

**THE LOESS HILLS
REGIONAL FIRE MANAGEMENT PLAN**

Prepared for the
THE LOESS HILLS ALLIANCE STEWARDSHIP COMMITTEE
by Agren, Inc.

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Tom Basten
Mark Bohner
Tom Bragg*
Tom Buman*
Jim DeCoster
Shirley Frederichsen
Chad Graeve*
Susanne Hickey*
Gail Kantak
Scott Moats*
Brent Olson
Kevin Pape*
Brian Peterson
Mark Peterson
Dennis Sohl*
Tim Sproul
Jerry Von Ehwegan
John Walkowiak*
Bob Walrod
Ed Weiner

*Denotes workgroup facilitator

The Loess Hills Regional Fire Management Plan

1. INTRODUCTION

The Loess Hills Alliance, through the Stewardship Committee (Appendix A), identified the need to develop a comprehensive fire management plan for the Loess Hills region. The purpose of the plan is to provide a framework for continued collaboration among stakeholders to identify and incorporate common prescribed fire goals and objectives.

The process of writing the Loess Hills Fire Management Plan was facilitated by Agren, Inc. a private contractor, through a series of workshops and small workgroups comprised of representatives of local, state and federal agencies and organizations. Participating stakeholders and workgroups are listed in Appendix B.

Stakeholders established the **collaborative goal** to restore and maintain viable ecological communities, provide protection from unwanted wildland fire, and improve productivity and value of the land through implementation of a regional fire management plan that is adopted by stakeholders in the Loess Hills.

The Loess Hills Fire Management Plan is iterative and is intended as a strategic document that will be adapted as necessary to achieve the following objectives:

1. Maintain high quality natural areas and in good condition while promoting native biodiversity
2. Improve the health of grasslands for livestock producers in the region
3. Reduce hazardous fuels accumulation to reduce the probability of extreme wildfires
4. Reduce the abundance of aggressive non-native species
5. Restore the fire culture of the region.

Prescribed fire can be used to help achieve all of these objectives. However, it is anticipated that the Loess Hills Fire Management Plan ultimately will be incorporated into a regional stewardship plan to more effectively restore the fire adapted systems of the Loess Hills landform.

2. GENERAL CONSIDERATIONS

Landform Characteristics

The Loess Hills region is a 650,000-acre landscape in western Iowa and northern Missouri that parallels the Missouri River valley. Exceptionally thick deposits of windblown silt form a steep and rugged landform located within the Central Tallgrass Prairie Ecoregion (Map 1.) The unique geological formation has been described as the best example of loess topography not only in the Central Lowlands, but in the United States (NPS 1985) and most recently the National Park Service (NPS) identified the resources in the landform as nationally significant (NPS 2002).

Natural Communities

The rugged topography creates a diversity of microhabitats resulting in a highly diverse landscape. Over 700 species of plants have been identified in the Loess Hills. The dissected landscape, with its varied exposures, results in moist ravines as well as droughty, sparsely vegetated ridgelines. Protected by the rugged topography, the region has escaped much of the intensive row crop agriculture, with an estimated 22,000 acres of native prairie remaining in the hills. This native prairie represents approximately 50% of Iowa's remnant prairie. In addition, the hills also contain bur oak communities.

Following the U.S. National Vegetation Classification system (USNVC), the Loess Hills contains the following community types:

- Eastern Great Plains Big Bluestem Loess Prairie *Andropogon gerardii*-*Sorghastrum nutans*-*Stipa spartea* (USNVC code C EGL002025)
- Loess Hills Little Bluestem Dry Prairie *Schizachyrium scoparium*-*Bouteloua curtipendula*-*Bouteloua hirsuta* – (*Yucca glauca*). (USNVC code C EGL002035)
- Great Plains Bur Oak woodland *Quercus macrocarpa*/*Andropogon gerardii*-*Stipa spartea* (woodland) (USNVC code C EGL002053)
- Basswood-Bur Oak forest, (*Tilia Americana*) – (*Quercus macrocarpa*)/*Ostrya virginia* forest (USNVC code C EGL002012)

For our purposes, the two prairie types listed above are treated as one community. Additionally, based on canopy cover, we have differentiated a bur oak savanna type from a bur oak woodland type under the Great Plains Bur Oak woodland. For more detailed descriptions of these vegetation associations please refer to "Plant Communities of the Midwest" (Faber-Langendoen 2001).

The Loess Hills provides a sanctuary for many species more indicative of the grasslands further west. The loess soil, rugged terrain and the southwestern exposed slopes create a habitat in which many Great Plains species thrive at the eastern edge of their range (Mutel, 1989). *Yucca* (*Yucca glauca*), Cowboy's delight (*Sphaeralcea coccinea*), and ten-petal mentzelia (*Mentzelia decapetala*) are just a few of the western plant species finding refuge in the Loess Hills. In addition, the eastern most population of prairie rattlesnake (*Crotalus viridis viridis*) in North America can be found in the northern Loess Hills where the grasslands are also large enough to maintain viable populations of the Ottoe skipper (*Hesperia ottoe*) and the regal fritillary (*Speyeria idalia*). Grassland birds such as the sharp tailed grouse and bobolinks also find habitat in the expansive grasslands in the northern Loess Hills. Over 40 species of special concern are identified in the Loess Hills region (Appendix C).

Invasive woody plants, most notably eastern red cedar (*Juniperus virginiana*), smooth sumac (*Rhus glabra*), rough-leaf dogwood (*Cornus drummondii*), have increased dramatically over the last century, fragmenting open grasslands and reducing the region's grazing livestock carrying capacity. Woody plant invasion has reduced oak regeneration in the bur oak woodlands and caused an approximate 2% annual loss of the grassland community, contributing greatly to the decline in grassland obligate species (Orwig, 1990).

Land Use

Over 91% of the landform is privately owned, thus presenting unique challenges to landscape scale restoration (Table 1).

Table 1. Land Ownership*

Land Owner	Acres
Private	585,848 acres
City/Town	39,500 acres
County Conservation Board	4,627 acres
The Nature Conservancy	3,197.5 acres
Iowa Department of Natural Resources	16,716 acres
TOTAL	649,888.50 acres

*National Park Service, 2002; Iowa DNR; and County Conservation Boards

The nature and extent of farming is undergoing significant changes. Over the last 30 years, agricultural practices have evolved from small, diverse farms to large row crop farming. The number of farms has steadily declined, while the average farm size has increased.

Currently, 39.1 percent of the Loess Hills, or 251,834 acres, are cropped (Table 2). The natural areas of the Loess Hills are interspersed among corn and soybeans, the primary row crops. The predominance of cropland allows easy access to most natural areas and provides some level of fire break around the natural areas.

Table 2. Vegetative Cover Types of the Loess Hills Landform in Iowa

Cover type*	Area of landscape in percent	Conservation targets found within this cover type
Grassland (both native & non-native)	50.4%	Loess Hills native prairie (3%)
Woodland	11.3%	Bur oak savanna/woodland and basswood-bur oak forest
Cropland	39.1%	NA

*Cover types: Grassland – includes both cool season grasslands (planted), warm season grasslands such as Conservation Reserve Program (CRP) acres, and native prairie. Woodland – includes evergreen woodlands/forest, deciduous woodland and forest, and other land cover with predominance of woody vegetation. Cropland – under annual crop rotation for primarily corn and soybean.

Source: Iowa DNR GAP Analysis, 1992.

Livestock production has declined dramatically over the last two decades. Beef cow production within the seven-county region of the Loess Hills has decreased 42% from 20,229 head in 1982 to 11,514 head in 2001 (National Agricultural Statistics Service, 2001).

Native prairie communities, which comprise approximately three percent of the Loess Hills region, are being threatened by invasive woody species. It is estimated that 1500 acres of grassland are invaded by woody vegetation each year.

Rural acreages are increasing, especially near the two metropolitan areas of Sioux City and Council Bluffs/Omaha. These acreages further fragment the landscape and contribute significantly to the challenges of restoring fire to the Loess Hills.

Economic Development and Tourism

The increase in urban and rural housing development is bringing new owners and new challenges to the Loess Hills. These new owners frequently do not have an agricultural background and the placement of their homes is often in conflict with natural areas management. From 1993 to 1999, 1,333 non-farm residences were built in the unincorporated areas of the seven loess Hills counties, reflecting a 6% to 23% increase in the counties' total residential base as of 1999 (Hamin, 2001).

Tourism and recreational activities are increasingly important to the region, with between 16.6% and 41.4% of the overall earnings in the seven-county region coming from the retail and service sectors (NPS, 2002). Interest in tourism and recreational opportunities in the region is growing, as evidenced by the number of public areas and businesses catering to Loess Hills visitors.

Special Landscape Areas (SLAs)

In 2001, the National Park Service identified 12 Special Landscape Area's (SLA's) in the Loess Hills region. These 12 areas, defined on the basis of biological, geological and topographical features, capture over 80% of the native prairie in the landform, or just under 100,000 acres (Map 2). Coarser mapping indicates that 58% of the SLA's are categorized as grassland of various types, including pasture, hayfields or alfalfa.

As of September 2000, 17 percent of the SLA's, or 17,059 acres, was in some sort of protected status, either being owned by state or county government units or by The Nature Conservancy. The 12 SLA's represent an opportunity to manage up to 20,000 acres of native prairie annually through the use of prescribed fire.

3. FIRE IN THE LOESS HILLS

Past Conditions in the Loess Hills

Historically, the predominant vegetation throughout the Loess Hills was native prairie (>90% of the landform). Trees were not absent from the landscape, but were found primarily in the steep areas within a few miles of the Missouri River and along smaller streams. With fires occurring frequently in the highly flammable native prairie, woodland communities were restricted to areas with natural fire breaks such as steep ravines and draws.

Prior to settlement, fires in the Loess Hills regularly occurred in 3-5 year intervals and frequently were large and of high intensity (fuel models 1 and 3). Table 3 provides the range of variation for the historical fire regime. This historical fire regime has been drastically altered over the last 150 years due to changes in land use. Conversion of pasture to row crop and an increase in home sites located throughout the Hills, coupled with active fire suppression have resulted in significant reductions in fire frequency in the past 50 to 75 years.

Table 3. Historical and current range of variation in fire regime

	Historical	Current
Fire frequency	3 – 5 years	25-100 years
Fire severity*	High (stand replacement)	Mixed
Season	Spring, summer and fall	Spring and Fall
Size & pattern	Small, patchy summer burns (less than 1,000 acres); larger (1,000 ac – 10,000 acres) dormant season burns.	Small (less than 100 acres)
Type	Surface	Surface

*Fire severity is a measure of the physical change in an area caused by burning (Sousa 1984). Fire severity describes the effects of fire on vegetation. Fires are ranked for severity from low to high. A high severity or stand replacement fire top-kills > 75% of the vegetation; a mixed severity burn has 25 -75% of the vegetation top-killed and in a low severity or surface fire >25% of the vegetation is top-killed. With grassland burns, fire severity is classified as ‘stand replacement,’ because most of the vegetation is top-killed or burned to the ground, although the vegetation will re-grow. An example of a low severity fire is a fire in oak woodland, where most of the over-story trees are not replaced or top-killed.

Current Conditions in the Loess Hills

In 2000, an estimated 2,000 acres burned as wildfire in the Loess Hills. Uncontrolled fire, or wildfire, can occur throughout the year, but usually is precipitated by periods of dry weather and high winds common during the early spring and fall. Dry weather and low humidity reduces fuel moisture and creates favorable fire conditions. This, combined with human activity, contributes to wildfire occurrences. Prescribed fire reduces fuel loads thereby reducing the frequency and severity of wildfire.

Efforts are being made to increase the number of acres treated with prescribed fire in the Loess Hills. In 2002, approximately 5000–8000 acres were treated with prescribed fire. Treated areas were comprised of high quality prairie and woodlands as well as pastureland with interspersed natives and land enrolled in the Conservation Reserve Program (CRP). Much of this prescribed fire activity was conducted on publicly-owned land or on land managed by The Nature Conservancy (Table 4).

Table 4. Prescribed Fire Activity in the Loess Hills

This data includes information provided to Susanne Hickey, The Nature Conservancy (TNC), from County Conservation Boards, Iowa DNR, TNC & some private lands routinely managed by agencies.

County	Acres owned by agencies or organizations	Acres managed with fire	Acres treated annually	Acres treated in 2003
Plymouth	Approximately 6,000 ac	3,260	500-700 acres	882.5 + 300 ac wildfire
Woodbury	3,794 acres	911	390	221
Monona		225	108	65
Harrison	Approximately	3,017	45 +	1481

	10,600 acres			
Pottawattamie	2000 acres	850	415 acres	369
Mills	581 acres			0
Fremont	Approximately 850 acres	100	100	125
TOTALS		8363	Estimated 1343	3,143

Table 4. Continued

Agency	Acres treated with fire	Acres Burned in 2003
Plymouth CCB	800	150
Woodbury CCB	454	211
Monona CCB	155	53.5
Harrison CCB	116.5	40.5
Pottawattamie CCB	850	369
Mills CCB	?	?
Fremont CCB	0	0
DNR – Plymouth County	300	300
DNR – Woodbury County	1069	10
DNR – Monona (Preparation Canyon)	70	11
DNR – Loess Hills State Forest	10,600	1440
DNR- Waubonsie State Park	100	125

Several barriers and challenges to the implementation of a comprehensive fire management plan have been identified. They include:

- A. Approximately 91% of the Loess Hills is privately-owned and tracts of land do not follow natural fire breaks, resulting in the need for multi-owner burn units.
- B. The Loess Hills are a high-risk wildland-urban interface area as a result of increasing urban development. This wildland-urban interface presents additional challenges including smoke related issues, habitat fragmentation, and lack of public understanding and support of fire.
- C. Most local fire departments and landowners are not trained to deal with wildland fires in a safe, effective manner and local conservation agencies lack the capacity to burn on a landscape level.
- D. The fear of liability has inhibited the wide-scale use of fire on private lands.

Desired Fire Conditions

Ecological objectives throughout the landform can be accomplished with seasonally prescribed fires occurring every 2-5 years during restoration stages and every 3-7 years during maintenance, with fire frequency adjusted depending upon grazing pressure and other disturbance factors. Surface fires of low to extreme intensity covering 60-90% of the region in small to medium burn units (100-2,000 acres) will be needed on the landscape.

To restore the health of the natural communities, an estimated 100,000 acres must be treated annually with fire throughout the landform, with 20,000 acres targeted in the 12 SLAs.

Desired Future Conditions

The natural habitats of the Loess Hills, in particular native prairie, will suffer irreparable damage within 10-15 years without some kind of management effort. Therefore, land managers should initially prioritize restoration/protection efforts in the SLAs to facilitate management of the highest quality areas, where 80% of the prairie is captured and high quality areas outside of the SLA's should receive some attention.

Desired future landscape conditions will be accomplished through a combination of management tools including fire. (See Chapter 12 Integrated Management Alternatives). Through a

collaborative effort of stakeholders, twenty-five (25), fifty (50) and one-hundred (100) year landscape restoration goals have been identified (Appendix D). Monitoring of progress will be ongoing (See Chapter 13 Monitoring and Evaluation).

Desired future conditions of the plant communities are listed in Table 5 and Table 6. Because of the logistics of assessing all prairie fauna, two groups will be initially assessed; butterflies and birds. Available data suggest that these two groups are best diagnostic groups for fauna.

Table 5. Target plant communities

Herbaceous Community	Current Spatial Extent	Desired Future Spatial Extent
Native Prairie	3% of landform (20,000 ac)	10 – 30% (65,000 – 200,000 acres)
Warm Season Grassland	13% (84,000 acres)	13%-20% (84,000 – 130,000)
Cool Season Grassland	25% (161,000 acres)	20% - 30% (130,000 – 194,000)
Bur Oak Savanna	2.5% (16,000 acres)	10% -15% (64,000 – 97,000)
Bur Oak Woodland	2% (14,400 acres)	5% - 10% (32,000 – 64,000)
Bur Oak Mesic Forest	11% (69,600 acres)	2% - 5% (14,000 – 32,000)
Crop	40% (258,000 acres)	10% – 30% (64,000 – 194,000)

Source: Iowa DNR GAP Analysis, 1992.

Table 6. Desired community composition and characteristics for native prairie, Bur Oak Savanna, Bur Oak Woodland, Basswood-Bur Oak Forest, Warm Season Grassland, Cool Season Grassland, and Cropland.

Native Prairie	
Flora:	<ul style="list-style-type: none"> • Herbaceous plant cover ranging from 80-100% • Species diversity quite high (~100 species/100 acres, 6-10 spp/lm², <2 exotic spp/lm²) • Shrubs may be present and provide up to 5% cover • Scattered trees (primarily of bur oak) of various ages may be present (canopy cover < 10% and basal area extremely low i.e. <5 sq. ft./acre)
Fauna	<ul style="list-style-type: none"> • Characteristic breeding birds include: Grasshopper sparrow, bobolink, meadowlark, dickcissel, greater prairie chicken, northern harrier, and short-eared owl. • Characteristic butterfly species include: ottoe skipper, regal fritillary, pawnee and leonard's skippers
Bur Oak Savanna	
Flora:	<ul style="list-style-type: none"> • Herbaceous plant cover ranging from 80-100% • Species diversity high (80-100 species/100 acres, 6-10 spp/lm², <2 exotic spp/lm²) • Tree canopy cover 10-25% and dominated by bur oak • 90% of trees DBH ranging from 12” – 30” and tree age from 40 – 200+ years • Mid story limited to next generation shade intolerant species • Basal area 5 – 50 sq. ft/acre
Fauna:	<ul style="list-style-type: none"> • Characteristic breeding birds include: Eastern bludbird, orchard orioles, eastern kingbird, rose-breasted grosbeaks, red-headed woodbecker, barn owl

Bur Oak Woodland	
Flora:	<ul style="list-style-type: none"> • Herbaceous plant cover ranging from 60-80% • Species diversity moderate (60-80 species/100 acres, 5-10 spp/lm², <2 exotic spp/lm²) • Tree canopy cover 25-75% and dominated by bur oak • 70% of trees DBH ranging from 12” – 24” and tree age from 40 – 200+ years • Mid story present yet many trees retain lower limbs and light levels are high enough to support high herbaceous cover and oak regeneration • Basal area > 50 sp ft/acre
Fauna:	<ul style="list-style-type: none"> • Characteristic breeding birds include: Red-headed woodpecker, Baltimore oriole, indigo bunting, whippoorwill, Cooper’s hawk
Baswood – Bur Oak Forest	
Flora:	<ul style="list-style-type: none"> • Herbaceous plant cover ranging from 40 – 60% • Species diversity low – moderate (30 – 60 spp/100acres, 3-5 spp/lm², <2 exotic spp/lm²) • Tree canopy cover >75% and dominated by basswood and bur oak. 70% of trees DBH ranging from 12”-24” and tree age from 40 – 200+ years
Fauna:	<ul style="list-style-type: none"> • Characteristic breeding birds include: Gray Catbird, Ovenbird, Red-eyed Vireo, Sharp-Shinned hawk
Warm Season Grassland (primarily land in the Conservation Reserve Program (CRP))	
Flora:	<ul style="list-style-type: none"> • Herbaceous plant cover ranging from 80-100% • Species diversity moderate (>25 species/100 acres including 5 native grasses and 20 native forbs, 3-5 spp/lm², <2 exotic spp/lm²) • Shrubs may provide up to 5% cover
Fauna:	<ul style="list-style-type: none"> • Characteristic breeding birds include: Grasshopper sparrow, bobolink, meadowlark, dickcissel, greater prairie chicken, northern harrier, and short-eared owl
Cool Season Grassland (primarily land in pasture)	
Flora:	<ul style="list-style-type: none"> • Herbaceous plant cover ranging from 80-100% • Species diversity low- moderate (5-10 species? Native vs. non-native?) • Shrubs less than 5% cover
Fauna:	<ul style="list-style-type: none"> • Characteristic breeding birds include: Grasshopper sparrow, bobolink, meadowlark, dickcissel, great prairie chicken, northern harrier, and short-eared owl.
Cropland	
	<ul style="list-style-type: none"> • Row crop production limited to areas of high corn suitability rating (CSR) and low erodibility factors (See Map 3-Corn Suitability Rating—this is not available at this time.)

Calculated information using Iowa DNR GAP analysis (1992) and NPS colored infrared maps

4. CURRENT STRATEGIES TO RESTORE FIRE ADAPTED SYSTEMS

Education, training, equipment, and technical assistance are the cornerstones of the prescribed fire efforts in the Loess Hills. We believe that in order to be successful in reaching our stated objectives, it is important to work cooperatively with private landowners and coordinate programming efforts with our partners. A number of collaborative strategies have been initiated to increase safe and effective prescribed fire in the Loess Hills region. The current strategies include:

- A. **Landowner Prescribed Fire Workshops:** Since Spring 2000, 110 participants have attended workshops designed to teach landowners fire behavior and the techniques and equipment necessary for safe prescribed burning.
- B. **Prescribed Fire Equipment Caches:** The LHA, in partnership with the U.S. Fish and Wildlife Service (USFWS), has established seven fire equipment caches (PPE, ATV's and pumper units, slip on units, radios, drip torches, bladder bags, and hand tools) in the region available for use by private landowners who participate in a one-day prescribed fire workshop.
- C. **NWCG Fire Training:** In cooperation with the National Park Service (NPS), United States Fish and Wildlife Service (USFWS), Iowa Department of Natural Resources, (DNR), The Nature Conservancy (TNC), County Conservation Board's (CCB's and the Loess Hills Alliance (LHA), fire training courses have been established in the Loess Hills region. These training opportunities include the National Wildfire Coordinating Group (NWCG) course S-130/190 and S-290, and Rx-300. Additionally, several agency personnel completed a 10-day NWCG Crew Boss Academy funded by the NPS and TNC.
- D. **Loess Hills Wildland Fire Crew:** The Loess Hills Wildland Fire Crew was established in August 2000 in response to requests for assistance with fire suppression efforts in the Western U.S. and as a means to increase training opportunities for fire management personnel in Iowa. Since the 2000 wildland fire season, the crew has been mobilized three separate times, with members assisting in both fire suppression and prescribed fire detail. The crew is comprised of a variety of individuals from the public and private sector. Most members are employed by conservation organizations (i.e. The Nature Conservancy, Iowa DNR, Plymouth County Conservation, Woodbury County Conservation, and Pottawattamie County Conservation), however, some are volunteer firefighters and business owners, One member is a retired botanist.
- E. **Fire Learning Network:** In 2002, the Loess Hills was selected as 1 of 25 landscapes from around the country to participate in the Fire Learning Network, a part of the cooperative project, "Restoring Fire Adapted Ecosystems," with the Department of Interior, US Forest Service and The Nature Conservancy. The Fire Learning Network has provided a unique opportunity for partners to initiate formal cooperative prescribed fire management planning in the Loess Hills. (www.tnc.ecomanagement.org/fire)
- F. **Mobile Prescribed Fire Crew:** With funding from a U.S. Forest Service Wildland Urban Interface Grant, and the U.S. Fish and Wildlife Service (USFWS) Private Stewardship Grants program, a Land Stewardship Specialist and seasonal burn crews will expand the capacity of local landowners, natural resource professionals, and private natural resource businesses to conduct safe, prescribed fire. The program communicates Firewise principles and the benefits of prescribed fire through the media and public education programs. A geographic information system (GIS) component provides a mechanism to track management practices completed and corresponding landowners in order that follow-up contacts and maintenance agreement compliance checks can be efficiently completed.

G. Natural Resource Business Development: Since 2000, nine businesses have been enhanced or expanded with the assistance of the USFWS, the Iowa DNR, and Golden Hills RC&D. Five of these businesses provide local eco-type seed propagation and four businesses work with private landowners to clear and control invasive woody plants.

5. FIRE TRAINING AND EQUIPMENT

5-1 Goal Statement

To ensure that all government, for profit and nonprofit entities that support the Loess Hills Regional Fire Management Plan and who apply prescribed fire in the Loess Hills, meet National Wildfire Coordinating Group (NWCG) PMS 310-1 standards within 5 years of plan endorsement.

Rationale

There are numerous county, state, and federal agencies in the Loess Hills region that use prescribed fire as a management tool. Several nonprofit organizations also manage land with prescribed fire. However, uniform training and equipment standards currently do not exist among the agencies and organizations conducting prescribed burns.

Adopting uniform standards will enhance the safety and effectiveness of prescribed fire efforts and help to control public liability in the Loess Hills. By using the same training and equipment standards, wildland firefighters and their staff will improve communication lines and realize safety standards intended to create a positive climate for prescribed fire throughout the landscape.

5-1.1 Action Step

Develop fire standards for the Loess Hills region using National Wildfire Coordinating Group (NWCG) 310-1 as a framework. [Note: PMS 310-1 can be downloaded from: <http://www.nwcg.gov/pms/docs/310-new.pdf>]. The standards include:

- a. Personal Protective Equipment Standards
 - Nomex trousers and shirt or other NWCG approved wildland fire resistant clothing
 - Hard Hat (designed for high heat environments)
 - Eight (8) inch leather boots with lug-type soles
 - Eye protection (goggles, face shield, or safety glasses)
 - Leather gloves
 - Fire ignition devices (matches, lighter, fusee)
 - Fire shelter
- b. Physical Fitness Standards

Each agency will be responsible for issuing fitness test, health screening, and certification forms. Fitness levels include:

 - Moderate level fitness test – all firefighters required to carry a 25-pound pack for 2 miles in 30 minutes or less (Field test).
 - Arduous level fitness test – all firefighters required to carry a 45-pound pack for 3 miles in 45 minutes or less (Pack test)

c. Training Standards

- Most agencies/organizations utilize seasonal workers on the fire line. Seasonal workers will be designated as trainees and can participate as firefighters as long as they meet their respective agencies' physical fitness standards.
- Within five years of plan endorsement, all agencies and organizations should have a burn boss.

5-1.2 Action Step

Facilitate the adoption of NWCG standards among cooperating agencies and organizations.

- a. Seek funding to assist with the acquisition of equipment, training, and Personal Protective Equipment (PPE).
- b. Set up centralized locations to qualify individuals for physical fitness testing (field and pack test).
- c. Offer NWCG training opportunities in cooperation with Iowa DNR Fire Coordinator Specialist.

5-2 Goal Statement

Increase to 100% the number of burn bosses who utilize a fire complexity rating system for prescribed fires.

Baseline: Two burn bosses currently use fire complexity rating systems.

Rationale

A fire complexity rating system is used to identify prescribed fire plan elements or characteristics that may pose special problems or concerns and where prescribed fire plan changes may be prudent to mitigate or eliminate these problems or concerns. Fire complexity rating system considers three factors: 1) Risk, the probability or likelihood that an adverse event or situation will occur; 2) Potential consequence, some measure of the cost or result of an adverse event or situation occurring; and 3) Technical difficulty, which indicates the skill needed to implement the burn and deal with unexpected or adverse events.

The fire complexity rating system determines whether a prescribed fire is of low, moderate, or high complexity.

5-2.1 Action Step

Develop a prescribed fire rating system for the Loess Hills Region, or utilize the established prescribed fire complexity guide (PNS-424, NFES 2474). (See www.nwcg.gov/pms/Rxfire/complexity%20analysis%20worksheet.doc)

5-2.2 Action Step

Establish guidelines for the use of a fire complexity rating system.

Example: for low complexity burns, agencies may be able to determine their own qualifications, whereas burns of moderate or higher complexity, and on which resources of more than one agency are utilized, NWCG 310-1 standards should be used.

6. WILDFIRE RESPONSE

6-1 Goal Statement

To coordinate firefighting capabilities and training among fire departments and other resources (i.e. county conservation board, non-profits, and government agencies).

Rationale

There are 116 volunteer fire departments (VFDs) in the seven-county region of the Loess Hills. Some local fire departments do not have adequate staff to respond to wildfires and many of these VFDs lack the necessary training and equipment that enable them to respond safely and effectively to wildfires.

Volunteer fire departments can enhance their resources by requesting assistance from neighboring fire districts, county conservation boards, non-profits, and government agencies. Furthermore, VFDs can access equipment from U.S. GSA (General Services Administration) Federal Excess Equipment Program (FEED) through the Big Rivers Fire Compact or through direct purchase by contacting the Iowa DNR State Foresters' office. The Iowa DNR also administers a Federal grant program through the U.S. Forest Service for VFD to access small hand tools and communication equipment.

There is no regional coordinated effort to utilize existing resources that would help train volunteer fire departments within the Loess Hills. According to the Fire Service Training Bureau, which provides training opportunities for Iowa firefighters, they have no immediate plans to offer wildfire response training to local firefighters.

Currently, fire departments are dispatched by the county communication center and upon arriving at the scene, assume incident command: they become the primary decisions maker. Fire departments responding to incidents, including wildfires, track all calls on a database compiled and maintained at the State Fire Marshall's Office.

It is not known how many wildfires occur or total acres that burn annually in the Loess Hills. It also is unknown how many fire departments would choose to become trained in wildfire response. However, the Harrison County Conservation Board has received requests from four local volunteer departments for assistance in assessing wildfire response training.

6-1.1 Action Step

Develop a regional coordinated education program that will train 20% of interested volunteer firefighters with knowledge on basic wildland firefighting by 2005 and an additional 10% each year.

Baseline information: It is not known how many volunteer firefighters are trained at this time.

- a. Contact all VFD and full time Fire Departments in the Loess Hills to assess their desire for wildfire response training.
- b. Direct training resources towards those fire departments interested in leading and assisting with wildland fire fighting efforts and prescribed fire applications.
- c. Develop training curriculum for Fire Departments and make prescribed fire training available on a regional basis. (See Chapter 5 Fire Training and Equipment)
- d. Seek training funds from Wildland Urban Interface and other granting sources.

6-1.2 Action Step

Provide access to wildfire suppression equipment to 20 volunteer fire departments within the Loess Hills by 2008.

- a. Work with the IDNR Fire Program to obtain an inventory of the Federal Excess Equipment Program (FEP) to map out the type of wildland fire fighting equipment on hand and available to Loess Hills Volunteer and full time Fire Departments.
- b. Provide cost share funding to Fire Departments to purchase equipment. Contact Iowa DNR to access GSA equipment through the Big Rivers Fire Compact or through direct purchase.
- c. Work with the Fire Services Training Bureau and the DNR Fire Program to locate and map the Dry Hydrants found in the Loess Hills region.
- d. Seek outside funding sources to subsidize the purchase of additional equipment.

6-1.3 Action Step

Provide mutual aid frequencies for radio communication to all suppression resources.

- a. Coordinate communication efforts with Emergency Management Coordinators in the 7-county region.
- b. Outline the communication needs, protocol(s), and potential restrictions related to radio wave frequency use.
- c. Submit request(s) for equipment to the Federal Excess Equipment Program (FEED) through the office of State Forestry (IDNR) as needed.

6-1.4 Action Step

Establish a system to track wildfires and prescribed fires within the Loess Hills, including the number of acres treated or burned each year.

- a. Establish a one-call system to report wildland fire through the office of the State Fire Marshal or Iowa DNR.

7. FIRE MANAGEMENT COORDINATION

7-1 Goal Statement

Establish the framework for a wildland fire organization or fire council to provide technical assistance for prescribed fire activities within the Loess Hills.

Rationale

In the ensuing years, there will be an increased need for public education to promote the acceptance of prescribed fire activities in the Loess Hills. A wildland fire organization could become the conduit for coordinated, positive public messages. Furthermore, the organization could provide the means by which partners in the Loess Hills could work collaboratively on prescribed fire issues.

7-1.1 Action Step

Convene a meeting of fire practitioners (e.g. Iowa DNR, Loess Hills Alliance, The Nature Conservancy, private contractors and others) to discuss the possibility of developing a wildland fire membership organization. Organizational functions may include:

- a. Determine the educational needs of the public and identify existing materials and resources for prescribed fire and wildland fire fighting education initiatives. Develop new materials as needed.
- b. Provide public education and conduct outreach activities.
- c. Provide a mechanism to track acres treated with prescribed fire, as well as the number of acres burned by wildfires. Monitor the progress of treating acres with fire under the Loess Hills Regional Fire Management Plan.
- d. Monitor training needs, Coordinate training, track training accomplishments (i.e. red cards), and order training materials.
- e. Provide a response team to review escapes at members' requests (not for legal purposes).
- f. Support and sustain the Loess Hills Wildland Fire Crew.
- g. Conduct annual review of laws and regulations and provide updates to members.
- h. Serve as a mechanism to receive grants for implementation of fire and fire education.
- i. Formalize relationships among stakeholders to facilitate resource sharing.

7-2 Goal Statement

Coordinate fire management in the Loess Hills among agencies, departments, organizations, and private individuals.

Rationale

There is no established or official coordination among agencies, departments, organizations, and private individuals currently conducting prescribed burns. Furthermore, most land managing agencies do not possess the capacity to undertake prescribed fire activities without assistance from partnering agencies or organizations. At this time, several agencies and organizations are assisting one another with their prescribed fire needs. A good example of this cooperation is in the northern Loess Hills where The Nature Conservancy, Plymouth County Conservation Board and Stone State Park (Iowa DNR) work together to develop a list of burn units for each burn season and then work cooperatively to complete those burns. Personnel from each agency provide their own personal protective equipment (PPE), while other fire equipment is frequently shared. The shared responsibilities and equipment result in the multi-partner crew being able to meet the fire demands most of the time.

This type of cooperation has worked effectively to date. However in the event of unforeseen problems such as personal injury or an escape causing damages, it is critical to clearly outline the roles and responsibilities of each partner.

7-2.1 Action Step

Formalize work agreements among agencies, departments, organizations, private business and individuals.

- a. Actively promote and develop Memorandums of Understanding (MOUs) and/or 28E Agreements between agencies, departments, organizations, and private individuals who are cooperating in prescribed fire. Memorandums of Understanding and 28E Agreements are ways in which separate entities can formalize mutually beneficial agreements.

- b. Develop a template Memorandums of Understanding and 28E Agreements that can be used between agencies, organizations, and private individuals cooperating in prescribed burns.
- c. Seek legal advice to review sample MOUs.
- d. Develop mutual aid agreements between Volunteer Fire Departments and conservation agencies as needed.

7-2.2 Action Step

Share information and lessons learned about prescribed fire and fire escapes among agencies, organizations and private individuals. (See federal Wildland Fire Lessons Learned Center at <http://www.wildfirelessons.net/Index.htm>)

7-2.3 Action Step

Develop a computer-based fire weather reporting system to assist in prescribed fire management.

- In cooperation with the DNR/TNC/Golden Hills RC&D, establish two fire weather stations; one at Broken Kettle and one at The Loess Hills State Forest.

7-3 Goal Statement

Assure that all agencies and organizations that apply prescribed fire in the Loess Hills will have a plan to assess their seasonal preparedness within 5 years of plan endorsement.

Rationale

Fire can occur in almost any month in the Loess Hills, depending on weather. People that fight wildland fire or use prescribed fire need to ensure that their plans, equipment, and personnel are ready for the fire season.

7-3.1 Action Step

Develop an annual fire readiness checklist to assist regional wildland firefighters in becoming better prepared to control fire. The checklist may include the following:

- a. Planning
 - MOUS in place?
 - Firebreaks functional?
 - Burn plans complete?
 - Communicated with prescribed fire partners?
- b. Equipment
 - Routine Service performed?
 - All equipment functional?
 - Additional equipment needed?
- c. Personnel
 - Physical fitness standards met?
 - Training standards met?
 - PPE functional?

8. Prescribed Fire Management on Private Lands

8.1 Goal Statement

Increase the number acres treated on private lands and the number of private landowners working cooperatively to conduct large-scale burns.

Rationale

Since ninety-one percent of the land in the Loess Hills is privately owned, coordination with private landowners will be needed to increase the number of acres treated with prescribed fire. Landowners with common ecological goals can benefit by providing assistance to one another during the prescribed fire process.

8-1.1 Action Step

Assist private landowners with the identification of prescribed burn units that cross private boundaries.

8-1.2 Action Step

Assist private landowners with the application of prescribed fire and encourage the use of personal protective equipment (See Chapter 5: Fire Training and Equipment).

- a. Inventory and replenish landowner equipment caches in all seven counties annually (See Appendix E. for a list of equipment).
- b. Continue to assist private landowners with prescribed fire through the Loess Hills mobile fire crew.
- c. Provide cost-share incentives for landowners to finance prescribed fire.
- d. Assist in the identification and/or establishment of private contractors for hire. Address liability issues.

8-2 Goal Statement

Work with private landowners in the Loess Hills to assure safe, effective application of prescribed burns on private land.

Baseline: As of spring 2004, 110 participants have attended the workshops designed to teach landowners fire behavior and the techniques and equipment necessary for safe prescribed burning. Fire equipment caches are located in each of the seven counties and are available to private landowners (see Appendix E for list of available equipment).

Rationale

Private landowners are not expected or required to adhere to the same fire training and equipment standards as government agencies and various other private organizations. Additionally, landowners have different insurance and liability requirements.

With 91% of the land under private control it is important to include private landowners in training initiatives. Private landowners are encouraged to attend fire training workshops that are made available by the Loess Hills Alliance and others. The Landowner Fire Ecology Workshop, for example, is a one-day workshop that provides some basic training in equipment use, prescribed fire planning, fire weather, and fire ecology.

The Loess Hills Alliance also provides equipment caches for landowners to facilitate the safe application of fire. Landowners are encouraged to develop a written prescription for their fires and have those plans reviewed by others.

8-2.1 Action Step

Provide up to four training opportunities each year on prescribed burning techniques to private landowners each year in the Loess Hills.

8-2.2 Action Step

Promote the use of fire cache equipment to private landowners conducting prescribed burns (Appendix E: Landowner Equipment Cache).

9. RULES AND REGULATIONS

9-1 Goal Statement

Assure that all the individuals involved in prescribed fire are informed of the laws, regulations, and ordinances that affect prescribed burning, and achieve 100% compliance with regulations.

Rationale

In the face of conflicting feelings over the need to use prescribed fire and the tendency of the general public to reject fire because of the adverse affects such as smoke and escapes, it is critical that all laws, regulations, and ordinances are adhered to. Currently, the State of Iowa has few rules and regulations governing prescribed fires, however, these laws, regulations, and ordinances are necessary and provide protection to the citizens of Iowa.

9-1.1 Action Step

Complete a thorough annual review of the laws, regulations, and ordinances that apply to the seven-county region of the Loess Hills.

9-1.2 Action Step

Provide information and set up training sessions regarding laws, regulations, and ordinances that affect prescribed burns through the Loess Hills Regional Fire Management Plan (see Appendix F: Regulations Affecting Fire).

9-2 Goal Statement

Monitor pending legislation and provide input to local, state, or federal governments on legislation that would impact prescribed burning in the Loess Hills.

Rationale

In addition to existing laws, regulations, and ordinances there may be future regulations in Iowa that affects prescribed fire. In order to affect policy in a positive manner, it is critical that the partners of the Loess Hills Regional Fire Management Plan monitor proposed legislation and be proactive in the development of any new laws, regulations, and ordinances affecting prescribed burns. Members of the Loess Hills prescribed fire community should remain visible to policy

makers so that when issues relating to prescribed fire and wildland fires arise, knowledgeable spokespersons for the prescribed fire community will be sought out as experts on the subject.

9-2.1 Action Step

Identify new or impending changes to relevant to prescribed fire in Iowa.

- a. Contact Iowa DNR Bureau of Air Quality annually
- b. Contact the State Fire Marshal's office annually
- c. Provide information on changes in state law or local ordinances to burn bosses through the wildland fire association
- d. Contact each County Conservation Board Director annually for changes in local ordinances.

9-2.2 Action Step

Review the relevancy to Iowa of any new and existing prescribed fire regulations and legislation set forth by other states.

10. BURN UNIT PLANNING

10-1 Goal Statement

Increase to 100% the number of burn units with established burn plans within 5 years of plan endorsement.

Rationale

The business of applying fire to any landscape is risky. A prescribed burn should accomplish its intended objective(s) through good planning. The burn plan should ensure the safety of participants, minimize liability exposure, and ensure the appropriate and effective application of fire as a management tool. It is in fact, the planning process which makes prescribed fire work. Without planning, fire application might be regarded as controlled, but not prescribed.

Prescribed fire planning also calls for awareness and adherence to burn permits. Permit requirements vary between states, within counties and by municipalities. Prescribed fire burn bosses should review local ordinances to determine which permits are required.

Within the Loess Hills, there are no requirements for permits at the state level unless there is a local burn ban authorized by the State Fire Marshall. In the event of a local burn ban, permits must be requested through the local fire chief. There are no county permits required in Plymouth, Woodbury, Monona, Harrison, Pottawattamie, Mills, or Fremont County. The City of Council Bluffs has a permit process that must be initiated through the Department of Public Health. The City of Sioux City has a permit process that must be initiated through the Fire Department (See Chapter 9: Rules and Regulations and Appendix F).

Every agency/organization/individual will tend toward certain preferences in the planning process but all good burn plans will have critical common elements.

The burn plan should outline the following critical elements:

1. Objectives of the burn
2. Prescribed conditions necessary to accomplish the objectives

3. Definition of the unit to be burned (i.e. location, size, physical and biological elements/features, boundaries, etc.)
4. Map of the unit and surrounding area (separate maps may be required)
5. Identification of resources required
6. Outline of procedures to be followed (i.e. pre-burn considerations, ignition, holding, mop-up, and post-burn)
7. Contingency plan
8. Smoke Management plan
9. Notifications (i.e. neighbors, 911 Communication Center, local fire department, etc)
10. Communications
11. Go/No Go checklist

1. Objectives of the Burn

This section should describe specific, workable, measurable conditions which will result from the application of prescribed fire.

2. Prescribed conditions necessary to accomplish the objectives

This section will identify the fuel and weather conditions necessary to attain the desired fire behavior. Specifically temperature, relative humidity, wind direction, wind speed, mixing height, and Haines index should be considered. Additionally, it is important to identify the weather conditions expected following the burn operation.

3. Burn Unit Definition

A good definition will provide a description of the vegetation (i.e. overstory, understory, and groundcover), fuel model, firebreaks, and other physical features. Additionally, the legal description of the property, property location, the 911 addresses, and burn unit size should be identified.

4. Maps

A map of the unit identifying fuels, firebreaks and control lines, fire sensitive features, ingress and egress, smoke sensitive features, areas to be affected by smoke, property ownership, etc should be made. More than one map may be necessary to adequately portray all desired elements.

5. Resources

The resources necessary to safely and effectively apply and control fire under the conditions prescribed should be identified. This includes personnel and their training as well as equipment and its preparation.

6. Action Plan

Outline the procedures for ignition, holding, and mop-up. It may be necessary to describe pre-and post-burn operations as well. This section must allow enough flexibility to allow the burn boss the necessary discretion but also should be thorough enough that any other burn boss can utilize the plan to implement a similar operation.

7. Contingency Plan

Outline the plan in the event of an escape, injury, equipment breakdown, etc. This plan should outline the actions to be taken, and the resources that will be necessary to mitigate the problem. If additional resources will be required, the plan for mobilization and timeline should be identified.

8. Smoke Management Plan

Identify areas sensitive to smoke (i.e. surrounding residences/businesses/gathering points, transportation routes, airports, etc). Develop a plan to minimize the impact of smoke on such features. Consider wind direction, transport wind speed, atmospheric stability, firing techniques, length of fire operational period, etc. It may be possible to control or divert traffic, clear public areas or select operational period coinciding with low use, reduce the size of the area to be burned, or take other action to minimize the impact.

9. Notifications

Identify the surrounding property owners to be notified of the burn operation. Additionally, the 911 Communications Center and local fire protection resources should be notified. Include phone numbers.

10. Communications

This describes communication capabilities. For example, how many radios and what frequencies will be utilized? Where is the nearest available phone and what is the phone number?

11. Go/No Go Checklist

This is an itemized list of everything that must be in place in order to proceed with the operation.

10-1.1 Action Step

Provide information about burn unit planning to burn bosses. This information should include permit requirements for prescribed fire operations and an outline of the basic elements of a burn plan.

10-1.2 Action Step

Provide a working template for a burn plan that can be utilized by agencies, organizations and individuals conducting prescribed fire management in the Loess Hills (Appendix G: Burn Plan Sample).

10-2 Goal Statement

Assure that 100% of agencies, organizations, and private individuals that adopt the Loess Hills Fire Management Plan will document and report fire application efforts to a centralized location such as a wildland fire association (See Chapter 7: Fire Management Coordination).

Rationale

As the effort to expand the application of prescribed fire in the Loess Hills landform continues, it becomes increasingly important to document successes and failures. Documentation enables analysis and learning opportunities while providing information which may be used to solicit additional funding.

10-2.1 Action Step

Collect and analyze all reportable information about prescribed fire application from agencies, organizations and private individuals that adopt the Loess Hills Regional Fire Management Plan.

11. WILDLAND URBAN INTERFACE

11-1 Goal Statement

To reduce the risk to human safety and property from wildfire and escaped prescribed fire in the Loess Hills region of Iowa.

Rationale

The Wildland – Urban Interface (WUI) is defined as the line, area or zone where structures and other human development intermingle with undeveloped wildland. The existence of human development in the Loess Hills region complicates the use of prescribed fire and wildfire management, adding risk to human safety and property loss.

Risks in the WUI include: public health, structures/infrastructure, and firefighter safety. Secondary risks include: local business financial losses; disruption of transportation; loss of recreational value, environmental costs and public confidence.

In order to use prescribed fire effectively as an ecological management tool and deal with wildfire issues on both public and private lands, it is important to recognize the importance of the WUI and plan and implement accordingly to reduce threats to public safety and property.

11-1.1 Action Step

Develop an awareness and education campaign in the Loess Hills to promote the value of fire and illustrate the capacity of public agencies to minimize the impacts to public safety while applying fire.

- a. Develop educational materials that discuss the benefits of prescribed fire for the following audiences as needed: general public, private landowners, fire departments and elected leaders.
 - Brochures
 - Traveling displays for local county fairs
 - Testimonials from locals of successes
 - Coffee shop materials
 - Radio/news media
 - Speakers Bureau for local service clubs
- a. Investigate the benefits of wildland fire risk reduction through prescribed fire for community insurance ratings; a cooperative effort with local fire departments and community governments/Council of Governments

11-1.2 Action Step

Collect and analyze wildland fire and prescribed fire data to determine values at risk, public safety areas and threats from escaped or wildfire in the Loess Hills region.

- a. Work with the State Fire Marshall's Office to request timely wildland fire causes and impact data from local Volunteer and Full-time Fire Departments in the Loess Hills Region.
- b. Work with the IDNR grant programs for wildland fire data collection
- c. Work with the IDNR on land cover mapping and fuels data analysis

12. INTEGRATED MANAGEMENT AND ALTERNATIVES

12-1 Goal Statement

To create an awareness and share information and knowledge about best practices for management and restoration of natural areas in the Loess Hills.

Rationale

There are many tools and practices that can be used to manage natural areas, depending upon the objectives of a land manager. Fire is only one tool and should be integrated into an over all management plan. By sharing information about best management practices, including scientific research as well as anecdotal observations, land managers can have the best available information to identify the necessary tools or techniques to achieve a certain objective.

Land managers and members of the Loess Hills wildland fire association, or fire council, should have access to up-to-date information on management practices including grazing, herbicide use, mechanical clearing, mowing and haying. Information about contractors willing to aid in implementing such practices should also be available.

12-1.1 Action Step

Develop an integrated management checklist for land managers.

12-1.2 Action Step

Develop a list of available resources or tools (e.g. bibliography of scientific research, fact sheets, etc).

12-1.3 Action Step

Disseminate information via a list serve or newsletter.

13. MONITORING AND EVALUATION

13-1 Goal Statement

Establish a monitoring system by the year 2005 that will measure the progress made towards achieving the Fire Plan objectives which are:

- Maintain high quality natural areas and in good condition while promoting native biodiversity
- Improve the health of grasslands for livestock producers in the region
- Reduce hazardous fuels accumulation to reduce the probability of extreme wildfires
- Reduce the abundance of aggressive non-native species

- Restore the fire culture of the region

Rationale

Monitoring is needed to effectively measure progress towards 1) restoring and maintaining ecological communities; 2) maximizing productivity 3) maintaining the value of the land; and 4) establishing and maintaining fire management coordination in the Loess Hills.

- A. **Monitoring Loess Hills Communities:** Monitoring the success of fire management in restoring and maintaining ecological communities will be accomplished by a) measuring spatial extent of community types, b) measurements of community characteristics such as composition, structure and diversity, c) monitoring of selected animal species, and d) monitoring geomorphic process.

Monitoring protocols should be developed that guide the collection of the necessary information to assess the quality of each community type expected in the Loess Hills. Protocols may vary from simple, less time-consuming procedures, to complex ones that are more time-consuming.

Which protocol to follow depends on a balance between the objective of the assessment and the time and resources available. However, there is little useful information to be gained by establishing a monitoring protocol that is so simplistic that will not provide the basic information needed to assess plant community quality.

The focus in the SLA's will be monitoring plant community composition with a priority for conservation and restoration. The following guidelines will be considered in setting up monitoring activities:

- Latitudinal monitoring sites will be established to best capture the differences in loess hills plant communities arrayed from the northern to the southern loess hills.
- Sites will be selected so as to incorporate topographic variability (i.e. differing plant communities on hilltops, north-facing and south-facing slopes, and lowlands). For the prairie community, priority locations will be on south-facing slopes where the greatest proportion of prairie remnants remains.
- When practical and available, at least three locations in each SLA will be established in order to capture variations among sites. Where three locations at a site are not possible, the location selected should best represent the dominant plant community.
- Monitoring sites will be permanently marked with metal poles and documented GPS coordinates.
- Monitoring plots will be the same location at each site in order to accurately compare important parameters such as plant diversity
- Initially, monitoring at a site will be conducted for 1 – 3 years after which monitoring will be conducted every five (5) years.

- 1. Monitoring the Spatial Extent of Plant Communities:** Monitoring changes in the spatial extent of plant communities can best be measured using various remote sensing techniques. Updating the Iowa DNR GAP analysis data with current imagery will be a useful tool to analyzing spatial extent of target plant communities. Remote imagery may also be useful in identifying areas of significant erosion, such as may occur with

woody plant removal or other restoration activities. Success will be measured by assessing the degree to which the spatial extent of target plant communities is within the range described for each community type below (Table 6).

- 2. Monitoring Plan Community Composition, Structure and Diversity:** The qualitative assessment of plant communities, including their composition, structure and ratio of native/non-native species requires detailed on-the-ground sampling. The priorities for monitoring should be (1) establishment of a base composition against which future assessments can be compared, and (2) systematic monitoring every 5 years. Assessing plant community composition on the ground requires both a reasonable level of taxonomic expertise and time, although it provides a more accurate assessment of the quality of prairie than can be accomplished with remote sensing.

Indicators of success will be a desired range of variation in plant structure and composition and the presence of characteristic breeding birds and butterflies. In addition, any species of concern may be added to the list of species monitored.

- 3. Monitoring of other biota (e.g. vertebrates, invertebrates, fungi, and microorganisms):** Because of the logistics of monitoring all prairie animals, two groups should be the initial focus: butterflies and birds. Available data suggest that these two groups are the best diagnostic faunal groups to measure the quality of plant communities [Need reference here]. Working with local universities and colleges is likely to be the most economic means by which to monitor faunal communities.

Faculty who make regular (i.e. biennial, etc.) field trips with classes could be contacted to determine if they would be willing to conduct visits for particular sites across the Loess Hills. Conceptually, the coordinated efforts of several faculty members could provide a Loess Hills regional survey of some of these biota over many years. In addition, by providing information to local faculty about research needs at certain sites (some specifically described and others not), individuals may focus at least a portion of their research efforts on sites. To encourage such activities, some indication of resources available (e.g. on- or near-site quarters) could be identified.

- Monitoring Avifauna: [need to figure out how we want to monitor (expansion of Jim Miller research?) (also see Bayou Ranger District monitoring plan)]
- Monitoring Butterflies [see Selby & Farrar 2003 report to DNR for protocol]

- 4. Monitoring geomorphic conditions (e.g. erosion, etc.):** At some point, monitoring the effects on geomorphic processes may be necessary. As with faunal monitoring, local universities and colleges represent a possible source of assistance for this effort. In general, though, geomorphic monitoring will be primarily observational initially.

- B. Monitoring Productivity:** For land use objectives focused more on productivity (e.g. hay or cattle production, etc.) than on other factors (e.g. ecological diversity), different monitoring parameters will be measured. Monitoring productivity may be accomplished either directly, through the use of permanent plots (e.g. the same arrangement used for measuring diversity)

where plant biomass is collected over time, or indirectly, such as through records of hay or cattle production from the Loess Hills region. As with ecological parameters, base line data need to be collected early in the process to form the basis against which the success of management can be measured.

- C. **Monitoring Land Value:** Monitoring land values can most effectively be measured by tracking land values and rental rates over time.
- D. **Monitoring Fire Management Coordination:** Assessing coordination among land managers can best be accomplished by a central organization/office, such as the local fire department.
- E. **Centralized Data Location:** While each site (e.g. SLA) may retain its own permanent records, a central location should be established where all data from the Loess Hills monitoring sites are retained. This ensures continuity over time and provides a single source from which to obtain information and compare results. For example, not all sites may respond in the same way to the same treatment for a variety of reasons (e.g. uneven precipitation across the landscape). A central database would allow individuals to observe the range of responses from all sites enabling them to avoid making decisions based on single site-specific responses.

13-1.1 Action Step

Set up monitoring sites by [insert year] to evaluate plant communities using the most suitable means of evaluation. Possible protocols include:

- a. **Single Large plot:** Identify and mark for re-sampling a single large plot that characterizes a particular location within an ecosystem. In that plot, estimate the canopy cover of each species (equal amount of a species), the number of individuals present (from which density can be measured), and whether a species occurs in 1, 2, 3, or 4 of the quarters of the plot (equal distribution). A single large plot covers a relatively large area so the values you collect provide what amounts to an average cover for species and species-groups for the area. This procedure is fairly rapid but requires some knowledge of plant species. Unless many plots are evaluated, statistical evaluations are not possible with this technique. This procedure is used successfully in remote field sites in the Australian Outback where time is at a premium.
- b. **Several Small Plots (e.g. 20 or less plots):** Modify the above protocol to selectively evaluate a few plots within the community being evaluated. This procedure allows for a sampling of a great number of locations within a site and, depending on the number evaluated, provides for some statistical analysis. This procedure is often used with herbaceous species where species canopy cover is the principal parameter.
To facilitate relocation of the evaluation plots, they should be systematically or randomly placed along a linear transect pulled between two permanently marked poles (with metal poles at each end); GPS coordinates would also be located to facilitate relocation. Canopy cover can then be evaluated in each plot using standard procedures (e.g. Daubenmire, 1959). This procedure is much more time intensive than the single large plot.
- c. **Photo Points:** Photos taken at regular intervals (every 5 years) will provide a visual record of change and will provide a means to communicate restoration progress.

13-1.2 Action Step

Develop basic monitoring protocols by 2005 that include:

- a. Complete baseline monitoring of target communities (grassland, savanna, etc.) that provides quantitative data on selected sites, most likely emphasizing those where long-term ownership is stable.
- b. Establish photo points on selected sites and a mechanism to ensure photos are taken every 5 years.
- c. Provide a mechanism for central storage of monitoring records. (TNC or Iowa DNR may be capable of this.)
- d. Provide a mechanism to assess data collected from monitoring stations and disseminate results to stake holders.
- e. Provide a mechanism (e.g. minimum of photo points) that adds monitoring sites to newly restored/recovered prairie, new grazing lands, etc.
- f. Provide a mechanism that assesses economic records for sites recently restored to desired conditions (e.g. cattle production, hay production, etc.)

13-1.3 Action Step

Evaluate trends at each monitoring site on a 5-year rotational basis. Data collected from the monitoring process will be assessed by comparing actual with desired conditions.

14. ADAPTIVE MANAGEMENT [This section is under construction!]

[Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective for – “active” adaptive management – employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed.

14-1 Goal Statement

Rationale

Fire is one of the several tools available to land managers although its relevance and suitability is determined by land management objective(s). Appropriate fire frequency and season of application have the potential either to inhibit the encroachment of woody plants into grassland or to prevent their domination of savanna understory. Fire also has the ability to reduce the cover of woody plants, being most effective on small to mid-sized eastern red cedar, which is flammable and will not resprout from the base. It is nearly as effective on small diameter woody stems, such as small trees, dogwood, or smooth sumac, although all of these species have a tendency to resprout so that burns must be conducted frequently (nearly annually, perhaps) and generally during the summer, to substantially and at least semi-permanently reduce woody cover. While empirical data are lacking, field observations suggest that eliminating woody plants exclusively with fire is unlikely, particularly where large trees or dense shrubs cover has reduced understory. Field observations also indicate that fire alone cannot eliminate non-native invasive species (e.g. leafy spurge and smooth brome) and in fact, if used inappropriately, may favor these species. While the role of fire in maintaining diversity of forest understory has not been

quantitatively evaluated, studies clearly indicate that appropriate fire has the potential to maintain higher plant diversity than does the absence of fire and may also increase productivity. Field observations also suggest that fire induces increased productivity of Loess Hills Prairie plants although summer fires result in lower production than do spring fires. More data and other information on fire effects are needed to best adjust the use of fire in accomplishing land management objectives.

14-2.2 Action Step

By 2005, establish a database and central clearing house through which information on successful treatments, fire and others, may be assessed and passed among land managers.]