release for hire by Forest Service, if needed, the NFF’s shutdown equipment for fire standby on the Stewardship Project Area or other areas of the NFF’s Operations and personnel for fire standby or fire patrol, when such personnel and equipment are not needed by the NFF for other fire fighting or protection from fire. Equipment shall be paid for at fire fighting equipment rates common in the area or at prior agreed rates and, if the NFF request(s), shall be operated only by personnel approved by the NFF. Personnel so hired shall be subject to direction and control by Forest Service and shall be paid by Forest Service at fire fighting rates common in the area or at prior agreed rates.

   e) Fire Precautionary Period and Fire Precautions. Specific fire precautionary measures are set forth below. Upon request of Forest Service, the NFF shall permit and provide an individual to assist in periodic testing and inspection of required fire equipment. The NFF shall promptly remedy deficiencies found through such inspecting and testing.

37. Fire Control. The NFF shall, both independently and in cooperation with Forest Service, take all reasonable and practicable action to prevent and suppress fires resulting from the NFF’s Operations and to suppress any forest fire on Stewardship Project Area. The NFF’s independent initial fire suppression action on such fires shall be immediate and shall include the use of all necessary personnel and equipment at the NFF’s disposal on Stewardship Project Area or within the distance of Stewardship Project Area.
a) **The Partner's Reinforcement Obligations.** Whenever an Operations Fire or Negligent Fire, whether on or off Stewardship Project Area or any other forest fire on Stewardship Project Area, has not been suppressed by initial action and appreciable reinforcement strength is required, Forest Service may require further actions by the NFF until such fire is controlled and mopped up to a point of safety. Such actions may include any or all of the following as necessary to fight such fire:

33. **Temporary Roads and Skid Trails.** The NFF shall locate Temporary Roads and Skid Trails on locations approved by the Forest Service. Such location shall include the marking of road centerline or grade-line and the setting of such construction stakes as are necessary to provide a suitable basis for economical construction and the protection of National Forest lands.

Temporary road surface width shall be limited to truck bunk width plus four (4) feet, except for needed turnouts which shall not exceed two (2) times the bunk width plus four (4) feet. If shovels or cranes with revolving carriage are used to skid or load, temporary road surface width equal to track width plus tail swing shall be permitted. As necessary to attain stabilization of roadbed and fill slopes of Temporary Roads, the NFF shall employ such measures as outsloping, drainage ditches, and water-spreading ditches.
APPENDIX B: Cottonwood Creek Watershed Project Area Map
APPENDIX C: Cottonwood Creek Watershed Project Design Map

Cottonwood Creek Restoration Design Project
FY22
Caddo-LBJ
National Grasslands

Project Area Statistics
Desired Future Vegetation:
190.3 acres Wet Sedge-Pecan Savanna
702.9 acres Dry Oak Savanna

Eastern Redcedar Removal:
X acres

Legend:
- Dam structure
- Wetland
- Research Natural Area
- Upper Cottonwood Creek Watershed
- Restoration Project Areas
- Wet Sedge-Pecan Savanna
- Tallgrass Prairie
- Dry Oak Savanna
- Llano Grassland Allotments

Version 20220628a RAS
1:35,000
LBJ Prairie Savanna Restoration Project

Environmental Assessment
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Purpose and Need

Introduction

We are proposing changes to our adaptive management strategy to accelerate the transition of degraded lands and streams to properly functioning and healthy prairies, savannas, and streams across the whole LBJ National Grassland. Expanding and emphasizing applications of natural processes, namely fire and grazing, that historically drove ecosystems would form the backbone of the system. We would use herbicides and mechanical tools (hand and machinery) where needed to complement, but not replace, the beneficial effects of fire and grazing. Additional management actions we would take include soil conservation practices, improvements for managing livestock, and stream improvements for fish and wildlife.

Background and Existing Condition

The LBJ National Grassland units are within the Cross Timbers ecoregion on clay and sandy soils. Historically, sandy soils were mostly occupied by a savanna of post oak and blackjack oak. Tree canopies were spaced apart so that the canopy covered only ten to fifty percent of the ground. The understory was dominated by a continuous layer of tall grass species, mostly little bluestem and Indiangrass. Clay soils were occupied by tallgrass prairies with almost no tree cover except near perennial streams (Dyksterhuis 1946, 1948). Prior to European settlement the Cross Timbers Ecoregion was a disturbance-maintained system driven by landscape-scale fire and grazing by large herbivores. A pre-European fire frequency of about 2 to 5 years and regular grazing suppressed woody species and invigorated herbaceous prairie species.

Historically, fires of various size and intensities burned across the project area. These fires were either purposefully started by Native Americans, or lightning-caused. Fires returned to each area on an average of two to five years.

Intense grazing by bison and other native herbivores would follow the initial regrowth of plants after each fire; but after the first growing season, subsequent grazing would be light or none until the next fire.

This relationship between fire and grazing created a variety of habitats for plants and animals that shifted across the landscape over time. Depending on time since the last fire-grazing event, vegetation could be uniformly short like a lawn, dominated by wildflowers with little grass, or dominated almost exclusively by two- to four-foot tall grasses.

The fire-grazing relationship was the major force in shaping and maintaining vegetation in uplands.

As European Americans settled the region in the 1800s the bond between fire and grazing was broken. Grazing occurred without fire almost continuously (without rest) by domestic livestock.

Lands quickly degraded as a result of European-American activities. Soils were severely eroded wherever they were tilled and remaining savannas grew into briar-oak thickets. Over time, eastern red cedar, which is not native to this ecosystem, spread into the prairies and woodlands to become a dominant force in the vegetation. Cedar can out-compete and eventually displace a diversity of trees, grasses, and forbs creating a monoculture of cedar; decreasing habitat suitability for native wildlife. Cedar also reduces water availability.

Now, much of the project area is in a degraded state. Oak savannas have degraded into brush and briar thickets. In some places prairies have lost most of their topsoil to erosion, and in other places mesquite...
and honey locust are encroaching. Cedar is encroaching into all areas – prairies, woodlands, and streamsides. It already dominates many sites. Most streams are incised; eroded and cut down sharply past their original stream channel.

**Purpose and Need**

**We need to restore degraded lands and streams to benefit present and future generations.**

Degraded streams do not store and supply as much clean water as streams in good condition; vegetation that has deviated from its historical composition becomes poor habitat for the native plants and animals. Forage for livestock is lower quality and less abundant in degraded rangelands.

Restored lands and streams provide many enhanced benefits, including: optimal habitat for wildlife and game, sustainably produced agricultural products in the form of grazing livestock, more and cleaner drinking water, and better looking landscapes for recreational users.

Our goal is to move these unique ecological systems toward the desired future condition described in the forest plan; restoring the functionality of soil, vegetation, fire, and other resources that comprise the cross timbers ecoregion.

**The desired vegetation types on sandy soils are oak-tallgrass savannas.**

These areas should closely resemble the pre-settlement composition of the Western Crosstimbers (Dyksterhuis 1948). Trees should have canopy cover from ten to fifty percent in these areas. This usually translates to a spacing between tree trunks of about sixty to one hundred feet, depending on soil productivity. Post oaks should dominate tree species with Blackjack oak being sub-dominant. Other trees native to the cross timbers should be present in minority proportions. These include bumelia, sumac, plum, and elm. Lower portions of trees, about zero to eight feet high, should be clear of lateral branches or any other eye-level visual obstructions other than tree trunks. There should be few to no eastern red cedar trees.

The understory should be mostly free of woody species and should be prairie-like in an almost continuous layer of grasses and herb-like plants. Little bluestem should dominate this layer. Other plants include indiangrass, big bluestem, side oats grama, dropseed, Texas wintergrass, sunflower, asters, western ragweed, and daisies.

**Figure 1. Photos showing desired future vegetation: Oak-tallgrass savannas on sandy soils (top), and tallgrass prairies on clayey soils (bottom). Location: LBJ Allotment 71. Photo by Reese Sewell.**
LBJ Administrative Area
Desireable Cover Type
based upon SSURGO Soils.

Figure 2. Vegetation potential based on soil type (see also Desired Vegetation Classification at the beginning of appendix B for more detail)
The desired vegetation types for clayey soils are tallgrass prairies. These areas should closely resemble the pre-settlement composition of the Grand Prairie (Dyksterhuis 1946). Woody trees and brush should occupy less than ten percent of the total area. The rest should be a prairie dominated by tallgrasses. Little bluestem should be dominant with indiangrass, switchgrass and big bluestem as subdominants.

Herb-like plants should be common and even dominate at times according to the fire - grazing cycle. Such plants include sunflower, coneflower, prairie clover, and evening primrose.

The desired vegetation types should cycle in patches over time across the project area as a result of fire and grazing.

The project area should be portioned into logical burn units. Each burn unit should be treated with prescribed fire and followed by intense prescribed grazing. Each unit should be burned repeatedly every two to five years. This should mimic the fire - grazing relationship that occurred in pre-settlement times.

Grazing may occur in years outside of the year burned, but grazing prescriptions should focus on recovery of desired plants and accumulation of fuel for the next planned fire. This may mean that we permit only light grazing in the second year, and only light or moderate grazing in the following years until the next fire. Our actual grazing prescriptions should be continuously adapted to fit the environment, the needs for other land restoration activities, the needs for wildlife habitat, and the sustainable, multiple use of forage.

We should eventually divide some larger range allotments into multiple burn units with livestock allowed to free range from one burn patch to the next. This allows us to create a patchwork of different habitat types in large range allotments instead of just one uniform habitat; which should greatly benefit wildlife conservation efforts. This “patch-burn grazing” strategy would not take priority over our initial restoration treatments that are more effectively done on larger scales; and would not impact appropriate restoration treatments occurring in other allotments (Fuhlendorf and Engle 2001).

The desired condition for streams is that they are restored to their original stream beds. Streams should have a relatively narrow but deep channel that is adjacent to a wide floodplain. Both should be on the same level as the original streambed.

Large woody debris should be abundant in and around the stream. This helps reinforce the stream bed and make it resistant to erosion – much like rebar in concrete. Also, woody debris helps slow down stormwater flows, preventing erosion.
Beaver should be present and active in perennial streams as well as some springs and intermittent streams. A community of plant and animal species native to local streams and streamsides should be present in healthy populations.

Figure 4 shows a photo of a stream on private land in Wise County that is representative of all these features.

**We have been working to restore these lands, but it hasn’t been enough.**

**Vegetation:**

We have been using frequent prescribed fire combined with prescribed grazing to restore some of these lands, but only about 25 percent (5,000 acres) of the whole LBJ has received combined treatments. Our treatment results have been very good.

We have been using prescribed grazing without fire on 50 percent (10,000 acres) of the whole area. Results here are mixed. In wooded and cedar-infested areas, grazing without fire has little effect. In open prairie areas, grazing without fire does improve and maintain the health of many of the prairie species, especially the dominant grasses. However, the results are not as effective as they could be if prescribed fire were also used.

There has been no fire or grazing on 25 percent of the project area, and as a result, this area is the most ecologically compromised. Lack of management is due mostly to the lack of critical fire and grazing infrastructure, like fences and firelines.

*Prescribed fire and grazing treatments need to be scaled up and applied to the whole project area (about 20,000 acres) to successfully restore it.*

**Streams:**

A number of earthen structures such as dams and terraces have been constructed over the past sixty years to stop erosion. They have largely stopped a lot of the progression of gullies. However, most streams remain as gullies and we need to take the next step to restore them to their original stream beds.

*We need to restore degraded streams to their original stream beds.*
How we have handled environmental documentation has hindered progress on the ground.

Many laws and regulations govern the process of land management activities on federal lands. Though the intent of them is good, adhering to such laws and regulations takes a lot of upfront planning and analysis to cover all foreseeable consequences of all needed actions.

Much of the documentation was pieced together as available manpower allowed. At the time, this allowed us to move forward in at least some areas. New analysis and documentation was required each time work was planned for a new area. Meanwhile, old environmental documents needed review and replacement. Not all documents authorized the same activities. Some activities were not covered at all due to the extra work involved in their authorization; such was the case with using herbicides.

All these layers of environmental documentation (or lack of documentation), have created uncertainty and hesitation for our personnel charged with implementing projects. This has made it difficult to efficiently and effectively implement the various management actions. Progress on the ground has been slow and limited in scope as a result.

We need to develop a unified management strategy for the entire project area.

Forest Plan Direction

According to the 1996 Revised Land and Resource Management Plan for the National Forests and Grasslands in Texas (the Plan), the project area lies within Management Area 3 (MA-3), Grassland Ecosystems; and Management Area 4 (MA-4) Streamside Management Zones; with small areas of Management Area 8a (MA-8a), Research Natural Areas; and Management Area 8d (MA-8d), Natural Heritage Areas.

MA3: Grassland Ecosystems

Desired Future Condition

Most of the area will be viewed as a grassland landscape interspersed with woodland savannahs on uplands with forested woodlands occupying bottomlands and drainages. Grasslands will occupy at least 60 percent of the area. Existing bottomland hardwoods and woodlands lining streams and lakes will provide wildlife habitat and soil and water protection. Brush or short, woody vegetation will be dispersed across the prairie, providing wildlife habitat and vegetative diversity. Both native and long-established desirable non-native plant communities will exist, however, these areas will slowly revert to the native perennial grasses.

MA4: Streamside Management Zones

Desired Future Condition

This management area provides contiguous and diverse habitat for riparian area and wetland dependent species. Stream channels will remain stable providing suitable water quality. Limited manipulation of vegetation will filter sediment, thus maintaining aquatic habitat for those dependent species. Vegetation left within the management area will provide a continuous source of organic matter which contributes to the soil building process.
MA8a: Research Natural Areas

Cross Timbers Research Natural Area, 370 Acres, Allotment 31
The Cross Timbers Research Natural Area (RNA), located on the Lyndon B Johnson (LBJ) National Grassland in Wise County, was established in 1977. The RNA lies in the Western Cross Timbers Ecological Region. National Forests and Grasslands in Texas (NFGT) limestone mesa and cross timbers landtypes are found in this RNA. Three Texas Natural Heritage Program (TNHP) exemplary plant communities (Bluestem Tallgrass Prairie, Western Post Oak-Blackjack Oak Woodland, and Texas Oak Woodland) are found in the area.

Desired Future Condition
Plant and animal communities native to the area evolve with little or no impact from humans. The forest and woodlands you see appear as a mix of many species of some young, but primarily old trees. You also see areas of native tallgrass prairie. Late seral or climax plant communities predominate.

While traversing the RNA, you will not see any programmed timber harvest, extraction of locatable minerals, or construction of new roads, trails or other facilities. Where the Cross Timbers RNA Establishment Report determined prescribed burning or grazing is needed to establish or maintain vegetative communities, you may see these activities. You may see oil and gas operations nearby that do not involve surface occupancy within RNAs, due to private ownership of the underground minerals.

MA8d: Natural Heritage Areas
- Bald Knob Hill, 33 acres, Allotment 32
- Pecan Creek Mesa, 30 acres, Allotment 31
- Post Oak Ridge, 88 acres, Allotment 02
- Pringle Creek, 93 acres, Allotment 03

Management Emphasis
In these areas, the natural disturbance effects of fire, weather, and erosive action should be allowed to work unimpeded. Some active management, in addition to natural processes, will be used for maintenance or to speed up needed restoration.

Allow frequent fire return intervals to enhance the species composition of fire maintained communities. Fires should be allowed to burn throughout the area, and not limited to specific sites, to allow natural plant community variability and ecotones to reestablish.

Public Involvement
We conducted public scoping beginning on January 19, 2017. We sent 124 emails; mailed 46 letters, and hand delivered 1 letter to potentially interested individuals, groups and organizations; and consulted with the Caddo Nation. We received 15 responses to scoping; 12 from individuals, 2 from organizations, and 1 from a federal agency. We also conducted a field trip for interested parties to the project area on March 3, 2017 in which six people attended, and May 4th, 2017 in which five people attended.

Our interdisciplinary team considered the scoping comments in their analysis, and they analyzed those comments related to resource concerns in their specialist reports which are included in the project record.
Public Concerns
From the public comments, the ID Team identified concerns that are related to fulfilling the purpose and need, and are addressed in this environmental analysis, including:

- Using lightning-caused fires to meet resource objectives in order to most closely approximate historical conditions.
- Analyzing the safety and efficacy of available and appropriate tools to control invasive species (herbicides, cattle, sheep and goats).
- Obliterating and barricading roads that are no longer needed because of the environmental impacts of OHVs.
- Minimizing fireline construction in riparian zones to protect these sensitive areas.
- Developing and using appropriate resource indicators and units of measure for analysis, monitoring and adaptive management.
- Analyzing and managing the effects of livestock on riparian areas to prevent degradation.
- Contacting adjacent landowners regarding their management activities, which could contribute to cumulative effects.

Alternatives Considered but Eliminated from Analysis
The Forest Service must consider an alternative that prohibits livestock grazing.
An alternative to managing and restoring lands in the project area with no grazing by livestock was considered. But, the weight of scientific evidence suggests that grazing by large herbivores, in combination with fire, is necessary for achieving desired vegetation conditions and cannot feasibly happen without it on a project of this scale. Therefore, a no-grazing alternative was eliminated from analysis.

The Forest Service should consider an alternative that emphasizes mechanical and herbicide treatments over prescribed fire.
This ecosystem was historically fire-adapted, and the vegetation in large part fire-dependent. Because this is a restoration project, one of our primary purposes is to reintroduce fire on an ever-increasing scale into this ecosystem. Therefore, reducing or eliminating the role of fire as a tool does not meet the purpose and need for this project.

The Forest Service should consider an alternative using bison and other native herbivores for grazing rather than cattle.
Ecologically, there is little difference in the grazing habits of bison and domestic cattle other than in the summer due to differences in their ability to thermoregulate (Dwayne Elmore, personal communication 2018).

Bison are categorized as livestock. Therefore, if a permittee proposed grazing bison, we would take that opportunity to develop an allotment management plan to use bison as an ecosystem management tool within the adaptive management framework of this project. At this time, there are no bison grazed on the LBJ National Grassland.

While bison and other native herbivores were the grazers on the historical landscape, restoring them to the project area specifically as a management tool is beyond the scope of this analysis.

Therefore, an alternative that considers bison rather than cattle as the primary grazer will not be considered in detail.
Alternatives

No Action
If no action is taken, then existing management practices would persist across the project area.

Proposed Action
We are proposing activities that would move the unique ecological systems of Oak-tallgrass Savanna, Tallgrass Prairie, and their embedded stream management zones toward the desired future condition described in the forest plan.

While we cannot return these areas to their truly original pre-European settlement states, we can rehabilitate these areas by restoring and maintaining the functionality of the ecosystem using natural and technical tools; primarily fire and grazing, mechanical vegetation treatment, herbicides, and constructions such as artificial beaver dams and stormwater diversion structures.

We would use a long-term adaptive management system to achieve and maintain our desired condition for these National Forest System lands. See appendix B for decision processes of the adaptive management strategy.

Prescribed Fire, Fireline and Fuelbreaks
Prescribed fire is the most important tool for restoring and maintaining desired conditions. We have used it extensively in the past, though more is needed. To achieve our initial restoration objectives, we would burn units every 1-3 years. For maintaining units that are in good condition, we would burn once every 2-5 years, depending on vegetation conditions. Fire intensity is also important; with poor condition units generally needing hotter, more intense fires than ones in good condition. We would follow the conditional decision processes (Appendix B) for classifying burn units and determining objectives for the prescribed fire program.

We would prepare site-specific burn plans in accordance with established regional and forest policies and parameters (The Plan, pages 63-64).

Prescribed Fire
We would burn up to 9,000 acres per year as allotments are initially treated and brought online for regular prescribed fire management. This frequent fire cycle would help control small hardwoods and shrub species, providing the opportunity for grasses and other herbaceous species to become established and flourish.

Wildfire as a Management Tool
We may manage wildfires caused by lightning or other non-human sources to achieve multiple objectives. Under the right conditions, we can achieve the same objectives for land management as with prescribed fire (above) while also protecting life and property. We would evaluate the conditions of each suitable ignition to determine feasibility and safety before making the decision to proceed. We would adhere to Forest Service directives (FSM 5140) for managing these kinds of fires.

Firelines
We may vary prescribed burning cycles based on availability of resources and favorable fire weather. Prescribed burning would use firelines and natural fuel breaks, and hand and aerial ignition techniques. In
order to keep the prescribed fire within these units, we would need to establish some new firelines and access gates. We may establish new firelines by blading, plowing, or by hand.

We would expand the mileage of firelines by about 2 to 5 miles per year until all prescribed burn units are established (over approximately 10 years); and maintain all firelines to allow for prescribed burning. Firelines will be 30 feet wide but may extend up to 90 feet only where needed for turnaround spots for fire engines. Maintenance includes but is not limited to, brush mowing and other mechanical treatments with wheeled tractors to keep the fireline clear of woody species; work with wheeled or tracked tractors to repair or reestablish erosion control and stream crossing structures; and reestablishment of firelines rights-of-way with wheeled or tracked tractors.

Firelines in Riparian Areas

Firelines within riparian areas would be constructed by hand or with non-soil disturbing mechanical equipment that can treat the necessary vegetation without actually setting foot, so to speak, in the stream management zone. E.g., tracked excavator with a mulching attachment on a boom that reaches the vegetation from the extension of the boom while not tracking into the stream management zone.

Fireline Crossing Intermittent or Perennial Streams

Where there is an absolute need for fireline to cross intermittent or perennial streams (number intermittent, number perennial) (Figure 5), we would create permanent stream crossings which we would use repetitively to limit disturbance by prescribed fire activities in riparian zones. Where possible, we would use existing crossings such as roads. Where we would need to construct crossings, we would use heavy equipment, and if necessary armor them with a hard substrate such as large gravel. Where appropriate, we would install culverts over intermittent and ephemeral streams to prevent stream channel erosion; and where applicable, to facilitate aquatic organism passage (see also Fish Passage and Stream Restoration). Eyebrow terraces, water bars, and seeding would be also be used to prevent erosion. All stream crossings would be planned and implemented under the supervision of the Forest fisheries biologist. See appendix B for conditional decision processes for constructing designated stream crossings.

Fuelbreaks

We would create and maintain a 200-foot wide fuelbreak from the fenceline inward around each unit's perimeter, excluding primary stream management zones. Panhandle and irregular sections may be wider than 200 feet but not more than 350 feet. All woody vegetation would be removed at ground level using wheeled tractors, skid-steer loaders, or by hand. To keep out woody vegetation, we would maintain these fuelbreaks through brush mowing, disk and herbicide use. These fuel breaks would facilitate prescribed burning while providing grassland and forb enriched corridors for wildlife. Fuelbreaks would not encroach into streamside management zones.

The debris from the fuelbreaks would be chipped in place, or piled using heavy equipment, in designated areas for burning. These debris piles would be burned with the following conditions: soil is moist, piles are the ignition sources, piles are small (approximately 15 feet long by 12 feet wide by 6 feet high) and the burn area is seeded after burning.
**Prescribed Grazing**

We use prescribed livestock grazing as a surrogate for historical bison grazing to maintain and restore herbaceous species composition and structure in prairies and savannas. We can manage many invasive weeds with prescribed grazing, including *sericea lespedeza* and Johnsongrass. Many native wildlife
species depend on habitat created by large domestic herbivores like cattle. For example, bobwhite quail, a management indicator species for the district, need multiple herbaceous habitats of varying heights and densities that can only be created by large herbivores.

**Mechanical Vegetation Treatment**

Some hardwood and cedar stands are too dense for prescribed fire to be effective. In these instances, we would use mechanical or herbicide treatment, or both, to reduce overstory canopy and increase herbaceous fine fuel layers. Once we have reduced stand densities mechanically, we should be able to incorporate these stands into the prescribed fire regimen.

We would mow brush to reestablish open grassland areas. Cedar would be cut, sheared, mulched, or chipped. We would leave any mulched or chipped material on ground. We may have cedar cut or sheared with wheeled-tractors or skid-steer loaders, except in primary streamside management zones (33 feet for ephemeral streams and 50 feet for intermittent and perennial streams). We would cut cedars by hand in primary streamside management zones. Any cedars cut may be left to lie, lopped and scattered, girdled, piled and burned, advertised for firewood, or sold as a special forest product, such as posts.

We would construct fuelbreaks up to 200 feet wide from the inside edges of firelines along the perimeter of fire management units. Trees and brush within fuelbreaks would be removed or chipped onsite to quickly restore prairie and savanna, increase efficacy of prescribed burns, and treat fuels in wildland urban interface for wildfire protection.

**Fish Passage**

There are culverts blocking fish passage. We would begin replacing these with bottomless arches as funding allows.

**Stream Restoration**

**Stormwater Diversion Structures**

The district is comprised mostly of highly erodible soils. Soil erosion is a large problem that requires lots of money to fix. Large, unnatural gullies are endemic throughout the district due to past agricultural practices (Figure 8). Some are 40-50 feet deep and actively eroding. To date, many soil conservation structures have been built and have successfully warded off further erosion. But many more are needed.

We would build structures to divert water where necessary to prevent further soil erosion throughout the project area. Examples include barriers on cattle trails and earthen eyebrow terraces around headcuts.
There are miles of gullied streams in the project area. In consultation with the forest fisheries biologist, we would use heavy equipment (such as reaching machinery that can operate no-touch from a static position and low-weight skidsteers on rubber tires or rubber tracks) to strategically construct stream restoration structures with natural materials, including undesirable vegetation (such as cedar) cut from adjacent streamside management zones. See the aquatic resources design criteria and the effects related to aquatic resources section for more information.

Natural and Artificial Beaver Dams

Beavers naturally speed up the restoration of degraded streams as their dams catch sediment, raise groundwater levels, increase vegetation, and over time eventually raise the whole stream bed back to its original level. Beavers are present and active in some of the project area. We would survey beaver populations to identify areas where they could be reintroduced.

Some streams are intermittent or have too much stormwater flow for beavers. In these streams, we may construct artificial beaver dams (Figure 7) to mimic the benefits of natural beaver dams (Pollock et al. 2014). These structures would be built with local woody materials by hand or with machines.

Gullied streams would be restored in phases beginning with the areas where there would be the greatest benefit and as funding allows.

Figure 7. Artificial beaver dam made from pounded posts woven with brush (Utah State University)
Livestock Water Development

We would rehabilitate old water tanks and windmills as watering sources for livestock and create new sources as necessary to optimize livestock operation effectiveness and achieve multiple-use and natural resource management objectives. This would help move livestock away from impoundments and stream management zones.

Water Impoundments

We need to manage existing impoundments. The water impoundments were built a number of years ago as a way to stop erosion gullies caused by historical cultivation. These impoundments worked, and have silted in to the point where they are now wetlands. We do not propose to manipulate them in any way other than planting native wetland herbaceous species such as switchgrass; and reclassifying them as wetlands, so we can manage them appropriately.
Fences, Gates and Livestock Handling Facilities
The project area has approximately 400 miles of livestock fences. About half are in poor or critical condition and need immediate reconstruction. The rest will need repair and phased-in reconstruction as fence materials age.

We would construct and remove fences as needed to optimize effectiveness and efficiency of livestock operations and to achieve multiple-use and project management objectives. We would also construct and remove handling facilities as needed, such as corrals, pens, and traps, to meet these objectives.

We would build, reconstruct, and maintain 2 to 5 miles of allotment perimeter fence per year, and remove all interior fence over the next 20 years to allow grazing as a vegetation management tool to restore and maintain native grassland ecosystems; increasing biodiversity and plant community structure which is beneficial to prairie restoration and wildlife. Maintenance includes but is not limited to, brush mowing and other mechanical treatments with wheeled tractors to keep the fenceline clear of woody species; replacing broken, aged, or decayed fence materials; using wheeled or tracked tractors to repair or reestablish erosion control and stream crossing structures; reestablishing fenceline rights-of-way with wheeled or tracked tractors; and reconstructing whole fencelines with new materials.

We would install metal and timber kissing gates along the fencelines where we need access for prescribed burning, grazing, and general use.

Rangeland Seeding
Some native prairies and savannas have low herbaceous species diversity and need seeding from outside sources. We may select some plant species for propagation or seeding due to overall rarity, lack of abundance in a particular plant community (i.e. Tallgrass Prairie endemics), or because they benefit a specific wildlife species (i.e. milkweed seed collected, grown, and planted to benefit monarch butterflies).

We may seed rangelands to select native prairie species to optimize our restoration objectives. We may do this throughout the project area. We would prepare seedbeds for planting, at opportune times such as after a burn, with a harrow. We may use rangeland or no-till drills to plant seed, or we may broadcast seed into receptive seedbeds after a burn or similar opportune times.

Herbicide Use
We would use herbicides to maintain fencelines, firelines, and wildland-urban interface (WUI) fuelbreaks. We would also use herbicides selectively on black locust, honey locust, mesquite and sumac throughout the project area.

All herbicide use would be in accordance with forest plan direction and the 2008 Nonnative Invasive Plant Species Environmental Assessment.

Nonnative Invasive Plant Species Management
We would monitor the project area for infestations of nonnative invasive plant species during and following implementation of the proposed activities. Monitoring would conform to that which is being conducted as part of the Plan direction and 2008 Nonnative Invasive Plant Species Environmental Assessment (EA). Any nonnative invasive plants discovered would be removed following direction in the Nonnative Invasive Plant Species EA. We would conduct inventories for new infestations as a result of the proposed activities during the growing season by qualified invasive species personnel on the National Forests and Grasslands in Texas.
Native Ecosystem-invasive Vegetation, including Eastern Red Cedar

Honey locust is native and would be left untreated, along with other native woody species, where it falls within the range of desired future conditions. Outside of this, we would treat it with herbicides and other methods to achieve the desired future condition. Black locust is native to North America, but outside of its historic range here. It was planted throughout the Great Plains as fuel wood. Unfortunately, it has invaded many grassland ecosystems, including the project area. As such, we would manage black locust as a non-native invasive species.

Eastern red cedar, while a regional native species, is not native to this particular ecosystem based on historical accounts\(^1\). It has encroached over time, primarily due to fire suppression. We propose to minimize eastern red cedar in the project area. Some will remain due to its abundance and difficulty to treat in some areas.

In upland areas, we would cut or shear eastern red cedar with implements on wheeled tractors or skid-steer loaders. Depending on probability of consumption during a prescribed burn, each cut cedar tree may be left to lie; mulched in place, or piled in designated burn areas. Other pile and burn areas may be created in the interior if the following three criteria are met: (1) multiple cedar individuals in patches, (2) cedar is 5 foot or taller, and (3) the nearest designated burn area is more than 200 feet away.

In primary and secondary stream management zones eastern red cedar would be treated several ways. We would cut some of the cedars and leave them on the ground. We would girdle some cedars and leave them as snags. In consultation with the forest fisheries biologist, we would use heavy equipment (such as reaching machinery that can operate no-touch from a static position and low-weight skidsteers on rubber tires or rubber tracks) to strategically construct stream restoration structures with natural materials, including cedar cut from adjacent streamside management zones.

See the aquatic resources design criteria and the effects related to aquatic resources section for more information.

Road Maintenance and Repair

We would maintain and repair National Forest System roads to conserve soil and water quality. The forest plan includes a range of maintenance level options, some of which include gating and administrative closure. If closing or rerouting a road is necessary, additional analysis may be needed.

The floods in the spring of 2015 washed out a culvert under National Forest System Road 900A. For safety reasons, we propose closing this road segment as part of this initial proposed action.

Off-Road Barriers

We may build barriers to prevent off-road vehicle use and the resource damage and soil erosion they cause. We would emphasize placements where they can be implemented efficiently, like openings between woodlands. We may use posts and earthen barriers as well as other natural structures. There are locations where the nature of the vegetation and terrain is such that there is no practical way to barricade

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\(^1\) Conventional wisdom among conservation professionals, teachers and researchers on crosstimbers vegetation is that cedar was not present historically and is essentially an invasive species. It is native however, so it must have been historically present in some location at some quantity. A search for cedar or juniper in The Vegetation of the Western Crosstimbers and The Vegetation of the Fort Worth Prairie yielded no results (Dyksterhuis 1948, 1946). The fact that these exhaustive monographs have no mention at all of this genera suggests that it was not present in the region, or in such small amounts as to be deemed insignificant.
the access point. While we will use physical barriers where we can, we will also use education, signage and law enforcement.

**Trail Maintenance and Repair**

Overall, the LBJ National Grasslands trail system has erosion and sediment issues, in addition to public safety and general trail maintenance concerns. Safety will be greatly improved by eliminating dangerous wash-outs for horseback riders. The main concern is to keep the trail tread from degrading from the combination of the elements and frequent equestrian use.

Trail system maintenance and repair would conserve soil and water quality. All trail management activities would occur within the established prism of the existing trails. If maintenance or repair extends outside the trail prism additional analysis would need to be completed. Management access to the trail systems would use the existing trail. See appendix C for a list of trail maintenance and repair activities.

![Figure 9. Trails](image)

**Feral Hog Control**

We would control feral hog populations by all legal means. We may rehabilitate soils disturbed by feral hogs by disk ing with a tractor and seeding to conserve soil and reestablish disturbed plants.

Design criteria and monitoring, described below, will be implemented to reduce the potential for adverse effects of the project's activities.
Design Criteria

**Air Quality**
Ensure weather conditions for favorable smoke dispersal. Identify sensitive targets.

Burn must be completed by 1 hour prior to sunset. Follow an approved burn plan.

Parameters follow Forest Service direction found in FSM5140.

**Prescribed Fire**
Prescribed fire will only be applied under an approved burning plan to meet specific resource objectives, and under the supervision of a qualified burning boss. The burning plan will plot the trajectory of the smoke plume, identify smoke-sensitive areas, predict fire behavior, and set parameters for burning conditions to minimize risk of resource damage or fire escape. Burns will not be employed if the smoke plume will impact a smoke-sensitive area, or when the mixing height is less than 1,640 feet (500 meters) and transport wind speed is less than 9 mph (4 meters/second).

The Forest Supervisor's Office, Texas Forest Service, County Sheriff's Office, Volunteer Fire Departments, and adjacent landowners will be notified prior to ignition of any prescribed burn.

**Aquatic Resources**
Manage livestock use through control of time/timing, intensity, and duration/frequency of use in riparian areas and wetlands to maintain or improve long-term stream health. Exclude livestock from riparian areas and wetlands that are not meeting or moving towards desired condition objectives where monitoring information shows continued livestock grazing would prevent attainment of those objectives.

Manage livestock through control of time/timing, intensity, and duration/frequency of use so as to allow for riparian hardwood growth extension and reproduction. Manage woody species in riparian areas to provide for stream temperature, bank stability and riparian habitat.

Avoid any loss of rare wetlands such as fens and springs.

Keep stock tanks, salt supplements, and similar features out of the primary and secondary riparian areas if practicable and out of wetlands always. Keep stock driveways out of riparian areas except to cross at designated points. Armor water gaps and designated stock crossings where needed and practicable.

Maintain the extent of stable banks and terraces, if present in each stream reach at 74 percent or more of reference conditions. Consider degree of livestock trampling and riparian vegetation utilization on or immediately adjacent to stream banks when timing livestock moves between units.

All culverts larger than “cross-drains” should be buried to be level with the stream channel to avoid head-cutting (see NFGT engineering specs). Arches and buried arch pipes are preferred over traditional round culverts, although they can work if large enough and compatible with road top-cover requirements. Bridges are the preferred means of crossing as first consideration.

Do not use National Resource Conservation Services (NRCS) flood control/multi-purpose structures. They do not meet the objectives of the Forest Service or the forest plan due to restrictions on water control structures to effect biological control of nonnative invasive species and nuisance native
vegetation species; poor maintenance record and flawed hydrologic analyses (Windmill Lake and proposed Unit 36 lake).

Use rolling dips on fire-break slopes to control drainage while maintaining navigation:

Adjust management in riparian areas and wetlands to reduce detrimental soil compaction whenever it occurs.

Establish a 100 foot buffer on each side or any riparian feature that will act as a boundary for the exclusion of any equipment or other project related activities. A 50 foot buffer may be used only as an ecological necessity to remove nuisance species, etc. Also keep in mind the “land form” of the drainage should dictate buffer width. Fifty or 100 feet may not clear a tributary valley. The floodplain “bench” should rule decisions. Any wetlands present will require a 100 foot buffer.

EXCEPTION: The need to use heavy equipment in stream management zones (SMZs) (MA-4) is endorsed as unavoidable in order to manipulate large materials in the channel and to remove non-native or invasive native woody species from stream management zones, as well as using the trees for restoration structures in the channel and stream management zone. Mitigate with reaching machinery that can operate no-touch from a static position and low-weight skidsteers on rubber tires or rubber tracks.

Refer to forest plan direction on firelines on slopes and the Forest Supervisor amendment signed by Raum/Salinas, which specified hand-clearing the last 50 feet to streams, water-barring and immediate repair of damage. Seeding should not be neglected. The proposed action incorporates these precepts.
NNIPS

Many areas are infested with non-native invasive species of concern to the National Forests and Grasslands in Texas. Prior to moving off-road equipment on and off the project area, all off-road equipment must be cleaned to prevent and/or minimize the spread of species inside and outside the project area that are currently free of infestations.

Herbicides (per NNIPS Management Plan, pages 45-47)

Standard design criteria to protect soil productivity, water quality, visuals, and other resources in accordance with standards and guides established through forest planning. These include such measures as filter strips along streams.

Mitigations inherent to the project implementation process, contracts, and related activities. For this project, these include activities such as requiring pre-work conferences to ensure that standards are understood.

Mitigations associated with project design and management prescriptions. These include forest plan or legal direction, and locally developed enhancements in excess of forest plan standards. Mitigations in this category may be developed in response to scoping issues. Site-specific mitigations such as protection of a specific sensitive plant or group of plants. For this project, sensitive plants will be protected if found in the project area.

This project incorporates all applicable legal requirements and adheres to the Forest-wide standards and guidelines (management requirements necessary for achieving goals and objectives) established in the forest plan. Forest Plan standards and guidelines are not listed here; however, mitigations that apply to this project are described in appendix F of the forest plan. These standards meet environmental protection requirements found in the State of Texas Best Management Practices.

For the proposed action and all other action alternatives, the following design criteria (1996 NFGT Land and Resource Management Plan, 1989 Vegetation Management EIS, and this NNIPS Management Plan) are incorporated to minimize adverse effects and promote safeguards:

- Forest-wide guidelines are designed to minimize adverse effects and promote safeguards (1996 NFGT Land and Resource Management Plan, pages 55–60).
Best management practices (BMPs) (1989 Vegetation Management EIS, Volume 1, Section II, pages 44–64) are designed to minimize adverse effects and promote safeguards.

The proposed herbicides would be used according to the labeling and would not accumulate in water, soils, or organisms, when used in compliance with the Forest-wide guidelines, and BMPs found in the 1989 Vegetation Management EIS, the 1996 NFGT Land and Resource Management Plan, and the NNIPS Management Plan (Appendix 5).

Herbicide usage in this project follows all standard and guideline design criteria as stated in the Final Environmental Impact Statement: Vegetation Management in the Coastal Plain/Piedmont, Volumes I and II. Examples of mitigating activities include:

- Only herbicide labeled for aquatic use is ground-applied within 30 horizontal feet, of lakes, wetlands, or perennial or intermittent springs and streams.
- No herbicide is applied within 100 horizontal feet of any public or domestic water source.
- Herbicide mixing, loading, or cleaning areas in the field are not located within 200 feet of private land, open water or wells, or other sensitive areas.

Additional standards and guidelines can be found in the Final Environmental Impact Statement: Vegetation Management in the Coastal Plain/Piedmont, Vols. I & II (VMCP/P, 1989).

In addition, the following mitigation measures would be included as part of implementation.

**General**

Prior to initiating any NNIPS control treatment projects, it would be important to check adjacent activities for activities that produce similar effects and assess whether there could be additional cumulative effects from similar actions.

**Aquatic Resources**

The following mitigation measures are applicable to herbicide use.

- Diquat, Accord, Gly-Pro, and Rodeo brands of glyphosate (aquatic labeled): Implement NNIPS treatments in stages.
- Diquat, Accord, Gly-Pro, and Rodeo brands of glyphosate (aquatic labeled): Apply NNIPS treatments during cool weather prior to spawning.
- Habitat brand of Imazapyr- for aquatic use only: Do not use anywhere near non-target plants as target plants can exude toxic levels translocated through roots. Can be persistent in soil; use minimum rate.
- Fluridone (Sonar brand for aquatic use): Breakdown influenced by light and temperature so best used during growing season.

**Heritage Resources**

- After annual review of areas identified for the application of control and/or eradication measures, mitigation of adverse effects upon archeological and historical sites would be achieved by:
  - Removing the site containing NNIPS from consideration for control/eradication actions; and/or
  - Treating only those NNIPS populations that have spread beyond documented site boundaries.
Heritage Resources

Site-specific burn plans (see the forest plan, p. 63-64) will be reviewed by the heritage staff and will follow Section 106 of the Heritage Resource Protection Act, in order to ensure that recommendations for the protection of previously recorded cultural resources are implemented prior to the maintenance (reblading) of existing firelines in or near those cultural resources. Such recommendations may include using hand-cleared firelines in lieu of mechanical blading.

If historic or prehistoric cultural resources are found during the construction or maintenance of new or existing firelines, work within the immediate vicinity of the discovery will stop and the heritage resources staff will be notified. The cultural resource will be protected until consultation between NFGT and the SHPO is completed and a treatment plan is developed and implemented.

Local Native American groups have been contacted and responses solicited concerning this project. Ongoing consultation with members of the local Native American community would aid in identification of specific locations and issues of concern. Any identified religious or sacred site would be protected in accordance with the Native American Religious Freedom Act (P.L. 95-341). Additionally, contemporarily used Native American resource areas would be identified and protected, and perpetuation of traditionally used flora and fauna encouraged by Forest Service land management.

Heritage sites located within the project area will be identified according to specifications provided in FS Manual 2309.24 and FSH 2361.28. Marked heritage sites will be avoided during mechanical fuel reduction, fence construction or removal, fire line construction, road maintenance, and other land disturbing activities associated with the proposed actions.

It is recognized heritage resources may be present in the subsurface with no surface manifestation. Therefore, if additional heritage resources are discovered during earth disturbing (e.g. timber thinning) activities, all operations must cease within a 300 ft. (100 meter) radius of the site and a forest archeologist notified immediately. Any additional heritage resources located during project implementation will be protected based on recommendations of the forest archeologist, Tribal Historic Preservation Offices, and State Historic Preservation Officer. All sites will be evaluated under the terms specified in 36 CFR 60.4 and 36 CFR 800 and applicable Forest guidelines. If a heritage resource site is damaged during project implementation, work at and within the immediate vicinity of the site will cease until a Forest Service archeologist evaluates the damage, makes stabilization recommendations, and determines what additional protective measures are needed to protect the site. Project work will not restart until authorized by the Forest Archaeologist.

No ground disturbing activity will be allowed within a 30-meter perimeter of the designated site boundary. No new road, trail or fenceline construction will be allowed within 30 meters of the site boundary. Existing roads through the site will not be improved. Heavy equipment will not drive through or park within the site boundary, except within existing road prisms. During the planning stage, all proposed road maintenance through known site areas will be checked on the ground. On-the-ground flagging of the effect through known sites will be checked and confirmed. Once confirmed, the District needs to decide which mitigative steps seem most appropriate given the spatial/vertical extent of the protected site and its historic values. Additional archeological fieldwork may be required in certain instances to address these issues. The management choices then resolve down to mitigation through data recovery versus mitigation through avoidance. The latter could include permanently capping the site (or portions thereof) that exhibits the significant historic values (i.e., site preservation).

Heritage sites with exposed burnable material will be protected by manually removing surrounding/interior fuels, foaming wooden structures, building fire lines around sites, using back-fires or
a combination of measures to be determined on-site by the Forest Archaeologist, depending on the site’s location. If no protective measures can be effectively applied, sites will be avoided during prescribed burning activities. The majority of the LBJ Grasslands Units has protected sites within the boundaries. Some pile burning may occur within or adjacent to the protected sites with coordination with the forest archeologist. A detailed information packet will be available for these fuel reduction projects, and on the ground identification of the site boundaries will be accomplished by the heritage resource staff prior to implementation. All Forest Service and out-service personnel who may be working in the area of a site will be advised that under the provisions of 36 CFR 261.9, the following are prohibited: digging in, excavating, disturbing, injuring, or destroying any archeological, paleontological or historic site; or removing, disturbing, injuring, or destroying an object in such a site.

**Facilities**

Roads will have cattle guards placed where fences and roads intersect. An 8 foot walk through gate will be placed next to the cattle guard. Trails will have walk through gates where fences and trails intersect.

**Range**

Ground disturbing activities such as installation of water developments, pipe lines, fences, stock trails or exclosures will require wildlife, heritage resource, and botany surveys prior to construction. Consultation with the soil scientist and or hydrologist is recommended for site selection and suitability, and system design.

**Roads and Trails**

All temporary roads (if any) must be revegetated according to the recommended seed mixture.

Prescribed burn plans will be coordinated with the recreation specialist in order to avoid impacts to any planned recreation activities such as equestrian trail events on the TADRA.

Prescribed burning and herbicide application schedules and locations will be displayed at trailheads, campgrounds, and other recreation focal points in a timely manner.

**Vegetation**

Backing fires would be used to protect hardwood stands or inclusions where possible.

Fire would be ignited in the uplands would enhance diversity and natural recovery, and would be allowed to extinguish naturally in moist areas.

As to not invite non-native invasive species, disking will not occur along highways or in county roads.

**Soil and Water Quality**

Existing barriers (roads, streams, permanent fire lines) are utilized whenever possible to minimize fire line construction.

During fire and fence line constructed/reconstructed, bladed lines are used to minimize soil resource damage. Blading is restricted to the 30 foot width with the exception of 90 feet at turn-around areas, which are minimized. Any holes created from unearthed trees will be refilled with soil, smoothed out, and reseeded immediately. Mowing will be used for maintenance, unless the grass is too dry and then disking at a depth of 4-5 inches will be implemented to ensure fire does not escape and grass is not killed.
Construction of water diversion devices on constructed control lines followed by prompt revegetation minimizes soil movement off site.

Post-fire monitoring determines the need for follow-up implementation of additional erosion control measures.

Permanent fire lines are constructed for those areas scheduled for more than one burn. Measures for the construction of permanent fire lines include: using bladed push lines to minimize soil disturbance, using permanent water diversions or drain dips that would withstand disking when reused; and revegetation of exposed soils.

Construction of control lines within streamside zones is kept to a minimum. Fire within these zones is limited to low intensity backing or flanking fires.

No heavy equipment will be used when the ground is wet.

**Wildlife**

Burn plans will be reviewed by the District biologist prior to implementation to ensure that all protective measures are in place and that no new information has surfaced that would require further analysis.

Limit prescribed burns and mechanical fuels treatments from April 1 to May 31 to not more than 20% of total project area to protect turkey and migratory bird nests.

Stream crossing - all measures will be used to prevent siltation and erosion to protect aquatic organisms and will be reviewed and approved by the forest fisheries biologist.

Pre-implementation surveys will be conducted prior to any mechanical vegetation treatments for active migratory bird nests. Any nests would be flagged with a 300 foot no-treatment buffer.

**Visual Resources**

Modify firing methods (backing, flanking, spot firing versus head firing). Incorporate dormant season burns.

Burn on the cooler end of the burn prescription.

Keep fire out of streamside zones or allow the fire to back into these zones. Allow fire to back into highway/road and trail corridors.

**Socioeconomic**

Adhere to smoke management requirements regarding highways. Perform public notifications per the burn plan.

Timing and scope of burns should be carefully planned to minimize impacts on forest visitors.
Environmental Consequences

This chapter summarizes the potential impacts of the proposed action, both positive and negative, as analyzed by an interdisciplinary team of District resource specialists. The analysis tiers to the Forest Plan and its Final Environmental Impact Statement (FEIS) and Record of Decision. Many of the larger-scale effects are addressed in the Forest Plan FEIS, allowing us to narrow the focus of this analysis to the site-specific effects of implementing the LBJ Prairie-Savanna Restoration Project.

This chapter focuses on the concerns raised during the Scoping period. Analyses beyond those documented here were completed to support the Responsible Official’s decisions and to ensure compliance with laws and regulations such as the Endangered Species Act, the National Historic Preservation Act, the Clean Water Act, and the National Forest Management Act. Those analyses and associated references are part of the project record and available for public review at the Caddo-LBJ Grasslands office or by request to the ID Team Leader.

Currently the only past, present, and reasonably foreseeable activities relevant to cumulative effects analysis in the project area is the Forest Plan revision, which is in development, and expected to be implemented as soon as possible.

Effects Related to Range, Soils and Hydrology Resources

Tallgrass prairie, post oak – blackjack oak savanna, streams in tallgrass prairies and oak savannas, and bottomland hardwood savannas are the historical ecosystems on the project landscape. Range, soils and hydrology resources will be measured according to indicators for each of these ecosystems.

Environmental Site Descriptions, Affected Environment

Tallgrass Prairie

Tallgrass prairie is capable of supporting significant animal, insect and plant biodiversity. Tallgrass species are found in the understory layer. Historical climax tallgrass prairie plant communities were dominated by warm season tallgrass species like little bluestem, indiangrass and switchgrass. Blackjack oak (Quercus marilandica), post oak (Q. stellata), and hickory tree species occur in some areas, but generally in moderate densities. Bison (Bison bison) were historically a dominant species.

The tallgrass prairie biome is fire-dependent. Historically, tree seedlings and intrusive alien species without fire tolerance were eliminated by periodic fires.

Ecoregion/Major Land Resource Areas: Grand Prairie and Blackland Prairie in Texas.

Loss of tallgrass prairie is primarily attributable to historical plowing and cultivation practices, which breached tallgrass root systems and interrupted reproduction, in combination with overgrazing and fire suppression.

Estimates differ of how much original tallgrass prairie survives, ranging from less than 1 percent mostly in "scattered remnants found in pioneer cemeteries, restoration projects, along highways and railroad rights-of-way, and on steep bluffs high above rivers” (Graham 2011) to 4 percent.
Table 1. Ecosystem indicators for tallgrass prairie

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Current Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of potential tallgrass prairie acres with functioning tallgrass prairie*</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>51-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres burned under conditions that create desired fire effects.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres burned at desired return interval.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres managed to mimic the historical fire-grazing interaction with prescribed fire and prescribed grazing.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres grazed to desired effect by large herbivores such as bison and cattle.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Fair</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie impacted by feral hogs.</td>
<td>&gt;10%</td>
<td>5-10%</td>
<td>1-5%</td>
<td>&lt;1%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie impacted by invasive plant species.</td>
<td>&gt;15%</td>
<td>10-15%</td>
<td>5-10%</td>
<td>&lt;5%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres affected by active gully erosion.</td>
<td>&gt;0.5%</td>
<td>0.375-0.5%</td>
<td>0.25-0.375%</td>
<td>&lt;0.25%</td>
<td>Poor</td>
</tr>
</tbody>
</table>

* This indicator is a measure of the total number of acres on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of acres of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential acres contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

Post Oak-Blackjack Oak Savanna

Post oak – blackjack oak savanna consists of an historic climax plant community of savanna with an overstory dominated by post oak, with blackjack oak as a subdominant tree species. Tree canopy cover was between 10 and 50 percent; understories were 85 to 95 percent herbaceous species with warm season tall grasses dominating – particularly little bluestem at 65 percent cover. Bison (*Bison bison*) were historically a dominant species.

Ecoregion/Major Land Resource Areas: Grand Prairie and East-Central Texas Plains ecoregions / 84B West Cross Timbers and 87B Texas Claypan Area, Northern Part.

The fire regime has been highly altered since Euro-American settlement in the late 1800s. Woody vegetation has encroached in most areas and the herbaceous layer has been mostly lost. Much has been lost to housing and subdivision and conversion to introduced pasture and crops. The precise extent of ecosystems remaining intact is not known. There is less than 0.01 percent of oak savannas in Wisconsin that are in historically representative conditions (Henderson 1995). There should be more than this in Texas and Oklahoma; but it is still rare. Generally, this ecosystem is very similar to tallgrass prairie in terms of conservation status and stresses and threats (Stotts, et al. 2007).
Table 2. Ecosystem indicators for post oak-blackjack oak savanna

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Current Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of potential post oak-blackjack oak savanna*</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>51-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres burned under conditions that create desired fire effects.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres burned at desired return interval.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres managed to mimic the historical fire-grazing interaction with prescribed fire and prescribed grazing.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres grazed to desired effect by large herbivores such as bison and cattle.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Fair</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna impacted by feral hogs.</td>
<td>&gt;10%</td>
<td>5-10%</td>
<td>1-5%</td>
<td>&lt;1%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna impacted by invasive plant species.</td>
<td>&gt;15%</td>
<td>10-15%</td>
<td>5-10%</td>
<td>&lt;5%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres effected by active gully erosion.</td>
<td>&gt;0.5%</td>
<td>0.375-0.5%</td>
<td>0.25-0.375%</td>
<td>&lt;0.25%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of post oak-blackjack oak savanna acres in open canopy savanna</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
</tbody>
</table>

* This indicator is a measure of the total number of acres on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of acres of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential acres contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

Bottomland Hardwood Savanna

Historically, climax plant communities were savannas with an overstory dominated by large hardwood trees such as pecan, oak and elm; tree canopy was less than 40 percent; understories were dominated by herbaceous species, mainly tallgrass, wildrye and sedge species.

Ecoregion/Major Land Resource Areas: Grand Prairie and East-Central Texas Plains ecoregions / 84B West Cross Timbers and 87B Texas Claypan Area, Northern Part.

Most potential sites for this ecosystem have been heavily encroached by woody species; most sites have 80 percent or more canopy of trees. A few sites on the LBJ Grassland were cultivated last as bermudagrass pastures in the 2000s; these sites are quickly going through succession, but at least retain an open canopy for the time being. Gullies from nearby incised streams cut regularly into these sites. Hydroperiods have been severely altered by man-made alterations in the watershed such as dams, extirpation of beaver, and land use changes. Floods are less frequent and of more severity than in the past. Hydroperiod and depth to the water table were once ecological drivers in these sites but now have much less, if any effect. Fire can be a driver in some of the drier sites but is thought to have limited effect in general. These sites were historically driven by heavy grazing of bison, more so than the uplands because of distance to water.
Table 3. Ecosystem indicators for bottomland hardwood savanna

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Current Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of potential bottomland hardwood savanna acres with functioning bottomland hardwood savanna*</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>51-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of bottomland hardwood savanna acres burned under conditions that create desired fire effects.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna acres burned at desired return interval.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna acres managed to mimic the historical fire-grazing interaction with prescribed fire and prescribed grazing.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna acres grazed to desired effect by large herbivores such as bison and cattle.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Fair</td>
</tr>
<tr>
<td>Percentage of stream miles affected by active head cuts and channel incision.</td>
<td>&gt;60%</td>
<td>40-60%</td>
<td>20-40%</td>
<td>&lt;10%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of bottomland hardwood savanna acres with soils and vegetation with hydroperiods that are within the historic range of variability.</td>
<td>&lt;60%</td>
<td>60-80%</td>
<td>80-90%</td>
<td>&gt;90%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna impacted by feral hogs.</td>
<td>&gt;10%</td>
<td>5-10%</td>
<td>1-5%</td>
<td>&lt;1%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna impacted by invasive plant species.</td>
<td>&gt;15%</td>
<td>10-15%</td>
<td>5-10%</td>
<td>&lt;5%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna acres affected by active gully erosion.</td>
<td>&gt;0.5%</td>
<td>0.375-0.5%</td>
<td>0.25-0.375%</td>
<td>&lt;0.25%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of bottomland hardwood savanna acres in open canopy savanna</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
</tbody>
</table>

* This indicator is a measure of the total number of acres on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of acres of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential acres contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

Streams in Tallgrass Prairies and Oak Savannas

Historic channels would probably fall into Type C of the Rosgen Stream Classification (Rosgen 1996). Herbaceous vegetation would have been dominated with wetland obligate and facultative vegetation such as sedges, rushes, horsetail, switchgrass, etc. Stream dependent trees should dominate the overstory, such as Cottonwood, Sycamore, Bois d’Arc, and oaks.

Desired Future Condition: Intermittent and perennial streams that have floodplain and channel shapes and sinuosity that are consistent with historic conditions, or consistent with the functional needs of watersheds that are altered such that water flows are now different from historic flows.

Current Condition: Most channels are incised and now in Type G or F classification (Rosgen 1996). There is little occurrence of wetland obligate herbaceous plants. Cedar is encroaching and dominate in some
sites. Historically, there would have been little cedar present as beaver selectively harvest it for dam building material.

Table 4. Ecosystem indicators for streams in tallgrass prairies and oak savannas

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Current Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of miles of streams in tallgrass prairies and oak savanna ecosystems in desired vegetation and hydrologic condition.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>51-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of stream miles affected by active head cuts and channel incision.</td>
<td>&gt;60%</td>
<td>40-60%</td>
<td>20-40%</td>
<td>&lt;10%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of acres of streams in tallgrass prairies and oak savannas with soils and vegetation with hydroperiods that are within the historic range of variability.</td>
<td>&lt;60%</td>
<td>60-80%</td>
<td>80-90%</td>
<td>&gt;90%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of stream miles with beaver dams at capacity**.</td>
<td>&lt;25%</td>
<td>25-50%</td>
<td>50-75%</td>
<td>&gt;75%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of properly functioning stream miles impacted by feral hogs.</td>
<td>&gt;10%</td>
<td>5-10%</td>
<td>1-5%</td>
<td>&lt;1%</td>
<td>Poor</td>
</tr>
<tr>
<td>Percentage of properly functioning stream miles impacted by invasive plant species.</td>
<td>&gt;15%</td>
<td>10-15%</td>
<td>5-10%</td>
<td>&lt;5%</td>
<td>Poor</td>
</tr>
</tbody>
</table>

* This indicator is a measure of the total number of linear miles on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of linear miles of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential miles contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

** At capacity is defined as dams close enough together so that beaver can swim between dams without walking.

Effects

Based on the ecosystem indicators displayed in Table 5 through Table 8 for the proposed action, the conditions of all three resources would improve over time.

Table 5. Ecosystem indicators for tallgrass prairie

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current Condition</th>
<th>10 Years</th>
<th>20 Years</th>
<th>30 Years</th>
<th>50 Years</th>
<th>100 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of potential tallgrass prairie acres with functioning tallgrass prairie*.</td>
<td>Poor &lt;25%</td>
<td>Poor &lt;25%</td>
<td>Fair 25-50%</td>
<td>Good 51-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres burned under conditions that create desired fire effects.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres burned at desired return interval.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres managed to mimic the historical fire-grazing interaction with prescribed fire and prescribed grazing.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres grazed to desired effect by large herbivores such as bison and cattle.</td>
<td>Fair 25-50%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie impacted by feral hogs.</td>
<td>Poor &gt;10%</td>
<td>Good 1-5%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
</tr>
</tbody>
</table>
disruption to natural ecological processes and species sustainability. The DC in most cases is that 100 percent of potential acres contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

### Table 6. Ecosystem indicators for post oak-blackjack oak savanna

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current Condition</th>
<th>10 Years</th>
<th>20 Years</th>
<th>30 Years</th>
<th>50 Years</th>
<th>100 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of functioning tallgrass prairie impacted by invasive plant species.</td>
<td>Poor &gt;15%</td>
<td>Fair 10-15%</td>
<td>Good 5-10%</td>
<td>Good 5-10%</td>
<td>Good 5-10%</td>
<td>Good 5-10%</td>
</tr>
<tr>
<td>Percentage of functioning tallgrass prairie acres affected by active gully erosion.</td>
<td>Poor &gt;0.5%</td>
<td>Fair 0.375-0.5%</td>
<td>Good 0.25-0.375%</td>
<td>Very good &lt;0.25%</td>
<td>Very good &lt;0.25%</td>
<td>Very good &lt;0.25%</td>
</tr>
</tbody>
</table>

* This indicator is a measure of the total number of acres on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of acres of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential acres contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current Condition</th>
<th>10 Years</th>
<th>20 Years</th>
<th>30 Years</th>
<th>50 Years</th>
<th>100 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of potential post oak-blackjack oak savanna acres with functioning post oak-blackjack oak savanna*.</td>
<td>Poor &lt;25%</td>
<td>Fair 25-50%</td>
<td>Good 51-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres burned under conditions that create desired fire effects.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
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<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres burned at desired return interval.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres managed to mimic the historical fire-grazing interaction with prescribed fire and prescribed grazing.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
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</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna acres grazed to desired effect by large herbivores such as bison and cattle.</td>
<td>Fair 25-50%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna impacted by feral hogs.</td>
<td>Poor &gt;10%</td>
<td>Good 1-5%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
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</tr>
<tr>
<td>Percentage of functioning post oak-blackjack oak savanna impacted by invasive plant species.</td>
<td>Poor &gt;15%</td>
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<td>Very good &lt;0.25%</td>
<td>Very good &lt;0.25%</td>
<td>Very good &lt;0.25%</td>
</tr>
<tr>
<td>Percentage of post oak-blackjack oak savanna acres in open canopy savanna</td>
<td>Poor &lt;25%</td>
<td>Poor &lt;25%</td>
<td>Fair 25-50%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
</tbody>
</table>

* This indicator is a measure of the total number of acres on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of acres of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential acres contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.
Table 7. Ecosystem indicators for streams in tallgrass prairies and oak savannas

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current Condition</th>
<th>10 Years</th>
<th>20 Years</th>
<th>30 Years</th>
<th>50 Years</th>
<th>100 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of miles of streams in tallgrass prairies and oak savannas ecosystems in desired vegetation and hydrologic condition.</td>
<td>Poor &lt;25%</td>
<td>Poor &lt;25%</td>
<td>Fair 25-50%</td>
<td>Good 51-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of stream miles affected by active head cuts and channel incision.</td>
<td>Poor &gt;60%</td>
<td>Fair 40-60%</td>
<td>Good 20-40%</td>
<td>Very good &lt;10%</td>
<td>Very good &lt;10%</td>
<td>Very good &lt;10%</td>
</tr>
<tr>
<td>Percentage of acres of streams in tallgrass prairies and oak savannas with soils and vegetation with hydroperiods that are within the historic range of variability.</td>
<td>Poor &lt;60%</td>
<td>Poor &lt;60%</td>
<td>Fair 60-80%</td>
<td>Fair 60-80%</td>
<td>Good 80-90%</td>
<td>Very good &gt;90%</td>
</tr>
<tr>
<td>Percentage of stream miles with beaver dams at capacity**.</td>
<td>Poor &lt;25%</td>
<td>Poor &lt;25%</td>
<td>Fair 25-50%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of properly functioning stream miles impacted by feral hogs</td>
<td>Poor &gt;10%</td>
<td>Good 1-5%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
<td>Very good &lt;1%</td>
</tr>
<tr>
<td>Percentage of properly functioning stream miles impacted by invasive plant species</td>
<td>Poor &gt;15%</td>
<td>Fair 10-15%</td>
<td>Good 5-10%</td>
<td>Good 5-10%</td>
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</table>

* This indicator is a measure of the total number of linear miles on a given unit that are appropriate for a given system based upon ecological site types divided by the number of actual number of linear miles of that system on the given unit. This division yields a percentage. The DC in most cases is that 100 percent of potential miles contain the appropriate ecological system, however conversion should be performed over time and rapid changes to ecological systems should not be allowed as they may cause disruption to natural ecological processes and species sustainability.

** At capacity is defined as dams close enough together so that beaver can swim between dams without walking.

Table 8. Ecosystem indicators for bottomland hardwood savanna

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Current Condition</th>
<th>10 Years</th>
<th>20 Years</th>
<th>30 Years</th>
<th>50 Years</th>
<th>100 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of potential bottomland hardwood savanna acres with functioning bottomland hardwood savanna*.</td>
<td>Poor &lt;25%</td>
<td>Poor &lt;25%</td>
<td>Fair 25-50%</td>
<td>Good 51-75%</td>
<td>Very good &gt;75%</td>
<td>Very good &gt;75%</td>
</tr>
<tr>
<td>Percentage of bottomland hardwood savanna acres burned under conditions that create desired fire effects.</td>
<td>Poor &lt;25%</td>
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<td>Very good &gt;75%</td>
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</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna acres burned at desired return interval.</td>
<td>Poor &lt;25%</td>
<td>Good 50-75%</td>
<td>Very good &gt;75%</td>
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</tr>
<tr>
<td>Percentage of functioning bottomland hardwood savanna acres managed to mimic the historical fire-grazing interaction with prescribed fire and prescribed grazing.</td>
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<td>Very good &lt;10%</td>
</tr>
</tbody>
</table>
## Effects Related to Fire, Fuels, and Smoke

The desired future conditions of the LBJ National Grasslands are tallgrass prairies and oak savannas with tallgrass understory; which is what it was historically. However, woody plants have increased over the past 100 to 150 years and spread into areas they did not historically occupy due to the reduction of fire on the landscape. Encroaching woody vegetation needs to be thinned or removed and frequent prescribed fires or other management actions must be applied to the landscape. Prescribed fire is the most ideal practice for managing grassland ecosystems. Because the entire LBJ National Grassland is designated as wildland-urban interface, it will never be possible to use wildfire for management purposes.

## Purpose and Need

The primary land management objective for our program area is reducing hazardous fuel accumulation to protect private property and forest resources from catastrophic wildfire. A secondary objective is to reintroduce fire onto the landscape to better manage these fire-dependent ecosystems. The unnatural accumulation of wildland fuels is a result of a significant departure from the natural regime. This has resulted in fuel loadings above historic levels and poses a threat to not only neighboring private lands and communities but to fire-dependent ecosystems. Reducing the amount of dead and down material through prescribed burning will benefit rangeland health by stimulating the nutrient cycling process and increasing soil productivity while enhancing the growth of native grasses. It will benefit wildlife habitat by removing dead/dying material from brush and hardwood species. Threatened and endangered species will benefit nesting and brood rearing habitat. Fire will increase the diversity and coverage of native vegetation and improve overall range health.

## Environmental Effects

The nature of the proposed action is to improve conservation and restoration of ecosystems across the project area. As such, there are no unfavorable effects to the environment that cannot be mitigated with the proposed design features. The no-action alternative would cause much increased risk of catastrophic wildfires to rural residents as ecosystems remain in compromised, degraded states. Therefore, there are
significantly less unfavorable environmental effects with the proposed action than the no-action alternative. See Table 9.

More smoke would occur in the proposed action, but the effects are ephemeral. There is no perceived additional threat to human health and safety from the additional smoke because we will follow TCEQ regulations which have mitigations built into them.

**Table 9. Resource indicators and measures for no action and proposed action**

<table>
<thead>
<tr>
<th>Resource Element</th>
<th>Resource Indicator</th>
<th>Measure</th>
<th>Current</th>
<th>No Action</th>
<th>Proposed Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildfire hazard in wildland-urban Interface</td>
<td>Fuel condition class</td>
<td>Percent of ecosystem extent in desired future condition (Fire Regime Condition Class 1)</td>
<td>20%</td>
<td>20%</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td>Presence of defensible space on National Forest System / private boundary lines</td>
<td>Percent of boundaries with defensible firelines and/or fuelbreaks</td>
<td>20%</td>
<td>20%</td>
<td>90%</td>
</tr>
</tbody>
</table>

**Effects Related to Nonnative Vegetation Management**

The ground disturbing activities proposed in this project pose a high risk of nonnative invasive plant species (NNIPS) spread in:

1. habitats that have high susceptibility to NNIPS invasion or
2. areas that are already disturbed.

However, a comprehensive plan of NNIPS control and prevention would be integrated into the project design for all of the proposed activities regardless of where they would occur. This would reduce or contain NNIPS and improve the vigor of native vegetation, thereby increasing resistance to further NNIPS invasion. NNIPS treatment would include both manual non-mechanical and cultural control and prevention measures and would be included in the project design criteria (USDA Forest Service, Guide to Noxious Weed Prevention Practices, Version 1.0, Dated July 5th 2001). Under the proposed action, treatment of NNIPS would occur anywhere within the project area. Treatments would be commensurate with the location of existing populations and with individual risk of spread. Monitoring would determine effectiveness of treatment.

Ongoing NNIPS management in the analysis area will include any other NNIPS control actions as a result of any existing signed environmental documents, the NNIPS Management Plan, and the programmatic National Forests and Grasslands in Texas Nonnative Invasive Plant Species Project (NFGT NNIPS) EA (2008). Any active NNIPS control for this analysis area will incorporate the NFGT NNIPS EA by reference.
Effects Related to Botany and Wildlife

Federally Threatened and Endangered Species

Plants (no effect)
The project will not impact any listed threatened and endangered plant species. Navasota’s ladies’-tresses (spiranthes parksi) and Neches River rose mallow (Hibiscus dasycalyx) are the only listed plant species known to occur on the National Forest and Grasslands in Texas, and neither occur in the project area.

Interior Least Tern (no effect)
Because these birds nest in colonies where nests can be as close as 10 feet but are often 30 feet or more apart, there are no suitable nesting areas within the project area. None of the proposed actions are likely to directly affect foraging least terns. As fish-eaters, least terns could indirectly benefit from the fish passage and stream restoration work if it results in increased foraging opportunities.

Forest Service Sensitive Species

Plants (no impact)
There is no suitable habitat present anywhere within the project area for any Region 8 sensitive plant species. The LBJ Prairie-savanna Restoration Project will have “no impact” to any sensitive plant species.

Black-capped vireo (may impact individuals)
Given the habitat preference, rangelands with scattered clumps of shrubs separated by open grassland, it is possible that black-capped vireo could be present in the project area. However, survey conducted by the LBJ Grassland have yet to detect black-capped vireos (2017).

Prescribed fire and managing fire may benefit black-capped vireos. According to the FWS (2017), vegetational succession has been identified as residual threat in the eastern portion of the vireo’s range and is best managed by prescribed fire. Fire is a natural component of Texas rangelands, and prescribed burning has many range and wildlife management benefits. These include improved forage quality and maintenance of desirable plant composition and structure. Prescribed burning in some portions of the vireo’s range can be an excellent tool used to maintain or create the desired vegetation structure for vireo nesting; i.e. a mosaic of shrubs and open grassland with abundant woody foliage below 10 feet.

Prescribed grazing as proposed and vegetation treatment may improve vireo nesting cover. Stream restoration may increase foraging habitat.

There is potential for disturbance from noise during project implementation and depending on the proximity, workers adjacent to potential nests could cause birds to flush.

Bald Eagle (no impact)
During the winter, nonbreeding eagles often gather around man-made reservoirs and other areas that provide them with a source of food. Within the project area there are approximately 10 lakes that could provide food to wintering bald eagles.

The proposed action may have short-term direct effects, causing perching bald eagles to flush during times of activity. However, according to the habitat management guidelines for bald eagles in Texas, in winter roost concentration areas land clearing activity should be avoided within 1,500 feet. Disruptive, noisy, or out-of-the-ordinary land use activities should be avoided near communal roost sites. Normal
agricultural activities which have occurred traditionally on the land are generally acceptable near these roost sites as long as they do not appear to be affecting roosting eagles.

Bald eagles could indirectly benefit from the fish passage and stream restoration work if it results in increased foraging opportunities.

**Management Indicator Species**

**Plants (no impact)**
Because there is no suitable habitat in the project area for any management indicator plant species, the LBJ Prairie Savannah Restoration Project will have “no impact” on these species.

**Wildlife (no impact)**
The proposed action will not change the current forestwide population or habitat trend of any wildlife management indicator species; however, local trends may improve.

**Migratory Birds**

**Harris’s Sparrow and Red-headed Woodpecker**
Two birds, Harris’s sparrow (*Zonotrichia querula*) and red-headed woodpecker (*Melanerpes erythrocephalus*) are on the FWS Birds of Conservation Concern (BCC) list for the area (IPaC 2018). Only suitable winter habitat for Harris’s sparrow is present within the project area.

Implementation may result in some level of incidental mortality (unintentional take) of some birds. The removal of any eggs or fledglings is unlikely and would not result in a measurable negative effect to the populations Harris’s sparrow or red-headed woodpecker.

**Snags and Habitat Fragmentation**
During scoping concerns regarding snags and habitat fragmentation were noted. Mitigation measures and design features that have been developed for other resources during the implementation of this project (see appendix A) include:

- Retain, where available hardwood den trees and at least two snags (12 inches diameter breast height or greater) per acre during silvicultural treatments or fuelwood harvest. (MA-3-92)
- Retain, where available, hardwood den trees, or snags, (12 inches diameter breast height (DBH) or greater) during all stand entries, and silvicultural treatments. (MA-4-111)

Activities proposed including road maintenance repair, closures, trail repair and reroutes and fence repair will help reduce fragmentation.

**Effects Related to Aquatic Resources**

**Affected Environment**
The LBJ has no proposed, endangered, threatened or sensitive fish species, although the District does represent the edge of range or near-edge for several species that could experience range declines due to marginal habitats, which are most assured on neighboring private lands. Once lost from such habitats, these species have difficulty repatriating due to migration barriers, inadequate numbers of individuals and habitat loss. One such species could be the orange-throat darter found on the District in Rush Creek in
1995. South of the District this species was found in Ash Creek in 2007. The species has been absent from Rush Creek in subsequent samples. Often there is no water to sample due to seasonal drying and droughts. Conversely, the fathead minnow constitutes an eastern range extent in Pringle Creek (rather than western). Unlike the orange-throat darter, this species is tolerant of poor water quality, as in low oxygen and high turbidity.

Several Region 8 Sensitive mussels occur on the LBJ, southern hickorynut, Ouachita rock pocketbook, Texas pigtoe, Louisiana pigtoe, Texas heelsplitter, sandbank pocketbook and triangle pigtoe. Being sessile filter-feeding organisms, mussels are most susceptible to silt loading and turbidity caused by runoff and erosion. Often forgotten is the fact that mussel larvae depend on specific fish host. High quality mussel habitat is useless if the host fish are impeded from that particular reach by migration barriers.

**Effects**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Activity</th>
<th>Direct &amp; Indirect</th>
<th>Cumulative</th>
<th>Irreversible</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td></td>
<td>Continued degradation of streams without restoration of failing channels, roads, firelines &amp; culverts.</td>
<td>Some species may leave in poor seasons and habitats.</td>
<td>Stream, road &amp; fireline incision resulting in stream sedimentation, downcutting &amp; bank instability.</td>
</tr>
<tr>
<td>Preferred Alternative</td>
<td>Fireline/fuel breaks</td>
<td>-Some soil loss and possible drainage rilling.</td>
<td>-Heavy soil loss and gullying <strong>without veg rehab</strong>.</td>
<td><strong>Without Veg rehab:</strong> -Large gullying beyond repair with fill.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Some species avoidance due to exposure.</td>
<td>-Loss of prairie habitat if soil lost.</td>
<td>-Permanent loss of land-type and flow alteration with gullying.</td>
</tr>
<tr>
<td></td>
<td>Mulching – not burned. Left in place or wind-rowed.</td>
<td>-Erosion control when left in place.</td>
<td>-Some pH reduction in mulch decay.</td>
<td>-More carbon retained onsite and less in atmosphere.</td>
</tr>
<tr>
<td></td>
<td>Natural and artificial beaver dams.</td>
<td>-Sediment trapping and clearing of turbidity.</td>
<td>-Change in fish to lentic species, except below outflows where darter habitat improves.</td>
<td>-Channel morphing to stable banks, shallower profiles and slower, more continuous flows.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Flow-through storm attenuation.</td>
<td>-Increase in macroinvertebrates.</td>
<td>-Drought resistance in hydro retention.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Some brief soil disturbance from equipment access for restoration.</td>
<td>-Greater structure and veg diversity.</td>
<td>-Substrates and banks able to buffer flow velocities.</td>
</tr>
</tbody>
</table>

**Methods and Models**

Eureka Lake should serve as a model for gully plug maturity reverting to wetland status with some flow-through stream restoration (Unit 28).
Chicken Lake, Rucker Pond and Cottonwood Lake (s) would be good examples of NRCS flood/sediment control structures that have become too shallow for fisheries management and are nearing the end of their life as reservoirs.

FDR 970 in Unit 3 is a good sample of a successful hardened crossing in a perennial creek. “Successful” logic applies to crossings that show little to no effect channel integrity in above-and-below crossing comparison. Keep in mind that hardening crossing on erosive soils can create turbulence and large channel blowouts and downcutting. Example would be numerous cinder block hardened crossings on the Sam Houston National Forest, Permanently Marked Trail (PMT). New crossings should be monitored above and below for such effects. “Soft” techniques should be considered, such as geo-cell materials that incorporate natural substrates.

**Effects Related to Recreation and Roads**

**Existing Condition Trails**
The LBJ National Grasslands trail systems have erosion, sediment, public safety and general trail maintenance concerns. Heavy rains have created safety concerns for humans and horses due to more washouts, especially within the TADRA trail system. The main concern is to keep the trail tread from degrading due to the elements and frequent equestrian use.

**Existing Condition Roads**
Deferred maintenance is anticipated to accrue over time. Culvert replacement, rock replacement, grading and bar ditch maintenance are the primary maintenance needs on the district. User created roads and general unauthorized off-roading continue to be challenges that need to be addressed.

**Effects to Roads and Trails**
By proposed activity:

- **Prescribed Fire, Fireline and Fuelbreaks**
  Prescribed burning would have some effect on recreation resources and experiences. Fire and ephemeral smoke would directly affect recreation users in the area. Prescribed burning would need to coordinate with recreation to ensure that organized recreation activities such as scheduled equestrian events are not impacted by prescribed fire. In addition, structures such as timber kissing gates and plastic culverts in trails would need to be protected during prescribed burning.

  Trails would be incorporated into fire lines where appropriate.

- **Prescribed Grazing**
  Livestock grazing would have some effect on recreation resources. Fencing would need be placed around campgrounds and other recreational areas to avoid conflicts between range stock and recreational users in places such as Valley View Campground. See also Fences, Gates and Livestock Handling Facilities.

- **Mechanical Vegetation Treatment**
  Mechanical vegetation treatments can alter the appearance of trail routes. After mechanical treatment has occurred trails routes may need to be properly identified on the ground in areas that have been modified.
• Fish Passage
  N/A

• Stream Restoration
  Stormwater diversion structures would be a benefit to all areas of recreation and roads allowing for the proper removal of water off of areas that would impact users.

• Livestock Water Development
  Areas identified for water development would need to be sufficiently distanced from trails and campgrounds that interactions between livestock and recreation users would be minimized.

• Water Impoundments
  N/A

• Fences, Gates and Livestock Handling Facilities
  Improvements in fences, gates and livestock handling facilities would improve the recreation experience for users by improving the separation of recreation activities from livestock use.

• Rangeland Seeding
  Seeding with native species can improve the recreation experience by reducing the incidence of invasive plant species and replacing it with native plants that are more attractive to both the recreation user and watchable insect and animal wildlife.

• Herbicide Use
  In the longer term, herbicide use would be beneficial to recreation by reducing the incidence of invasive plant species. However, in the short term, herbicide application is an event that most recreation users would avoid. Any herbicide application in areas used by the recreating public would be prominently signed ahead of time, and information regarding the time and place of applications would be displayed at trailheads, campgrounds, and other locations where recreation use is concentrated.

• Nonnative Invasive Plant Species Management
  See rangeland seeding and herbicide use.

• Native Ecosystem-invasive Vegetation, including Eastern Red Cedar
  See rangeland seeding and herbicide use

• Road Maintenance and Repair
  Road maintenance and repair is a necessity throughout the Grasslands. Maintenance and repair allow for a positive recreational experience as a whole. It is important to have properly maintained roads for recreation users to access areas within the Grasslands.

• Off Road Barriers
  Off road barrier management and strategies would help protect nonmotorized recreation areas and improve the overall nonmotorized recreation experience.

• Trail Maintenance and Repair
Trail maintenance and repair is a necessity throughout the Grasslands. Maintenance and repair allow for a positive recreational experience as a whole. It is important to have properly maintained trails for recreation users to access areas within the Grasslands.

- Feral Hog Control
  
  Feral hogs root up campgrounds and trails. Reducing their numbers would reduce the amount of maintenance and repair needed on these recreation facilities.

Effects Related to Heritage Resources

Affected Environment

During the past decade, fuels from insect epidemics, storm damage, and heavy fallen fuels have built up and pose an immense fire hazard. Effects from wildfire are known to be greater to heritage resources than are the low intensity burns that accompany prescribed fire efforts (Jackson 1997). Wildfires tend to have greater flame lengths and often burn more intensely. Such fires would likely require bulldozers or indirect suppression tactics such as burnout operations or retardant drops to contain. The careful application of prescribed fire can benefit heritage resource management:

1) prescribed fire reduces fuel loadings and fuel densities;

2) lower fuel densities reduce the potential for hotter uncontrolled wildfires; and

3) prescribed fires burn away materials from the surface and provide for better visibility.

Environmental Effects

Heritage resource effects were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during commercial harvest, prescribed fire (broadcast burning), fuel break construction, and/or fuel reduction activities. The affected environment includes both known heritage resource sites and sites that will be located in the future as more of the Forest is surveyed. Most of these surveys and site documentations have been done in order to evaluate the effect of other projects (e.g., recreation or range projects) on heritage resources.

Management actions that can adversely affect heritage sites include anything that might significantly change the important features of a heritage site, and include any kind of ground disturbing activity or historic building maintenance. Under all alternatives there is a potential for management actions to lead to adverse effects on heritage sites. These potential effects would be identified as part of addressing the requirements of Section 106 of the National Historic Preservation Act and National Environmental Policy Act (NEPA) analyses under all alternatives. When effects are analyzed as part of project planning, there is also the opportunity to redesign the project to avoid those sites or adverse effects, or if necessary, mitigate them. Non-project specific effects, such as wildland fire or the illegal use of off-road vehicles, have the greatest potential to adversely affect heritage resources in the long-term. These effects are not as easy to anticipate, avoid and/or mitigate.

There is also the potential for management decisions to positively affect heritage sites through such things as interpretation (i.e. signs) and general watershed health. An active Heritage Program benefits heritage sites directly through implementation of Heritage Strategies, which emphasize Stewardship (identifying and protecting significant sites), Public Service (providing opportunities for people to enjoy their heritage), and Context for Natural Resource Management (applying heritage information to all areas of management). These activities include locating, documenting, and evaluating the importance of sites.
Management actions also include stabilizing sites, relocating trails or roads that run across sites, and using sites appropriately, etc. These uses include enhancing visitors’ understandings of the past (through research or interpretational programs), stabilizing sites as protected features for the future, or ensuring that American Indians can continue traditional uses of sites.

**No Action Alternative**

**Direct, Indirect and Cumulative Effects**

The No Action Alternative would not directly affect heritage resources through any activity proposed in the Lyndon B. Johnson Prairie Savanna Restoration Project. An indirect effect could possibly result from the fact that the no action alternative would not provide for any mitigation measures for resource protection, or stabilization of currently affected sites.

There would be no immediate adverse effects to heritage resources. However, the long-term risk of wildfire and potential damage of heritage sites would increase as environmental conditions continue to deteriorate. In the event of a wildfire, any remaining combustible materials at sites could be damaged or destroyed, and all heritage resources would be subject to exposure and erosion. If present, traditional use areas such as plant and firewood gathering areas, and Traditional Cultural Properties (TCPs) could also be damaged by future wildfire.

**Proposed Action**

**Direct and Indirect Effects**

Some form of burning (either broadcast or pile) is proposed under the action alternatives. Provides for the protection of heritage resources within fire areas. During the past decade fuels from insect epidemics, storm damage, and downfall have built up and currently pose a significant fire hazard. Effects from wildfire are known to be greater to heritage resources than are the low intensity burns that accompany prescribed fire efforts (Jackson 1997). Wildfires tend to have greater flame lengths and often burn more intensely. Such fires would likely require bulldozers or indirect suppression tactics such as burnout operations or retardant drops to contain. Sites that are susceptible to fire include those with flammable elements and/or rock features, such as rock art, which are subject to spalling (chipping or breaking of rock through heat). The careful application of prescribed fire can benefit heritage resource management: 1) prescribed fire reduces fuel loadings and fuel densities; 2) lower fuel densities reduce the potential for hotter uncontrolled wildfires; and 3) prescribed fires burn away materials from the surface and provide for better visibility. Site-specific mitigation measures will be outlined in the Prescribed Burn Plan, prior to implementation.

**Cumulative Effects**

The combination of forest activities such as vegetation management, recreation, and range activities may have a cumulative effect on Heritage resources in the form of increased soil erosion, increased visitor traffic, vandalism, and further alteration of historic landscapes. Many of the heritage resources located within proposed project area are newly recorded and do not have information on previous existing conditions. Both Alternatives propose ground-disturbing activity that, in turn, could increase the chances of damage to known or unrecognized Heritage sites. The proposed action alternative would reduce the potential for large-scale wildfire and degradation of the environment, and therefore offers protection over the long-term to Heritage Resources. No additional additive effects are expected with the implementation of the proposed mitigation measures, and effective monitoring of those measures.
Issues and Recommendations

Traditional Use:
Existing information about heritage and cultural values may often be inadequate; ongoing inventories tend to be project-specific rather than part of the general program. Obtaining information about traditional use sites from some American Indian groups is difficult because the Forest Service styles of communication and negotiation are often incompatible with these cultures and revealing traditional values and identifying traditionally used places to outsiders may be thought to imperil the values in need of protection. The ability to identify and protect sacred sites is heavily dependent on tribal representatives sharing information with the Forests. The heritage resource specialists can and do identify cultural material but it is critical for the tribes to provide cultural information. The Forest has been made aware of sacred sites on other parts of the Forest and we are currently protecting these types of sites Forest-wide.

Sacred places can include topographic features such as buttes, mountains, valleys, rocks, springs, and caves. People who use sacred places often consider them sensitive, so the specific names and locations of sacred places are not always released to the agency. Research efforts should be initiated on the Forest to identify traditional plants that may be located in the analysis area. It should be noted that within the preservation laws and regulations that we work under, the terms sacred site and Traditional Cultural Property (TCP) refer to two distinct categories of sites. Traditional Cultural Properties are formally documented sites using criteria defined in the Secretary of Interior’s Bulletin #38. To formally document and protect a TCP extensive oral history specific to that site must be collected and documented. There are a number of criteria that documentation must adequately address in order for a site to be classified as a TCP. Sacred sites do not require the same level of documentation. No Spiritual Sites or Traditional Cultural Properties were identified or made known to the Forest Service.

Access:
For those areas that contain traditional use sites, access needs will be high for traditional groups utilizing the area. This is particularly true for tribal elders, who may have difficulty accessing areas for physical reasons. The ability to access Tradition Cultural Properties, Sacred sites, traditional use areas, or traditional plant gathering areas is guaranteed under the American Indian Freedom of Religion Act (AIRFA) and under Executive Order 13007, and the Agency must not impede access to such locations.

Consultation
Many of the previously described laws, regulations, and directives instruct the Forest Service to consult with American Indian tribes, the state, and other interested parties on cultural resource management issues. The Heritage Resource Reports are sent to the Texas State Historic Preservation Office Review and Compliance for comment and eligibility determinations for the heritage resources located within the analysis area. Likewise the reports are also sent to Tribal Historic Preservation Offices and tribal groups requesting the reports, for their review and comment, and additional recommendations for the protection of American Indian traditional use sites. Follow-up contact will be made with Tribal representatives throughout the analysis process, to determine if additional information on the environmental document is needed, or if information pertaining to spiritual or traditional use sites exists. In similar analysis, tribal representatives recommended landscape treatments that were implemented to enhance areas for tribal use.

Conclusion
There are historic, pre-contact era, and multicomponent sites that could be indirectly affected by the No-Action Alternative. These sites include historic home sites, historic trails, open campsites, and pre-contact habitation sites. The potential for catastrophic wildfire is greatest with this Alternative, as it provides for no fuel reduction work, and does not provide for mitigation efforts for site protection.
There are sites that could be directly affected by the Action Alternative. These include historic sites with wooden remains that could be affected by prescribed burn activities, and historic and pre-contact sites that could be affected by ground disturbing activity. These sites would need to be avoided during broadcast burn activities and field reviewed prior to any vegetative treatment or other proposed projects. Pile burning would be more beneficial, and would cause minimal disturbance at these sites, with piles placed in designated locations outside of site boundaries. These sites could be adversely affected by large wildfire activity, and reductions in fuels would be desirable.
Finding of No Significant Impact

As the responsible official, I am responsible for evaluating the effects of the project relative to the definition of significance established by the CEQ Regulations (40 CFR 1508.13). I have reviewed and considered the EA and documentation included in the project record, and I have determined that neither the proposed action nor the action alternatives evaluated will have a significant effect on the quality of the human environment. As a result, no environmental impact statement will be prepared. My rationale for this finding is as follows, organized by sub-section of the CEQ definition of significance cited above.

Context

For the proposed action and alternatives the context of the environmental effects is based on the environmental analysis in this EA. The LBJ Prairie-savanna Restoration Project is a site-specific project that does not have international, national, regional, or statewide importance. The project is limited in scope and duration. The project encompasses approximately 20,302 acres of treatment areas and associated activities on the National Forests and Grasslands in Texas. The geographic area in which effects will occur is generally within the treatment areas, activity areas, and associated watersheds. The project was designed to minimize environmental effects with implementation mitigations, best management practices, action specific design criteria and standard management practices. Given the context and duration of activities, the analyses prepared in support of this EA indicate that the alternatives would not pose significant short- or long-term effects.

Intensity

Intensity is a measure of the severity, extent, or quantity of effects, and is based on information from the effects analysis of this EA and the references in the project record. The effects of this project have been appropriately and thoroughly considered with an analysis that is responsive to concerns and issues raised by the public. The agency has taken a hard look at the environmental effects using relevant scientific information and knowledge of site-specific conditions gained from field visits. My finding of no significant impact is based on the context of the project and intensity of effects using the ten factors identified in 40 CFR 1508.27(b).

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

Our consideration of the intensity of the environmental effects of this project has not been biased by the beneficial effects of the action. In all analyses prepared in support of this document we considered both the beneficial and adverse effects of the proposed action and alternatives; however, the beneficial effects of prairie and savanna restoration and watershed improvement activities were not used to offset or compensate for the potential adverse effects of the proposed treatments. We considered the impacts associated with the proposed action and alternatives separately from the beneficial effects, and neither the beneficial or adverse impacts are significant (See Environmental Consequences).

2. The degree to which the proposed action affects public health or safety.

There will be no significant effects on public health and safety because project specific design features, mitigations and implementation of standard management requirements (design features, and appendix A). There are potential short-term effects to public health and safety related to prescribed fire, and the use of
herbicides. These would be short term and temporary impacts, and there are design features in place to minimize impacts.

Prescribed burning would produce temporary smoke emissions that could affect human health. Prescribed burning is regulated by the Texas Commission on Environmental Quality and the Forest is required to comply with state rules that would restrict burn days with acceptable dispersion conditions and the amount of fuels burned per day.

All appropriate laws, policies, and regulations governing the use of herbicide, as required by the U.S. Environmental Protection Agency, the Texas Department of Agriculture and the Forest (The National Forests and Grasslands in Texas Non-Native Invasive Plant Species Project Management Plan 2007), will be followed, and all Forest Service personnel in charge of projects involving herbicide application will be qualified certified applicators. All contract applicators will be appropriately licensed by the state, coordination with the appropriate county agricultural commissioner will occur, and all required licenses and permits will be obtained prior to any herbicide application. The public will be notified prior to implementation of herbicide treatments through posting of signs at treatment areas and access points, as specified in the project design features. The proposed action adheres to all laws and regulations regarding herbicide use and includes stringent project design features which will minimize potential hazards to workers and to public health and safety. There will be no adverse effect to water quality because project design features include treatment buffers on all wells, ponds, and springs used for domestic water supplies. Furthermore, for treatment within 100 feet of recreation sites, cautionary notice signs will be posted at the recreation site prior to herbicide treatments.

3. Unique characteristics of the geographic area such as the proximity to historical or cultural resources, parklands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

In the EA we analyzed the potential for impacts to unique characteristics of the geographic area. There are no parklands, prime farmlands, or designated wild and scenic rivers within the project area. Wetlands will be protected by the treatment buffers (see design features).

In regards to historical and cultural resources, the analysis in the EA (Effects Related to Heritage Resources section) identified no significant effects to cultural resources because the project design features avoid impacts to these sites or characteristics (see also intensity item 8).

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.

The effects on the quality of the human environment are not likely to be highly controversial. The term “controversial” in this context refers to cases where substantial scientific dispute exists as to the size, nature, or effects of a major federal action on some human environmental factor, rather than to public opposition of a proposed action or alternative. There is no known credible scientific controversy over the impacts of the proposed action. The proposed project follows the management direction in the National Forests and Grasslands in Texas Land and Resource Management Plan (USDA Forest Service 1996) and the National Forests and Grasslands in Texas Non-Native Invasive Plant Species Project Management Plan (USDA Forest Service 2007). Potential adverse effects are minimized through design and the incorporation of project design features, to the point where there are no effects that draw controversy.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

We have considerable experience with actions like those proposed. The analysis shows the effects are not highly uncertain, and do not involve unique or unknown risk. The proposed project follows the management direction in the National Forests and Grasslands in Texas Land and Resource Management Plan (USDA Forest Service 1996) and the National Forests and Grasslands in Texas Non-Native Invasive Plant Species Project Management Plan (USDA Forest Service 2007).

Proposed activities are routine in nature, and employ standard practices and protection measures. The effects analyses documented in the EA and in the project record incorporate accepted techniques and methods, the best available scientific literature, reliable data, field review, and the judgment of qualified professional resource specialists. Neither these analyses nor public comments identified highly uncertain effects or unique or unknown risks associated with the alternatives.

Under the proposed action, herbicides will be applied in accordance with product label directions, Texas Department of Agriculture requirements, Forest Service best management practices for water quality (USDA Forest Service 2007, 2011); and Forest Service direction found in the Forest Service Manual (FSM 2080, 2150 and 2200) and Handbook (FSH 2109.14).

6. The degree to which the action may establish precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The action is not likely to establish a precedent for future actions with significant effects, because any future decisions would require site-specific analysis to consider all relevant scientific information available at that time. The proposed activities are in accordance with the best available science at this time regarding grassland, prairie, savanna and watershed restoration activities.

7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

The analysis completed for the EA does not identify any significant cumulative effects on the environment, either when combined with the effects created by past and reasonably foreseeable future projects.

8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

There will be no effect to cultural resources from implementing this project, and the proposed action does not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places. Activities associated with the proposed action will comply with the
National Historic Preservation Act (NHPA) of 1966, as amended and its implementing regulations 36 CFR 800 and Forest Service Manual 2360. The action will not cause loss or destruction of significant scientific, cultural or historical resources, because the treatment methods are either nonground disturbing, entail minimal disturbance, or will follow mitigation recommendations agreed upon by the Forest Service, Tribal Historic Preservation Officers and the State Historic Preservation Office, through consultation.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

There are no endangered or threatened species, and no critical habitat in the project area, so there will be no effect.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

National Forest Management Act
The National Forest Management Act (NFMA) reorganized, expanded and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on national forest lands. The NFMA requires the Secretary of Agriculture to assess forest lands, develop a management plan for each unit of the National Forest System (NFS).

The Forest Service is complying with the provisions of this law by designing the project to meet the standards and guidelines of the National Forests and Grasslands in Texas Land and Resource Management Plan (USDA Forest Service 1996).

Related to aquatic resources, this project is fully consistent with the standards and guidelines of the forest plan as amended. The project is expected to maintain or improve aquatic habitat conditions and move aquatic resources toward desired conditions.

Regional Forester Sensitive Species
The proposed action, including project-specific design criteria, will not adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973. The proposed action is likely to benefit Forest Service Sensitive species and possibly assist in the avoidance of future listings to local populations.

Endangered Species Act
Because there are no endangered, threatened, candidate species, and no critical habitat that could be affected by this federal action, consultation with the U.S. Fish and Wildlife Service is not required.

No federally-listed species would be affected by the LBJ Prairie-savanna Restoration Project.

Migratory Bird Treaty Act
The LBJ Prairie-savanna Restoration Project would have minimal impacts (unintentional take) to individual Harris’s sparrow and would not adversely affect migratory landbird conservation. This finding is based on the results of analysis conducted for this project. Adhering to Forest Plan standards as incorporated into the project design will maintain habitat diversity. The project meets the intent of the Migratory Landbird Memorandum of Understanding.
Clean Water Act
The project complies with Section 208 of the Clean Water Act, which requires States to prepare nonpoint source pollution plans that are to be certified by the State and approved by the United States Environmental Protection Agency (EPA). In response to this law, and in coordination with the State of Texas Commission on Environmental Quality and EPA, the USDA Forest Service, Region 8, has developed best management practices. The best management practices that are pertinent to the actions proposed here are included in this project, to protect beneficial uses of the water. The National Forests and Grasslands in Texas Non-Native Invasive Plant Species (NNIPS) Project Environmental Assessment, Management Plan (2008), incorporated by reference into this project, includes explicit direction on using herbicides as part of an integrated pest management and adaptive management for managing nonnative invasive plant species. The NNIPS Management Plan includes specific control plans by species and herbicide which include design criteria to protect aquatic resources.

Anti-degradation EPA policy 40 C.F. R. Section 131.12 states that existing water quality, even when it exceeds required levels for stated beneficial uses will be maintained. Potential effects of the proposed action, either through surface runoff of sediment and chemicals or chemicals entering water bodies through groundwater sources do not constitute a significant degradation of quality or impair existing beneficial uses.

Water quality monitoring is part of the adaptive management strategy for stream restoration.

Clean Air Act
The project is presumed to conform to the Clean Air Act because fire managers are required to follow rules and controls of the state and local nonattainment areas. Prescribed burning is regulated by the Texas Commission on Environmental Quality. Fire managers are required to meet all air state and area standards and therefore the prescribed burning operations are presumed to conform to the Clean Air Act.

National Historic Preservation Act
The proposed action does not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places. Activities associated with the proposed action will comply with the National Historic Preservation Act (NHPA) of 1966, as amended and it’s implementing regulations 36 CFR 800 and Forest Service Manual 2360. The action will not cause loss or destruction of significant scientific, cultural or historical resources, because the treatment methods are either nonground disturbing, entail minimal disturbance, or are located in areas with previous disturbance.
LBJ Prairie Savanna Restoration Project
Environmental Assessment

Appendix A: Forest Plan Standards and Guides, Non-native Invasive Species Direction
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Appendix A - Forest Plan Standards and Guides, Nonnative Invasive Plant Direction

Forest Plan Standards and Guides

**Prescribed Fire**

- Management activities will maintain air quality that meets applicable Federal and State Standards and Regulations (FW-001).
- Apply applicable Forest Service or State Smoke Management Guidelines during prescribed burns (FW-004).
- Utilize prescribed fire as a tool to manage fire-dependent communities and ecosystems, timber production, fuel reduction, forage, range and wildlife habitat improvement in combination with other treatments.
  - a Prescribed burning is conducted in a manner that is in compliance with air quality standards.
  - b Prescribed fire frequency and timing will be based on management area direction as guided by Ecological Classification System. (FW-061)
- To minimize erosion on firelines, develop water bars as specified in forest-wide soil & water standards and seed bare earth. (FW-062)
- Site-specific planning for all prescribed burns is done by trained resource specialists and approved by the appropriate Forest Service line officer prior to project implementation. This planning includes description of treatment area, burn objectives, weather factors and fuel moisture conditions, and resource coordination requirements. Coordination requirements include provisions for public and worker safety, burn day notification of appropriate agencies and persons, smoke management to comply with air quality regulations and protect visibility in Class I areas, protection of sensitive features, as well as fireline placement, specific firing patterns, ignition methods, and mop-up and patrol procedures. A post-burn evaluation compares treatment results with plan objectives. (FW-063-1)
- Where needed to prevent erosion, water diversions are installed on firelines during their construction, and are re-vegetated promptly after the burn (FW-063-5).
- Firelines which expose mineral soil are not located in filter strips along lakes, perennial or intermittent springs and streams, wetlands, or water-source seeps, unless tying into lakes, streams or wetlands as firebreaks at designated points with minimal soil disturbance. Low intensity fires with less than 2-foot flame lengths may be allowed to back into the strip along water bodies, as long as they do not kill trees and shrubs that shade the stream. The strip’s width in feet is at least 30 plus 15 times the percent slope. (FW-063-6)
- If a fireline is required next to a wetland, it is not plowed in the transition zone between upland and wetland vegetation except to tie into a natural firebreak. (FW-063-8)
- The best available technology to control smoke emissions is used, including accelerated mop-up, rapid ignition techniques, and burning when moisture conditions limit total smoke production. Burning is not done during stagnant weather nor when predictions indicate that smoke drift into highways, airports, populated areas, or other sensitive areas may be hazardous. (FW-063-9)
Generally, understory burns are not scheduled during nesting season to avoid disrupting reproductive activities. Forest managers may, however, use burns to meet specific objectives. (FW-063-11)

Burns are planned to achieve their most desirable distribution for wildlife habitat and to try to break up large, continuous fuel types. When consistent with burning objectives, burns are done to create a mosaic pattern of fuel types that complements fuel treatment and wildlife objectives. (FW-063-12)

Use an appropriate suppression response which minimizes the combined cost of suppression action and resource damage. The suppression response may be confinement, containment, or control. (FW-064, MA-4-32)

Utilize prescribed fire for forage and wildlife habitat improvement in combination with other treatments on a three to five year cycle. (MA-3-33)

Use prescribed fire cautiously and restrict or exclude where possible its use on areas showing evidence of active erosion. (MA-3-34)

Water bar firelines as appropriate, and seed bare earth to minimize erosion. (MA-3-34)

Prescribed fire will be used to enhance riparian vegetation or wildlife habitat.

a. Encourage the use of green lines, wet lines or foam lines rather than plowed firelines. Minimize the amount of plowed fireline which might impair the hydrology of the riparian ecosystems. Generally plowed firelines will not be allowed within the primary zone.

b. Prescribed fire will generally not be used in large riparian areas.

c. Low intensity backing fires may be used in smaller streamside zones (MA-4-31)

Crosstimbers Research Natural Area (MA-8a)

Limit suppression strategies, practices and activities to those which have minimal impacts to RNA values. Extinguish wildfires endangering the RNA. (MA-8a-31)

Avoid using chemical fire retardants. (MA-8a-32)

If fire is used to perpetuate a seral or successional stage, it should mimic a natural fire, but with prudent measures to avoid a catastrophe. (Managed or naturally occurring fire may be used to perpetuate a desired series of plant formation or changes). (MA-8a-33)

Normally allow fuels to accumulate at natural rates unless they threaten the objectives of the RNA. (Leave fire-caused debris for natural decay). (MA-8a-34)

Natural Heritage Areas (MA-8d)

Use prescribed fire to manage or maintain the botanical character and successional stages for which the area has been designated unless restricted in certain plant communities as defined in specific botanical areas (MA-8d-32)

Aquatic Resources

Aquatic weed and pest control, including use of EPA approved biological agents or aquatic pesticides, and fisheries habitat improvements are permitted pending appropriate site-specific environmental analysis. Consider biological control as first priority before chemical applications are proposed. (FW-012)

Construction of new impoundments, reservoirs, lakes and ponds shall follow appropriate construction standards and site specific environmental analysis. (FW-013)
- Natural lakes, perennial and intermittent streams will be managed for native species and communities (FW-014)
- Where beneficial uses of the aquatic resource are being impaired, investigate the cause and determine measures and/or methods needed to improve the aquatic ecological condition. (FW-015)
- Construct physical structures or initiate mitigation where USFS or USFS related management activities are causing or may cause deterioration of the streamside environment, or water quality impairment as determined by site-specific environmental analysis. (See Forest-wide Aquatic Standards and Guidelines.)
  - Implement action to protect or improve the aquatic and streamside environment including the hydrologic function of the riparian area.
  - Actions include, but are not limited to, construction of sediment traps, stream stabilization structures, or vegetative planting or manipulation. (MA-4-01)

**Biological Diversity**
- Manage all overstory and understory vegetation within SMZ’s of intermittent and perennial streams and lakes, as described in Management Area 4 to ensure ecosystem integrity.
  - Management activities such as stream crossings, recreation development, pipelines, safety hazard reduction, wildlife habitat improvements, and insect and disease control are permitted pending appropriate site-specific analyses (FW-022)
- Maintain or re-establish ground cover, and repair areas of bare soil using appropriate native and desirable non-native plant species.
  - Encourage re-establishment of native species as determined through site-specific analyses. (FW-023)
- Management area direction will be guided by information based on the Ecological Classification System (ECS). Ecological units for this Plan use Landtype Association(s) (LTA's); projects developed from this Plan will utilize appropriate ecological unit information (Forest Plan appendix A). (FW-026)
- Establish or maintain prairie on at least 60 percent of the limestone mesa landtypes, and at least 45 percent of the crosstimbers landtype in each diversity unit as soon as practical. (MA-3-03a)
- Exclude bottomlands and streamside zone ecosystems when determining these prairie or woodland objectives. (MA-3-03b)
- Establish or maintain woodland or forest on at least 5 percent of the limestone mesa landtypes, and at least 10 percent of the crosstimbers landtype in each diversity unit as soon as practical. (MA-3-03c)
- Maintain and restore woody vegetation within streamside zone ecosystems. (MA-3-04)
- Provide approximately 10 percent of low woody brush cover where possible per 10 acres of prairie or pasture for wildlife needs. (MA-3-05)
- Maintain or restore existing native plant communities (MA-3-06, MA-4-12)
- Manage non-native grass vegetation or pastures to encourage re-establishment of native species. (MA-3-07)
- The streamside zone and selected ecosystems are classified as potential old growth. (MA-3-08, MA-4-11)
Crosstimbers Research Natural Area (MA-8a)

- Research natural areas are allocated as designated old growth (MA-8a-01)
- Maintain old-growth characteristics or natural plant succession as natural conditions determine (MA-8a-02)
- Manage for the biological characteristics and attributes identified for each specific RNA within the Ecological Classification System hierarchy (MA-8a-03)
- Permit no introduction of exotic plant and animal species. (Re-introduction of former native species may be permitted if RNA objectives are met) MA-8a-04
- Allow any existing non-native plant communities to revert to native plant communities (MA-8a-05).
- Prohibit cutting and removal of all vegetation, including firewood, grass, fruit, seeds, etc.; except as part of approved scientific investigation and/or valid existing rights (MA-8a-06).
- Leave any felled trees in place, unless lying across maintained trails. Do not remove any trees. (Hazard tree felling may be permitted along boundary trails or roads for safety). (MA-8a-07)
- Ensure the protection and perpetuation of the Western Gross Timbers and Grand Prairie Vegetative zones. (U. S. Forest Service specialists and research station personnel will involve the Texas Natural Heritage program and The Nature Conservancy when developing strategies to address hardwood encroachment which has occurred in the last 90-50 years). (MA-8a-A1)
- Manage fire to maintain and enhance the two vegetative types featured here. (MA-8a-A2)

Natural Heritage Areas (MA-8d)

- Vegetation management activities can be used to restore or maintain the botanically significant character of the site. (MA-8d-123)

Chemicals

Please see the Forest Plan, pages 55-60 (FW-031), and the National Forests and Grasslands in Texas Nonnative Invasive Plant Species Project Management Plan (USDA Forest Service 2008) for specific direction.

- Prohibit non-aquatic herbicide uses except hand applications for noxious weed control following restrictions on the herbicide label. (MA-4-13)

Heritage Resources

- Inventories of cultural resources and consultation with the State Historic Preservation Office (SHPO) will be completed for all projects which involve a decision to implement ground disturbing activities. (FW-041)
- If archeological or historic resources are encountered during soil disturbing activities, work stops until an archeologist evaluates the site’s significance and completes any necessary consultation with SHPO. (FW-043)
- Implement the Heritage Program according to the stipulations contained within the Programmatic Agreement, among the USFS Southern Region, State Historic Preservation Officers and the Advisory Council on Historic Preservation (REPA). (FW-044)
- Inventories on areas not previously surveyed as part of site-specific analysis will be conducted according to the priorities established in the Heritage Management Plan for the NFGT. (FW-045)
• Work done on or around archeological sites will follow the mitigation guidelines set forth by the Archeologist and concurred upon by the consulting parties.

Facilities
• Eliminate unnecessary or unused livestock management facilities where compatible with cultural resource protection needs. (MA-3-22)
• Stream crossings should be at right angles to the stream (MA-4-22).
• Require appropriate structures at all designated trails, permanent and temporary road system stream crossings.
  ♦ a Design these structures to permit fish passage
  ♦ b Consider bridges on all perennial streams
  ♦ c Use culverts, anchored corduroy, bridges, gravel and/or concrete fords at intermittent and certain ephemeral streams that are determined during site specific analysis to require protective measures
  ♦ e Minimize or avoid crossings for roads and trails with deeply-incised stream banks (MA-4-24)
• Protect road and trail approaches to and from perennial streams with anchored corduroy, gravel, or concrete for a minimum distance of 20 feet from the edge of stream channel.
  ♦ Reinforced approaches to bridges may be necessary and the need for these will be determined on a case-by-case basis Extend the protection to the gradient break to include nearby transitions between the stream floodplain and other landforms (MA-4-25)
• Construction of physical structures within stream channels will be designed and engineered
  ♦ Construction will consider physical stream systems, including fishery habitat improvement structures, through coordination with other resource specialists (MA-4-26)
• Roads and trails will be constructed and maintained as per section 404 of the Clean Water Act. (MA-4-27)

Crosstimbers Research Natural Area (MA-8a)
• Subject to valid existing rights, prohibit new roads, trails, fences or signs unless they contribute to the objective or protection of the RNA. (Boundary fencing is permitted for protection against livestock or excessive human use. Buildings are not permitted. In rare instances, temporary gauging stations and instrument shelters may be permitted). (MA-8a-21)

Range
• Use livestock grazing as a vegetation management tool. (MA-3-51)
• Protect soil and water improvements from grazing until project objectives have been met (2-3 years). (MA-3-52, MA-4-72)
• Place salt and mineral blocks at locations to improve grazing distribution (MA-3-54).
• Allow no supplemental livestock feeding nor salt/mineral blocks within streamside management zones (MA-4-73)
• In the absence of perennial water, provide at least one perennial stock/wildlife pond per 160 acres. (MA-3-55)
- Conduct mowing, grazing, disking, brushhogging, vegetation manipulation, prescribed burning, spraying, fertilizing, seeding, planting, and vibratilling to achieve the management area goals and the desired future condition.
  ♦ a Prescribed burning shall be favored over mowing, brushhogging, or other mechanical treatments
  ♦ b Structural improvements such as fences, ponds and crossings may be developed to achieve area goals and grazing distribution. (MA-3-56)
- Favor biological and mechanical practices over the use of herbicides to achieve management area goals. (MA-3-57)
- Maintain native prairie vegetation in satisfactory condition using ECS information (See Forest Plan Appendix A), management emphasis, and desired future condition.
  ♦ a. Manage allotments in less than satisfactory condition so as to meet the long-term goal of satisfactory condition
  ♦ b. Generally recreation/wildlife emphasis areas favor forbs, early/mid seral grass type vegetation components, grazing emphasis areas favor grass type (mid/late seral) vegetation components
  ♦ c. Use the county soil survey published by the NRCS to supplement ECS information and define capabilities for each site (excluding critically eroded lands) (MA-3-58)
- Retain up to 50 percent of the average annual production of desirable forage species to maintain and improve soil cover and productivity, wildlife habitat, and plant vigor for the appropriate grazing system on each site. Use the county soil surveys published by the NRCS to identify and manage sites within eroded soils. (MA-3-59)
- Use dormant season grazing (when appropriate) instead of growing season grazing as a method of improving native range conditions or to maintain native rangeland in a satisfactory condition. (MA-3-60)
- On native prairies in a satisfactory condition, allow at least 60 days rest during the growing season at least once every 3 years to maintain native rangeland. (MA-3-61)
- On native prairies in a less than satisfactory condition, allow at least 75 days rest during the growing season every 2 years until condition improves to a satisfactory condition. (MA-3-62)
- Promote natural succession on non-native pastures (MA-3-63)
- Assess range condition based upon ecological potential and the future condition of that allotment (MA-3-64)
- Use vibratilling, fertilization, or herbicides only for soil and watershed improvements or to improve native range condition (MA-3-65)
- Protect watershed improvements from grazing until project objectives have been met. In most cases this would entail a three-year protection period (MA-4-72)
- Permit livestock grazing where consistent or compatible with adjacent management areas.
  ♦ Monitor any livestock grazing within this management area and restrict, control, or exclude cattle if evidence of degradation occurs (MA-4-71)
Crosstimmers Research Natural Area (MA-8a)

- Permit livestock grazing only as part of approved scientific investigation. (Where grazing is needed to establish or maintain vegetative communities, define objectives for grazing and RNA). (MA-8a-81)
- Initiate fencing or other methods of livestock control when incidental or casual livestock grazing exceeds 25 percent of annual desirable forage production. (MA-8a-82)
- Do not implement structural or non-structural range improvements within the RNA. (MA-8a-83)
- Manage the range program to ensure that the quality and sustainability of the Western Cress Timbers and Grand Prairie plant communities are maintained. (The Texas Natural Heritage Program and The Nature Conservancy should be consulted to review range management guidelines). (MA-8a-A4)

Natural Heritage Areas (MA-8d)

- Prohibit livestock grazing except as part of approved scientific investigation (standard). Where grazing is needed to reestablish or maintain vegetation communities, define objectives for grazing (guideline) (MA-8d-81)

Boundary Management

- Identify, post, maintain, and protect property boundaries as per FSM to prevent encroachments and other unauthorized uses.
  - Survey, post and maintain boundary lines as feasible with priority for boundaries adjacent to management activities. Maintain on a five-year cycle for initial maintenance and 10-year cycle for subsequent maintenance. (FW-083)

Roads and Trails

- Apply road use restrictions to protect other resource values.
  - A site specific analysis will be prepared for each proposed travelway closure or restriction. This analysis shall consider the effects on developed and dispersed recreation including the needs of people with disabilities. (FW-059)
- Trail planning, design, construction and maintenance will conform to the USFS Trails Handbook and/or the Trails South Guide.
  - Designated trails will have a management zone corridor up to 300 feet as/or appropriate for type of trail use, these corridors are to enhance the recreational experience and will be determined through site specific analysis. (FW-158)
- Reconstruct multiple or relocate sections of trail that are over 50 feet in length when incised or gullied to a depth of 10 inches or greater, and which occur on slopes exceeding 5 percent. (FW-161)
- Off-road vehicle (ORV) use and trails will be inventoried, evaluated, managed and monitored to minimize damage and ensure sustainability and integrity of all resources.
  - Utilize guidelines provided in Plan Appendix E for ORV inventory, management and monitoring.
  - OPEN - The Sabine, northern Angelina and Davy Crockett National Forests will be open to ORV use
  - RESTRICTED - The Sam Houston National Forest, MA-6 (Longleaf Ridge) and MA-4 (crossings only) will manage ORV use on an identified trail system
Prohibit ORVs. Restrict use to street legal vehicles with licensed operator on designated Forest System Roads. (MA-3-73)

- Trails, except off-road vehicle (ORV), may be constructed within this management area where consistent or compatible with adjoining management areas. (MA-4-84)

- Equipment may not enter into the primary streamside management zones, except at designated crossings. Entry shall not be authorized during wet ground conditions (MA-4-103).

**Crosstimbers Research Natural Area (MA-8a)**

- Limit trails to those needed for access to conduct research and for educational purposes. (Existing trails may be allowed to remain as long as the RNA objectives are not compromised). (MA-8a-98)

**Silviculture**

- This area is classified as unsuitable for timber production. Unregulated harvest for fuelwood generated from other projects benefiting other resources or for salvaging mortality may be permitted. (MA-3-91, MA-4-101)
  - Harvest and silvicultural management may occur within the secondary streamside management zone to achieve the desired future condition (MA-4-101a)
  - No harvest shall occur within the primary zone unless for forest health, safety or to provide habitat for threatened or endangered species (MA-4-101b)
  - Harvest and silvicultural management may occur within the secondary zone to achieve the desired future condition (MA-4-101c)

- Retain, where available hardwood den trees and at least two snags (112 inches diameter breast height or greater) per acre during silvicultural treatments or fuelwood harvest. (MA-3-92)

- Leave vegetation and naturally-felled timber wherever they afford shade over a stream channel or maintain the integrity of the soil near such a stream. (MA-4-104)

- Prompt revegetation is done if treatments leave insufficient ground cover to control erosion by the end of the first growing season (FW-204-15, VM-43)

- Only mowing, chopping, shearing, ripping and scarifying are used to sustained slopes over 15 percent. No mechanical equipment is used on sustained slopes over 35 percent (FW-204-16, VM-44)

- Mechanical site preparation is not done on sustained slopes over 20 percent with erodible or failure-prone soils (FW-204-17, VM-45).

- To limit soil compaction, no mechanical equipment is used on plastic soils when the water table is within 12 inches of the surface, or when soil moisture exceeds the plastic limit. Soil moisture exceeds the plastic limit if the soil can be rolled to pencil size without breaking or crumbling (FW-204-18, VM-46)

- Mechanical equipment is operated so that furrows and soil indentations are aligned on the contour (with grades under 5 percent) (FW-204-19, VM-47)

- Windrows and piles are spaced no more than 200 feet apart to limit soil exposure, soil compaction, and nutrient loss from piling and raking. Windrows are aligned on the contour (FW-204-20, VM-49).

- When piling, at least 80 percent of the area must retain some ground cover of litter and duff, and soil must not be displaced by piling rakes (FW-204-21, VM-50).
- All trails, roads, ditches, and other improvements in the project area are kept free of logs, slash, and debris. Any road, trail, ditch, or other improvement damaged by operations is promptly repaired (FW-204-22, VM-52).

- Silvicultural practices for riparian areas damaged by past management or catastrophic events will be designed to reestablish stands that provide desired vegetation characteristics.
  - Use information from the established ECS and vegetation community to achieve riparian ecosystem goal; restoration activities will be designed to maintain or improve the stated desired ecological condition (MA-4-105)
  - Retain, where available, hardwood den trees, or snags, (12 inches diameter breast height (DBH) or greater) during all stand entries, and silvicultural treatments. (MA-4-111)

**Soil and Water**

- Maintain soil erosion with the tolerance levels for that soil type and minimize increases in stream turbidity (Forest Plan Appendix F) and meet non-point source pollution goals and aquatic habitat objectives (FW-211).

- Equipment will not be operated during wet ground conditions if damage to soil occurs. Operation should generally be stopped when 30 percent of the traffic area has ruts that are 6 inches or deeper. Exceptions for pond construction, soil erosion and rehabilitation, facility maintenance and construction or fire suppression activities may apply (FW-212).

- Waterbars will be constructed at angles of 30-40 degrees downslope with the centerline of unimproved roads, trails and firelines; the minimum waterbar height will be 1.5 feet (compacted) and the minimum channel depth will be one foot (FW-215).

- Maximum waterbar spacings are indicated in the Forest Plan (FW-216).

- Identify and protect wet sites, jurisdictional wetlands, bogs and seepage zones through direction provided in Management Area 4 (MA-4). (FW-217)

- Identify ephemeral streamcourses during site-specific analysis and determine the need to provide additional protection. Characteristics of the individual streamcourse, soils, slope of the adjoining terrain and location are considered during analysis.
  - Ephemeral streamcourses exist throughout the Forest and require different degrees of management, depending upon the stream’s characteristics and the proposed management actions. In some cases, specific limitations on various types of work are necessary. Because of the varied nature of these water courses, the protective measures needed are evaluated on a case-by-case basis. This evaluation will be accomplished during the environmental analysis for any proposed projects which would affect an ephemeral stream(s). (FW-218)

<table>
<thead>
<tr>
<th>Soil Erosion Hazard</th>
<th>5% slope</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td>33 feet*</td>
<td>40</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td>45</td>
<td>55</td>
<td>66</td>
<td>88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td></td>
<td></td>
<td>66</td>
<td>80</td>
<td>95</td>
<td>110</td>
<td>125</td>
</tr>
</tbody>
</table>

*Width (ft) both sides from streamcourse
• Prohibit soil disturbing mechanical activities within streamside zones (See MA-4 for specific guidelines). The following types of projects may be allowed within streamside management zones if a site-specific environmental analysis determines they are acceptable. (a) Restoration and rehabilitation of eroded or disturbed states; (b) construction, repair or rehabilitation of stock/wildlife ponds, (c) special use, utility and pipeline crossings; (d) seismic surveys, (e) road or trail construction, reconstruction, or maintenance; (f) timber harvest for non-timber or vegetation enhancement purposes; (g) recreation facilities; and (h) correction of safety hazards. Protect soil and watershed restoration sites from concentrated livestock and recreation use for 3 to 5 years or until these are fully stabilized. (MA-3-101, MA-4-121)

Crosstimbers Research Natural Area (MA-8a) and Natural Heritage Areas (MA-8d)
• Initiate watershed restoration where man-induced erosion is damaging area values, water quality, or soil productivity (MA-8a-121, MA-8d-131)
• Monitor all erosion control structures annually. If maintenance is needed, use the least intensive methods possible. Consult with the Forest RNA Coordinator prior to initiating maintenance). (MA-8a-A5)

Wildlife
• Retain all turkey roost tree groups of 0.10 acres or more in size. This group includes the trees actually used for roosting and other adjacent trees used for cover. (MA-3-112)
• Leave one-tenth (1/10) acre per ten (10) acres of low brush or unmowed grassland to provide cover for wildlife. (MA-3-113)
• Construct artificial cavities for wildlife where necessary and feasible.
  ♦ Placement of these cavities should be compatible and consistent with the adjacent management areas (MA-4-131)
• Development of greentree reservoirs, ponds, and other wildlife habitat improvements as defined in the Forest Service wildlife habitat handbook are permitted.
  ♦ These wildlife improvements will consider compatibility and be consistent with the adjacent management areas. (MA-4-133)

Crosstimbers Research Natural Area (MA-8a)
• Do not permit management practices specifically designed to improve wildlife habitat. (MA-8a-131)

Nonnative Invasive Plant Species Direction
The National Forests and Grasslands in Texas use an Integrated Pest Management (IPM) strategy. Integrated pest management is a process for selecting strategies to regulate invasive plants to maintain healthy, diverse, and sustainable ecosystems. It is the planned and systematic use of detection, evaluation, and monitoring techniques; and all appropriate strategies, as budgets allow, preventing or reducing damage and losses to levels that are economically, environmentally, and aesthetically acceptable. IPM consists of an aggressive prevention and education program together with chemical, mechanical, biological, and cultural control technologies. Activities included under integrated pest management would include and fully utilize prevention, education, mechanical (hand pulling/digging, collecting propagules, mowing, etc.), cultural (revetgating with natives, prescribed burning [not in MA 7.0]), biological (use of triploid grass carp or Salvinia beetles), and cooperative control efforts to combat NNIPS across the Forest. Herbicides would be used in conjunction with these other activities where necessary or
appropriate. Herbicide application would be selective (limiting treatment to the point of origin) and would depend on the specific NNIPS being treated, the location in which it is being treated, and protection of TES species. Site monitoring would follow.

**MA 3**

Control and eradication measures used will include the pulling, cutting, mowing, chopping, girdling, and/or the application of herbicides to all individuals of the high and medium-priority species to the extent that funds are available on a yearly basis. All girdled or frilled trees will be left standing, except when the snags become a safety issue to humans. By leaving the dead trees standing, it will reduce impacts to the surrounding vegetation, as well as create habitat for species that feed or nest in snags. To prevent those species not yet present within MA 3 from invading partnerships will be developed with neighbors to remove it from their lands if necessary. Localized infestations of any of these species do not generally interfere with management goals when they are present along the major roads through this MA, and it is believed that the costs of controlling it there would outweigh the benefits of reducing the chances of re-introduction from these locations. However, this shall not apply to new infestations of an invasive species that has not been documented elsewhere in the MA.

**MA 4**

Control and eradication measures used will include the pulling, cutting, chopping, girdling, and/or the application of herbicides to all individuals of the high and medium-priority species to the extent that funds are available on a yearly basis. All girdled or frilled trees will be left standing, except when the snags become a safety issue to humans. By leaving the dead trees standing, it will reduce impacts to the surrounding vegetation, as well as create habitat for species that feed or nest in snags. To prevent those species not yet present within MA 3 from invading partnerships will be developed with neighbors to remove it from their lands if necessary. Localized infestations of any of these species do not generally interfere with management goals when they are present along the major roads through this MA, except where the road crosses over a culvert, and it is believed that the costs of controlling it there would outweigh the benefits of reducing the chances of re-introduction from these locations. However, this shall not apply to new infestations of an invasive species that has not been documented elsewhere in the MA.

Pages 52 through 78 of the National Forests and Grasslands in Texas Nonnative Invasive Plant Species Project Management Plan detail the control options and procedures for each of the NNIS listed in table 2.
<table>
<thead>
<tr>
<th>Management Area 3</th>
<th>High (Where known to occur or may occur)</th>
<th>Medium (Unless infestations are discovered that occur in the most highly valued habitats or areas of the site, especially areas that contain rare or highly valued species or communities and areas that provide vital resources, in which case the priority level assigned would be elevated)</th>
<th>Low (Mostly due to these species being overly difficult to control with the resources available and do not generally interfere with management goals)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arundo donax, Carduus nutans, Nandina domestica, Pueraria montana, Tridaca sebifera (known to occur) Ailanthus altissima, Lespedeza cuneata, Tamarix ramosissima (due to its drastic negative impacts on grassland ecosystems) Eichhornia crassipes, Hydrilla verticillata, Salvinia molesta, and Myriophyllum spicatum (natural lakes, wetlands, and marshes within the MA)</td>
<td>Albizia julibrissin, Bothriochloa ischaemum var. songarica, Hedera helix, Melia azedarach, Ligustrum sinense, Ligustrum japonicum, Phylllostachys aurea, Rosa multiflora Vinca major/Vinca minor</td>
<td>Sorghum halpense (seem to be restricted to roadsides)</td>
</tr>
<tr>
<td>Management Area 4</td>
<td>Ailanthus altissima, Arundo donax, Nandina domestica, Pueraria montana, Tamarix ramosissima (known to occur) Albizia julibrissin, Imperata cylindrica, Lygodium japonicum, Melia azedarach, Tridaca sebifera, Vernicia fordii (may occur at stream crossings and culverts) Eichhornia crassipes, Hydrilla verticillata, Salvinia molesta, and Myriophyllum spicatum (natural lakes, wetlands, and marshes within the MA)</td>
<td>Hedera helix, Ligustrum sinense, Ligustrum japonicum, Paulownia tomentosa, Phylllostachys aurea, Vinca major/Vinca minor, Wisteria sinensis</td>
<td>Bothriochloa ischaemum var. songarica, Lespedeza cuneata, Sorghum halpense (seem to be restricted to roadsides)</td>
</tr>
</tbody>
</table>
LBJ Prairie Savanna Restoration Project
Environmental Assessment

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Adaptive Management Decision Matrix

Desired Vegetation Classification

**Tallgrass Prairie**
Group of ecological sites that have in common the following characteristics: historic climax plant communities that were dominated by warm season tallgrass species like little bluestem, Indiangrass and switchgrass; climate, soils, topography, and; response to natural and man-made ecological disturbances in similar ways, such as, fire, grazing, drought, and cultivation - also, response to lack of disturbance, such as fire suppression. (Additional information for all desired vegetation classifications is located in the project record).

**Post Oak-Blackjack Oak Savanna**
Group of ecological sites that have in common the following characteristics: historic climax plant communities that were savannas with an overstory dominated by post oak with blackjack oak as a subdominant; tree canopy cover was between 10 and 50 percent; understories were 85 to 95 percent covered by herbaceous species with warm season tall grasses dominating this class - little bluestem particularly so at 65 percent cover. Also, this group of sites have the following characteristics in common: climate, soils, topography, and; response to natural and man-made ecological disturbances in similar ways, such as, fire, grazing, drought, and cultivation - also, response to lack of disturbance, such as fire suppression.

Some very important species have been extirpated, such as bison. The fire regime has been highly altered since Euro-American settlement in the late 1800s. Woody vegetation has encroached in most areas and the herbaceous layer has been mostly lost. Very little of this ecosystem is protected. Much has been lost to housing and subdivision and conversion to introduced pasture and crops. The precise extant of ecosystems remaining intact is not known. There is less than 0.01 percent of oak savannas in Wisconsin that are in historically representative conditions (Henderson 1995). There should be more than this in Texas and Oklahoma; but it is still rare. Generally, this ecosystem is very similar to tallgrass prairie in terms of conservation status and stresses and threats (Stotts, et al. 2007).

**Bottomland Hardwood Savanna**
Group of bottomland ecological sites that have in common: historic climax plant communities that were savannas with an overstory dominated by large hardwood trees such as pecan, oak and elm; tree canopy was less than 40 percent; understories were dominated by herbaceous species, mainly tallgrass, wildrye and sedge species; climate, soils, topography, and; response to natural and man-made ecological disturbances in similar ways, such as, fire, grazing, flooding, and cultivation - also, response to lack of disturbance, such as decreased flooding.

There is good basis for the identification of this ecosystem as a savanna in the literature (NRCS). But, no literature has been found on the rarity of it. Professional experience suggests that it is currently very rare, perhaps more rare than bottomland hardwood forests which are quite rare. Bottomland hardwood savannas are rarer because they are very susceptible to woody encroachment and loss of herbaceous layers.

Most potential sites for this ecosystem have been heavily encroached by woody species; most sites have 80 percent or more canopy of trees. A few sites on the LBJ Grassland were cultivated last as
bermudagrass pastures in the 2000s; these sites are quickly going through succession, but at least retain an open canopy for the time being. Gullies from nearby incised streams cut regularly into these sites. Hydroperiods have been severely altered by man-made alterations in the watershed such as dams, extirpation of beaver, and land use changes. Floods are less frequent and of more severity than in the past. Hydroperiod and depth to the water table were once ecological drivers in these sites but now have much less, if any effect. Fire can be a driver in some of the drier sites but is thought to have limited effect in general. These sites were historically driven by heavy grazing of bison, more so than the uplands because of distance to water.
Pasture Use Rating

Pasture use rating will be monitored and managed using *The Grazing Manager* computer program (see the project record for details regarding this software). Table 1 is the use rating classification system which becomes input for the computer program.

**Table 1. Pasture Use Rating Guide (from The Grazing Manager User Guide located in the project record)**

“This guide is to be applied to current year’s forage at the whole pasture level, not to individual plants or plots within a pasture. Note that this scale is in terms of animal nutrition and forage preference, not simply plant residue biomass. As such, it considers both the quantity and quality of both forage plant species and their respective parts.”

<table>
<thead>
<tr>
<th>Pasture Utilization (mid-point)</th>
<th>Pasture Utilization (range)</th>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>0-10%</td>
<td>None</td>
<td>Vegetation appears practically undisturbed when viewed from angle or from a distance.</td>
</tr>
<tr>
<td>25%</td>
<td>10-40%</td>
<td>Light</td>
<td>Preferred areas and high-choice(^1) Forage show moderate use. Light use of primary(^2) or low-value(^3) forage.</td>
</tr>
<tr>
<td>50%</td>
<td>40-60%</td>
<td>Moderate</td>
<td>Most accessible forage shows grazing. High-choice forage heavily used. Primary forage is moderately grazed and supplying most of the demand. Light use of low-value forage.</td>
</tr>
<tr>
<td>75%</td>
<td>60-90%</td>
<td>Heavy</td>
<td>High-choice forage completely used. Primary forage is closely grazed over most of the area. Moderate use of low-value forage</td>
</tr>
<tr>
<td>95%</td>
<td>90-100%</td>
<td>Severe</td>
<td>Pasture appears stripped of forage. Primary forage almost completely used. Low-value forage shows considerable use and is carrying the grazing load.</td>
</tr>
</tbody>
</table>

1 - High-choice forage – Plant species and plant parts that have high nutritive value and are preferred by grazing animals.
2 - Primary forage – Plant species and plant parts of moderate nutritive value and preference.
3 - Low-choice forage – Plant species and plant parts of low nutritive value. Preference for this forage is low, and it is not consumed in significant amounts when better quality forage is available.
Grazing Management

The process of grazing program management.
Left side, the process within a management information system, such as The Grazing Manager (see project record). The management information system is kept up to date with actual grazing use records. Before grazing is authorized, a grazing plan is created and modelled to determine predicted effects. Within the season, records are adjusted to actual ground conditions and the model is run again, plans are adjusted to achieve desired effects or mitigate unfavorable outcomes from drought. At the end of the grazing season, grazing records are updated and model inputs are calibrated to reflect real world results.

Right side, the process of managing grazing in the field. Grazing plans are implemented by authorized grazing resource users (e.g., permit holders). Qualified FS personnel coordinates observation of intra-season pasture use ratings, oversees implementation of adjusted grazing plans and enforces compliance to grazing plan. At end of season, qualified FS personnel coordinates observation of pasture use ratings.

Top right, long-term vegetation/ecological monitoring program informs the overall grazing management planning environment. E.g., trends in plant or animal species communities.
Prescribed Fire Regime Type and Prescription

**Maintenance Prescribed Fire Regime**
1. Rx Burn with moderate fire intensities and return intervals every 2-5 years during any season.
2. Continue indefinitely as long as monitoring indicates that vegetation is greater than or equal to 90% desired future conditions (DFC). If it drops below this, reclassify unit in process above.

**Restoration Prescribed Fire Regime**
1. Rx burn every 1-3 years during any season. Fire intensities should range from light to the maximum intensities in accordance with Forest Service Manual direction.
2. Areas with no grass layer should be burned with the objective of removing all of the oak leaf litter. Post oak leaf litter releases allelopathic chemicals into the soil which prevent grass seeds from germinating (Baldwin and Crosby 2016). Also it creates a physical barrier to grass seedling establishment (Burton et al. 2011). Therefore fire prescriptions should emphasize efficaciously reducing this fuel as much and as frequently as possible.
3. Where Eastern red cedar is present, live fuels moisture of cedar should be below 90% maximize tree mortality whenever possible.
4. Generally, burns should preferably occur during growing season, drought, or times of low live fuel moisture to thin live woody vegetation. However, more frequent light or moderate fires are generally more effective at restoring desired conditions than infrequent higher intensity fires. There are often environmental and administrative challenges to burning all units in the growing season or during drought or other special conditions, therefore it is still important to burn in the dormant season to achieve optimal fire frequencies.
5. Continue this regime until vegetation reaches 90% or greater DFC. When it does, burn unit should be reclassified in process above.
Fireline Construction
Start by checking all applicable statements in sections A-D

A. Permanent Fire Line
- Fire line is needed to effectively implement RX burns
- Fire line will be used for more than one burn
- No natural firebreaks are immediately nearby
- No agreement exists to burn across ownership boundary
- Slope is less than 60%
- Fire line does not cross any streamside management zones (SMZs)
- Fire line construction is compliant with Section 106 of the National Historic Preservation Act (NHPA)

B. Temporary Fire Line
- Temporary fire line is needed where no permanent fire line is present or permissible
- Slope is less than 60%
- Fire line does not cross any SMZs
- Fire line construction is NHPA compliant.

C. Hand Line
- Fire line is needed in primary SMZ
- Slope is greater than 60%
- Fire line is in a place where PFL/TFL are not permitted or feasible

D. Fuel Breaks
Are specific fuel breaks adjacent to fire lines needed for:
- Effective RX burn
- Firefighter and public safety

E. Stream Crossings
- Designated stream crossings are needed for efficient and effective Rx burn implementation

Then
- Any item is checked in section D or E
  - TRUE: Proceed to fuel break and stream crossing workflows
  - FALSE: All items in section B are selected

- All items in section A are selected
  - TRUE: Construct permanent fire line
  - FALSE: Construct temporary fire line

- Any item in section C is selected AND hand line construction is NHPA compliant
  - TRUE: Construct a hand line
  - FALSE: Do not construct fire line
Fireline Stream Crossing

- Proposed stream crossing is less than 15 feet from edge of highest bank to bottom of channel
- Proposed stream crossing is on a straight run of the stream (not in a bend)
- Proposed crossing is at a right (90 degree) angle of the stream run

**All statements TRUE**

**Some or all statements FALSE**

**Stream channel is less than or equal to 6 feet deep from edge of highest bank to bottom of channel**

**TRUE**

**FALSE**

**There is hard substrate in the stream channel to support passage of Type 6 wildfire engines**

**TRUE**

**FALSE**

- Height from bottom of channel to edge of bank is 6 to 15 feet high
- Back-cut and approach will be less than 50 feet long and less than 5:1 grade

**Some or all statements FALSE**

**Proceed to next page**
Based on analysis of engineer or expert opinion of hydrologist or fisheries biologist, properly built culverts will survive normal flood events (one in every ten years).

Stream is identified for fish passage, according to FS fisheries biologist

Do not build crossing, may consider in separate NEPA decision

Build crossing with bottomless culvert

Build crossing with conventional round culvert(s) or bottomless culvert
Patchburn Grazing

- Pasture vegetation canopy cover is equal to or greater than 90% desired future condition
- Internal firelines or features that may be used, like roads, are present or may be feasibly constructed
- Resulting burn patches will be greater than 80 acres (average per pasture). Or, whole pasture will be burned in a mosaic pattern and the whole pasture is greater than 240 acres

All statements true

- Implement patchburn grazing on this pasture

Some or all statements false

- Do not implement patchburn grazing on this pasture
Authorize Grazing

- FS System land and contiguous private land under Forest Service Management (if applicable, e.g., term private land grazing permit FS-2200-11) make a single logical grazing pasture that is equal to or greater than 75 acres.
- Forest Service personnel and equipment have access to manage pasture as needed. If private land must be crossed to access pasture, FS should have prescriptive rights or a permanent easement for a road/route to access pasture.
- The area of continuous land that is able to be managed by fire and other needed vegetation treatments is equal to or greater than 75 acres. (Lands are not cut off from management activities by physical barriers such as deep gullies.)
- Current grazing capacity for pasture is equal to or greater than 24 AUMs and can be reasonably expected to improve to 48 AUMs with foreseeable restoration treatments.

All statements TRUE

- Pasture has a current valid livestock grazing permit that is in full compliance. OR, pasture is being restored or managed by prescribed fire to restore vegetation to desired future condition

Some or all statements FALSE

Do not authorize grazing

TRUE

Authorize prescribed livestock grazing as a compatible use and tool for restoring vegetation to desired future conditions.

FALSE

Wait and consider authorizing grazing later once prescribed burns and other restoration methods have been initiated.
Grazing Prescription for General and Sensitive Areas

Use general grazing prescription(1) to start the adaptive management process.

Monitoring of current grazing prescription indicates that degradation is occurring or is expected to occur to rare plant/animal populations or to soils, streams or riparian areas if no adjustments to management are made.

Implement needed elements of grazing prescription for sensitive areas(2) as per monitoring findings.

Monitoring indicates that degradation is still occurring or is expected to occur if no adjustments to management are made.

Construct fences to create a smaller pasture(e.g., "riparian pasture") which includes the sensitive area as part of a smaller logical grazing management unit and provides for improved control of grazing.

Monitoring indicates that degradation is still occurring or is expected to occur if no adjustments to management are made.

Proceed to next page

Continue current management and monitor.
Grazing Prescription for General and Sensitive Areas (continued)

(1) General Grazing Prescription
- Implement prescribed grazing system that is integrated with prescribed fire. Use intra-season monitoring and modeling to achieve seasonal target whole-pasture grazing utilizations which are based on prairie or savanna restoration objectives.
- Generally to achieve this, utilization of primary forage (usually little bluestem) should be heavy (60 – 90%) in the summer growing season (May through September) in burn units that were burned in the current year (patch-burn patches, or whole-burned pastures). In the following two years, utilization of primary forage in these areas should be none (ungrazed) to light (10 – 40%) in the summer growing season as dominant tallgrasses recover. If these areas are not burned again by the fourth year, utilization should be none (ungrazed) to moderate (40 – 60%) until burned again, with emphasis on none to light (less than 40%) to stockpile fuels for the next burn. Heavy utilization (60 – 90%) of primary forage in the dormant or cool growing season (October through April) should be an option for improving forb diversity and wildlife habitat in pastures with no or infrequent fire regimes.
- Adjust livestock herd numbers (up or down) or grazing periods (shorter or longer, more or less frequent) to achieve objectives.
- Use best practices in placement of salt and mineral supplements.
- Turn off manageable water sources, such as wells, as needed to remove attraction of animals to sensitive areas.
- Monitor grazing effects on rare plant and animal populations, and effects on soils, streams and riparian areas.

(2) Grazing Prescription for Sensitive Areas (select elements as needed)
- Use prescribed fire to improve forage desirability and lure livestock away from sensitive areas.
- Adjust livestock grazing seasons to remove pressure on sensitive areas during critical periods.
- Adjust whole-pasture target utilization and adjust herd numbers to achieve this.
- Change or add livestock kinds/classes (e.g., species, breeds, age classes, sexes) to adjust foraging use and behavior.
- Use herding and/or supplemental feeding stations to keep livestock away from sensitive areas.
- Develop additional livestock water sources to draw livestock away from sensitive areas. Use ground/well water sources (e.g., developed spring, windmill) over surface water (e.g., ponds), unless groundwater is not available or is too costly to attain. After using as much of these adaptive measures as possible, does monitoring indicate degradation is continuing?
Nonnative Invasive Plant Species

Monitoring would be similar to that which is being conducted as part of the National Forests and Grasslands in Texas 1989 forest plan and Nonnative Invasive Plant Species (NNIPS) EA. Monitoring of environmental conditions would occur during direct NNIPS treatments. Monitoring of non-target resources, including wildlife, plant and animal abundance, and aquatic resources would also occur. Effectiveness monitoring would be conducted during the next growing season following treatment. Inventories for new infestations as a result of the proposed activities would be conducted every growing season. The monitoring and inventories would be conducted by qualified NNIPS, range, or botany personnel on the National Forests and Grasslands in Texas.
Stream Restoration and Stormwater Diversion Structures

A. Prioritize Stream Restoration
   - General Priorities
     1. Spring-fed perennial stream
     2. Perennial stream
     3. Intermittent stream, steep
     4. Intermittent stream, flat
     5. Ephemeral stream, steep
     6. Ephemeral stream, flat
   - Special Priorities/Considerations
     - Preservation of high quality watershed, habitat, hydrology, or cultural resources
     - Zone of influence of federal ownership and action
     - Integration with large scale ecosystem restoration work
     - Presence of beaver
B. Stream Restoration Methods

- Improve habitat and conditions for beaver on habitable streams

**Artificial Structures** (Zeedyk and Clothier (2009), chapter 5)

**Lateral Artificial Structures**
- Baffles
  - Rock/boulder baffles
  - Picket baffles
  - Picket/rock baffles
  - Whole tree baffles

**Vanes**
- Post vanes
- Boulder vanes
- Log vanes

**Vertical Artificial Structures**
- Weirs
  - Wicker weir
  - Boulder weir
  - One rock dam
  - Tree length log mat
  - Channel liner
  - Cross Vane

- Weirs as cascades or step pools
  - Zuni bowl
  - Rock arch dam (w/keystone)
  - Filter dam
  - Log and fabric step falls
  - Step pool and rock rundowns
Livestock Fences and Gates

Start

Fence(s) and/or gate(s) are needed for proper grazing and fire management AND all location compliant with Section 106 of the NHPA

TRUE

• Slope is less than 60%
• No not in a primary streamside management zone

FALSE

Do not construct fence and/or gates

All statements TRUE

Construct with soil disturbing heavy equipment, if needed

Some or all statements FALSE

Construct by hand or with non-soil disturbing equipment, like wheeled tractors
Rangeland Seeding

The appropriate seed mix and method depends on the season, soils, scope of work, and existing vegetation conditions. The District Rangeland Management Specialist should develop each mix and method special for each project, in concurrence with the Forest Botanist. Native species should be used in all cases, except for instances where native propagules from adjacent sites will establish themselves quickly, such as in a narrow strip, like a pipeline. In such cases, the objective is to simply conserve soil with a cover crop that is a non-persistent and non-invasive annual domestic plant, such as winter wheat, or millet; native species will establish themselves in following years.
Livestock Water Developments and Handling Facilities

Start → Livestock water trough/well and/or handling facility is necessary for proper management of livestock → TRUE

- Location is not in a primary or secondary streamside management zone
- Location is in a well-drained site with well-drained soils.
- Slope is less than or equal to 5%
- Location does not inhibit protection of cultural resources (NHPA)

All Statements TRUE → Construct watering and/or handling facility

Some or all statements FALSE → Do not construct watering and/or handling facility
Oak-Tallgrass Savanna Restoration Regime

Strategy One: For areas dominated by oak shrublands, prescribe burn every one to three years to keep allelopathic oak leaf litter from accumulating and to eventually reduce tree canopy to desirable range, implement a prescribed grazing regime to optimize grass fuels for burns, decrease woody cover (e.g., greenbriar) and increase native herbaceous cover; seed select native plants as needed to increase native herbaceous cover.

Strategy Two: For areas dominated by invasive brush, implement above strategies with addition of mechanical treatment of cedar and herbicide plus mechanical treatment of invasive hardwood brush such as mesquite, locust, and sumac. Photos by Reese Sewell.
Tallgrass Prairie Restoration Regime

Strategy One: For areas with short to midgrass plant communities, implement a prescribed fire regime with maintenance type fires every two to five years to keep out woody species and cactus; implement a prescribed grazing regime to increase tallgrass prairie species cover; seed select native prairie species as needed to increase soil health and productivity, particularly legumes.

Strategy two: For areas dominated with invasive brush, implement above strategies with addition of mechanical treatment of cedar and herbicide and mechanical treatment of invasive hardwood brush such as mesquite, locust, and sumac. Photo source: Reese Sewell (tallgrass prairie), and Ecological site descriptions from the USDA Natural Resource Conservation Service.
Bottomland Hardwood Savanna Restoration Regime

Strategy one, for areas in an introduced pasture or old field ecological state: Rx grazing, Rx burn every 1-3 years (drier sites), seeding with legume and native grass species to speed up desirable plant succession and build soil health, herbicide for releasing native perennial herbaceous species and brush management, restoring streams to correct the needed hydroperiod.

Strategy two, for areas that exist in a bottomland thicket state: strategy one plus mechanical treatment followed by selectively applied herbicide for resprouting plants and invasive brush (honey locust, black locust, mesquite, sumac) to achieve desirable savanna tree composition and cover.
Appendix C – Trail Maintenance Components

- Removing fallen trees and other large down woody material from the established trail corridors. The established trail corridor is defined as 3 feet each way from the tread center on the single track hiker and equestrian trails. Small woody brush that is overhanging or obscuring the tread or surface of the travel route will also be cut and removed. By clearing, brushing, and logging-out these trails in a timely manner, trail users would be kept within established trail corridors thus protecting off-trail soils and vegetation. All clearing and brushing would be done to specifications outlined in the FS Trail Maintenance Handbook.

- Inspecting all trail signs and route markers to assure that trail users can properly identify designated routes on the ground. Maintenance work will repair or replace any missing or damaged trail signs or markers. When signs and markers are kept in good condition, trail users will be less likely to travel off designated routes and create user trails that are susceptible to soil erosion.

- Posting all kiosks and information bulletin boards at established trailheads and staging areas so that trail users are informed of use regulations. Maintenance work will repair or replace any damaged bulletin boards or kiosks as needed.

- In areas where users have traveled off the established tread, downed woody material and logs place will be placed to discourage any further travel off of the designated routes.

- Inspecting all established trail drainage structures such as culverts, water bars, rolling dips and grade sags to assure that they are functioning properly. Maintenance work would include repairing existing drainage structures or constructing new structures as necessary where excessive trail rutting is occurring due to poor trail drainage. All drainage work will be conducted within the confines of the established trail tread. Soil that has collected in the bottoms and outlets of existing dips, grade sags or water bars will be recovered and spread back onto the trail tread where applicable or placed and compacted on the trail fill slope where not susceptible to erosion. At low spots in the trail susceptible to puddle formation, maintenance work will maintain or construct narrow ditches or channels to drain the water off the trail.

- Conducting routine tread maintenance where needed to repair excessive wash-boarding, to fill in ruts, to level tread surfaces and to narrow down portions of trail where the tread has widened over time. This would be accomplished by pulling soil, from sloughing cut banks and from the berms on the outer edge of the routes, back onto the route to reestablish a tread width specified for the designated type of tread use. All routine tread work will be confined to the existing established trail tread. Without routine tread maintenance, rutting of treads and an accelerated erosion of soils could occur. These tread maintenance activities help to control soil erosion. Sections of tread can become wash-boarded, rutted and full of loose rocks if tread maintenance is not performed.

- For trails in the TADRA system, routine tread maintenance would be accomplished with a combination of hand tools and the SWECO/SUTTER mini-dozer. Hand tools would be used for tread maintenance on trails where the established tread is too narrow for use of the SWECO. All routine tread maintenance would be done to specifications outlined in the FS Trail Maintenance Handbook.


- Conducting annual monitoring of trails for soil conditions, stream crossing conditions and for tread conditions.