Accelerated Watershed / Vegetation Restoration Plan

Nebraska National Forest

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INTRODUCTION

The Accelerated Watershed/Vegetation Restoration Plan for the Nebraska National Forest identifies our 5 year plan and 10 year strategy for restoring watersheds and ecosystems to sustainable, healthy, functioning levels.

The Nebraska National Forest (NNF) includes five administrative units: Nebraska and McKelvie National Forests, and Buffalo Gap, Ft. Pierre, and Oglala National Grasslands. The NNF recently completed its LRMP (2002), and the Goals and Objectives in this document line up well with the goals and objectives in the National Fire Plan on both national and regional levels.

The NNF manages a wide variety of ecosystems, including forests, savannahs, badlands, woody draws, riparian areas, shrublands, shortgrass, mixed grass, and Sandhills prairie. Goal #1 in the new forest plan is to ensure sustainable ecosystems. This will be done by promoting ecosystem health and conservation using a collaborative approach to:

- increase the amount of forests and grasslands restored to or maintained in a healthy condition with reduced risk and damage from fires, insects and diseases, and invasive species,
- improve and protect watershed conditions to provide the water quality and quantity and soil productivity necessary to support ecological functions and intended beneficial water uses,
- provide ecological conditions to sustain viable populations of native and desired non-native species.

The NNF is working to restore Federal lands to a healthy condition which supports the native diversity of the area, and can be maintained by fire and grazing while sustaining limited timber harvest and a variety of recreational opportunities.

AWRP FOCUS

In order to determine where to focus our efforts, we looked first at our treatment priorities. These priorities consider Condition Class, WUI, and hazard acres and the potential effectiveness of available treatments. Then we looked at where our geographic priorities are, these being static points or areas both in and outside of NNF administrative boundaries.

Nebraska National Forest Treatment Priorities

These priorities are based on the criteria listed below which describe the condition of the landscape as it relates to fire. The risks associated with them, along with the geographic priorities listed in the preceding section are used to determine the Treatment Priorities for the NNF.

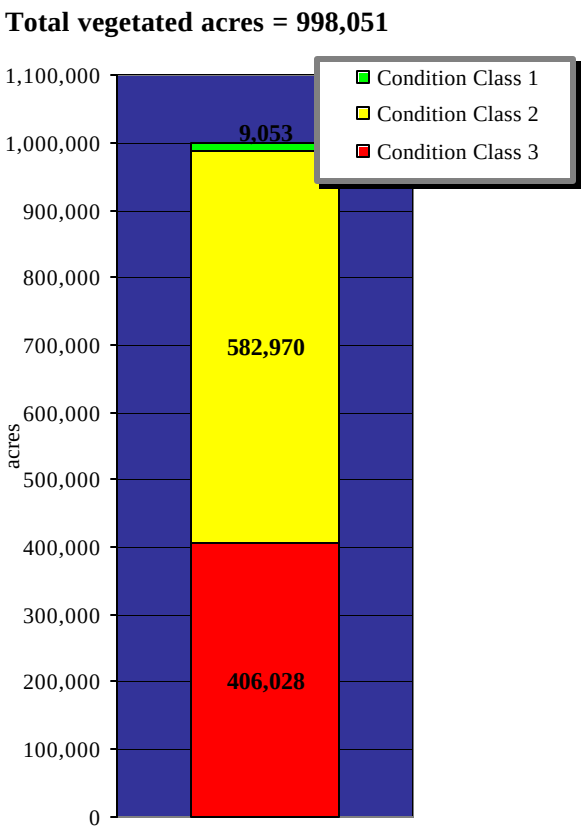


Figure 1. Condition Class acres for NNF units

Evaluation Criteria

These criteria, describe:

1) Current ecosystem health (Fire Regime/Condition Class)
2) Potential for effectiveness of treatment (WUI/non-WUI)
3) Fire behavior and resistance to control in the event of a wildland fire (High Hazard Acres)
4) Most frequent locations for wildland fire starts

1) Fire Regime/Condition Class

The Condition Class (CC) coverage we produced for this document is based on:

- evaluations done last summer using the complete Fire Regime/Condition Class protocols
- forest-wide Common Vegetation Unit (cvu) coverage
- grazing management
- fire history.

This first cut on a forest-wide CC coverage breaks the forest into three primary strata: ponderosa dominated, grasslands, and riparian. Using these criteria, historic fire regimes of the NNF are almost exclusively Fire Regimes 1 and 2.

For grasslands, it can be assumed that most areas do not have a grazing/browsing regime that is very similar to historic grazing (bison, elk, deer, pronghorn, sheep). The assumption can also be made that most areas have missed several fire cycles at a minimum. Given those two assumptions, any area dominated by a non-native species in the cvu layer was designated CC3.

In ponderosa, we used canopy closure on McKelvie and Pine Ridge as our primary indicator. Using historic photos dating to 1912 and the 1870s, along with historical accounts (1892), and tree ring data, it can be assumed that there was little heavy timber. Using cvu data again, polygons showing greater than 70% crown closure were designated as CC3. On the Bessey unit of the NNF, trees are all hand planted (or progeny of hand planted trees) so, technically, all forested areas are CC3. However, given management objectives on the Bessey unit to maintain a forested area, along with limitations of our cvu coverages we designated anything with greater than 30% crown closure on the Bessey unit as CC3.

Using those criteria, approximately 40% of the vegetated acres of the NNF are evaluated at a CC 3, with another 58% as CC 2 (Figure 1). We are continually improving our CC coverage as we obtain more data, but are confident that our first take is reasonably accurate, given the time and funding available.

Generally, wildland fire in grasslands will benefit the ecosystem, providing there is sufficient mid and late seral vegetation surrounding the burned area to provide habitat for species displaced by the fire, and assuming appropriate post-fire management. Improving the Condition Class on the grasslands of the NNF will involve strategies using both grazing and fire, with the objectives *for improving CC* including specific seral stage composition and species composition.

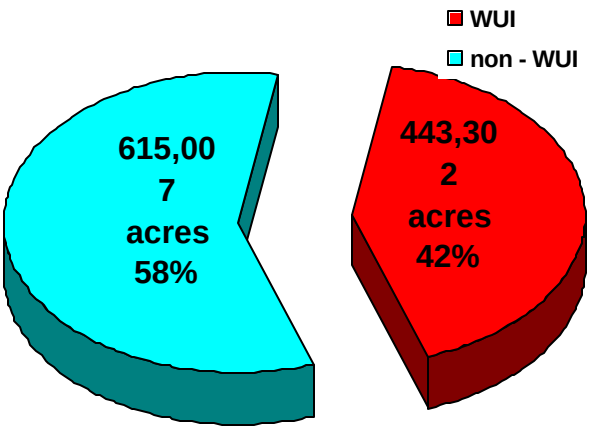


Figure 2. WUI/non-WUI acres on the NNF

Wildland fire in timber is not always beneficial. Wildland fire in overgrown timber can severely damage an ecosystem, causing either irreversible damage, or damage that can take centuries to heal. Mechanical treatments in timber can be quite expensive, but have a greater effect for a longer period of time than treatments available for grasslands. The majority of areas of Condition Class 3 timber will need multiple entries to achieve the desired Condition Class.

2) WUI Designation on the NNF

To identify WUI areas on the NNF, we used current HR 1904 guidelines, suggestions from the Federal Register (2001), descriptions from the National Wildfire Coordination Group (NWCG, 1996), and expert local knowledge to include topography and fuel and fire characteristics of the area. Local and state partners also recognize clusters of homes as communities to be protected as such. We included the hand planted forests because of their special status, and upcoming nomination as an historic site. The result was 433,302 acres of WUI, or 42 % of the NNF (Figure 2). Specifically, our WUI acres include:

- ?? Community Protection Plan areas
- ?? Evacuation routes w/1 ½ mile buffer as per HR 1904.
- ?? Historic sites/buildings
- ?? Intermix/interface (min of 28 people/mi^2) – ½ mile boundary around listed 'at risk' communities, includes 'isolated inholdings (Federal Register, 2001)
- ?? 1 ½ mile buffer if adjacent to an evacuation route

Using these criteria to define WUI, produces what some think is a surprisingly high percentage of WUI. Much of this WUI is in grasslands. They require a very different approach for effective fuels treatment. Nonetheless, we felt it was appropriate, at this time, to produce our WUI coverage based strictly on the written direction we were given. These definitions do not differentiate WUI based specifically on fuel type.

3) Hazard Acres

To determine 'Hazard Acres' on the NNF we looked at parameters affecting resistance to control for which we had forest-wide GIS data available. These parameters are different in forested areas than in grasslands, and the two are discussed separately below.

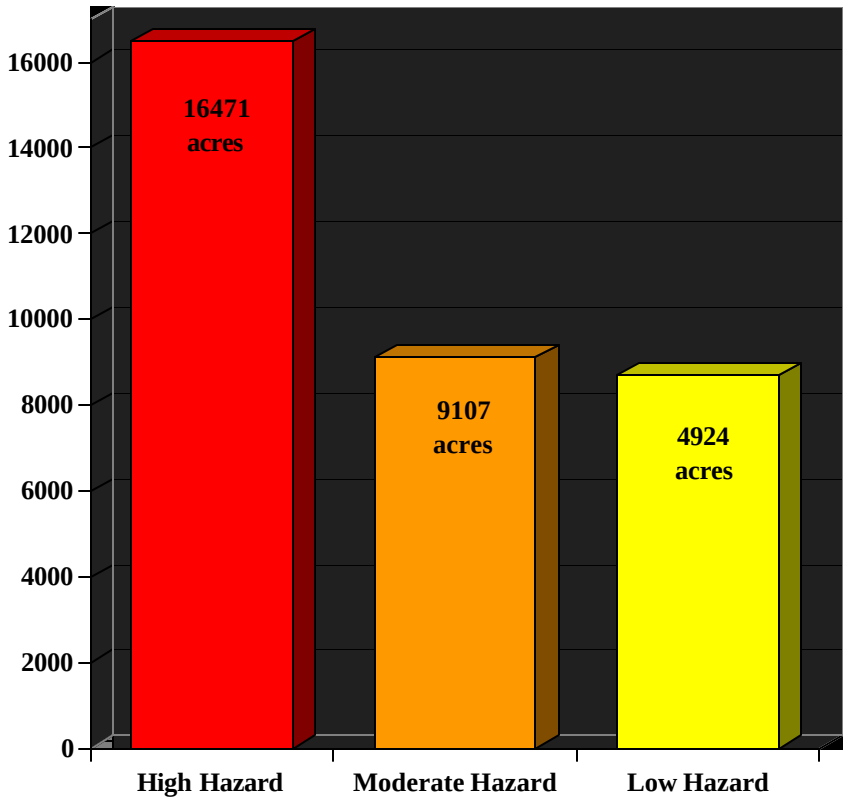


Figure 3. Forested Hazard acres

Forested Acres

We used a combination of vegetation type, crown closure, aspect, and slope, and included only those acres that can initiate or support a crown fire because the resistance to control from a crown fire in timber far exceeds any other type. Langowski, 2000, suggested that 70% crown closure may be able to initiate or support a crown fire. Using a combination of crown closure, fuel model, aspect, and slope, we determined that the NNF has approximately 31,000 acres of forest that present a significant hazard. 97%, of these acres are within the WUI (Figure 2, Table 1).

Grassland Acres

The determination of hazard acres for grasslands differs somewhat from forested lands because with the woody component gone, other factors are weighted differently. Much of the area administered by the NNF is classified as Fuel Models 1, 2, and 3. Fuel model 3 is the most intense of the grass group, and display extreme rates of spread under the influence of wind (Rothermel, 1983). This fast rate of spread, combined with an extremely volatile geometry of the fuel and the difficulty of walking through it rates it as a hazard fuel in grassland.

Figure 4. Broadcast burn in a Fuel Model 2. Note flame leigths.

There are many areas on the NNF that are easily identified as being a high hazard, and others which may

not be so obvious at first glance, but are significant and in need of attention. These less obvious areas most often fall into the category of WUI grasslands. A headfire in mixed or tallgrass prairie is one of the fastest moving types of fire at over 100 chains per hour. Individual treatments which can
prevent them are effective, but only for a very limited length of time unless a rotational cycle of treatments can be used on a regular basis.

4) Wildland fire statistics

Over a five year period, the NNF responded to an average of over 20 fires a year. The grasslands receive about 65% of the documented starts each year, and grassland fires tend to be only about 40 acres larger than timber (Table 1). The distribution of these starts is such that 70% of them fall on two districts: Pine Ridge and Bessey, 200 of these fires being in the timber (Figure 4). Grassland fires tend to be larger, with the largest recorded fires in the vicinity of Ft. Pierre NG reaching 384,000 (1947, Pierre, South Dakota) and 220,000 acres (2000, confluence of the Cheyenne River and the Oahe reservoir, South Dakota).

	Acres/yr	Average fire size	Starts/yr
Grasslands	4408	339	13
Ponderosa	2318	290	8
Total	6726	326	21

Table 1. Wildland fire statistics for the NNF from 1976 through 2001

On the timbered portions of the Pine Ridge District fires exceeding 1,000 acres occur on average every 5.8 years. Estimates using local VFD statistics of fire frequency along the Pine Ridge escarpment of 1,000 acres or more increases large fire occurance to less than five years.

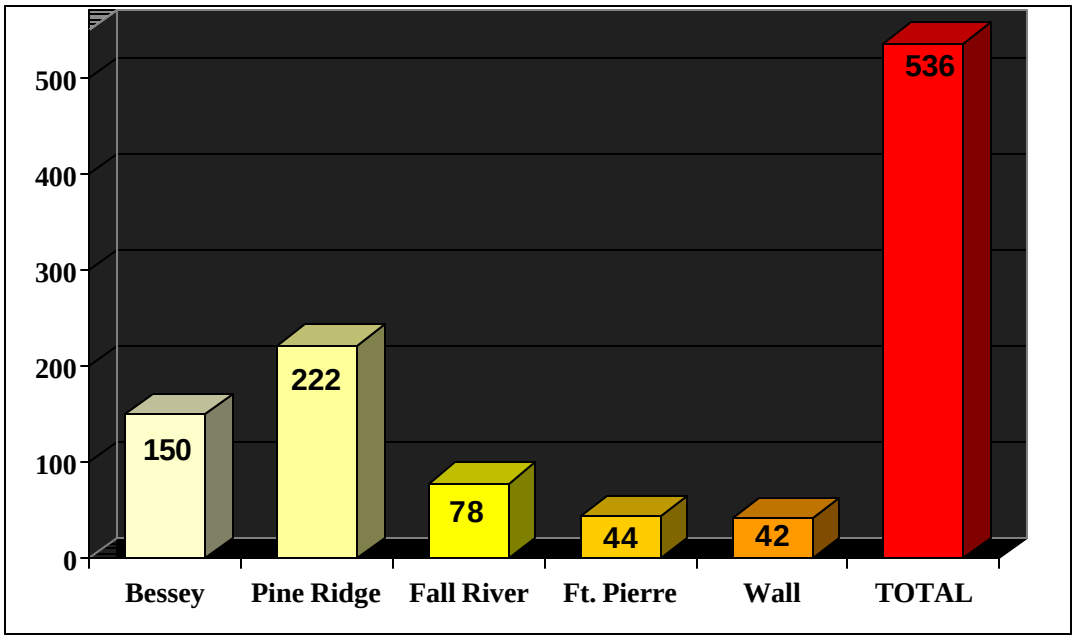


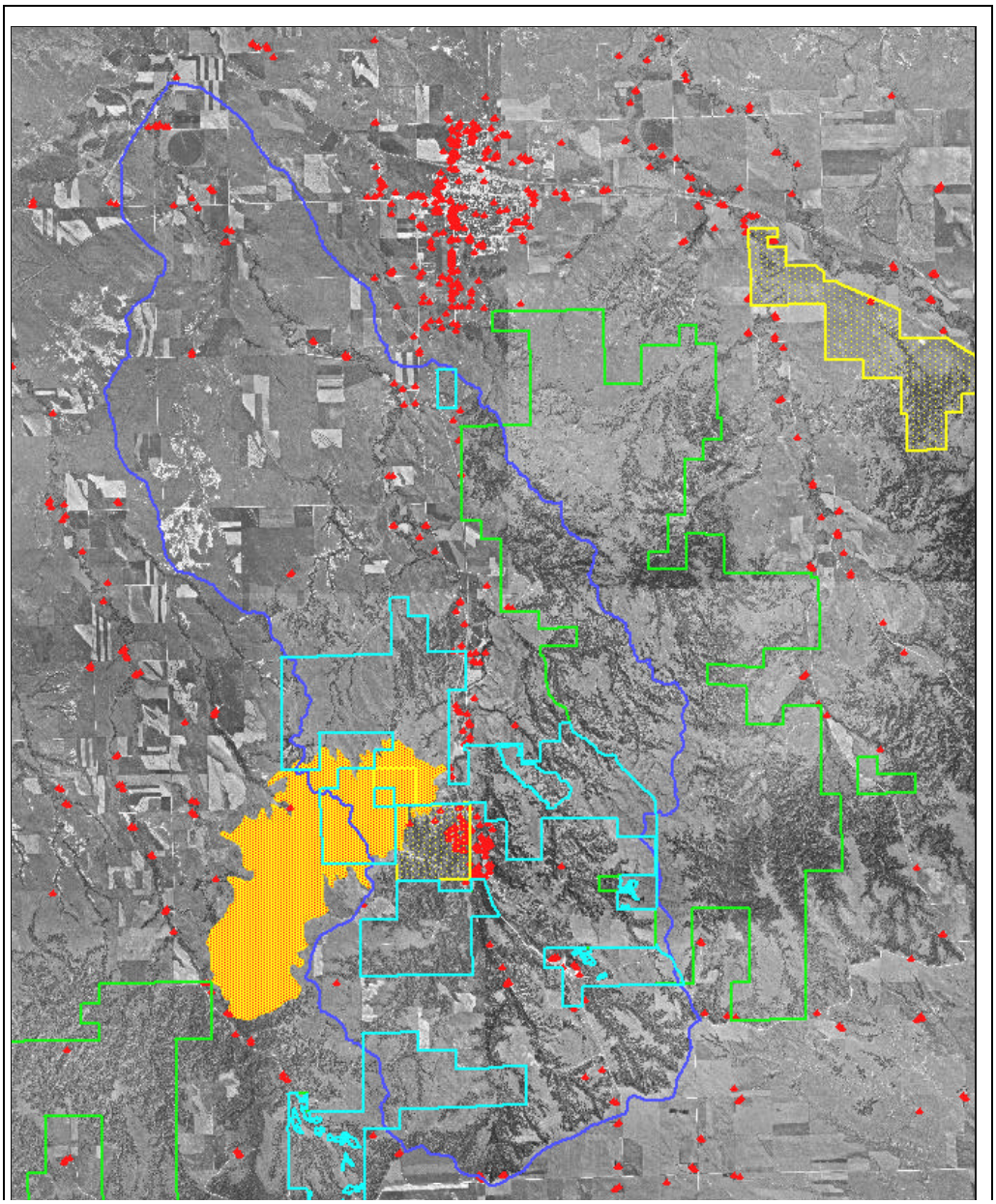
Figure 5. Total fires responded to on the NNF 1976 - 2001

Nebraska National Forest Geographic Priorities

The list below represents specific features or areas within or adjacent to the NNF that may be affected by management activities, particularly in regards to hazardous fuels. These areas will be evaluated with the criteria listed in the previous section to prioritize vegetation treatments on the NNF. The priority areas are listed here in alphabetical order.

- **Bessey's Hand Planted Forests** – 22,000 acres of the Nebraska National Forest and 2,500 acres on McKelvie were hand planted. These forests are nationally a unique and significant historical resource that could be nominated to the National Register of Historic Places as early as 2004. In 1965, the 20,000 Plum fire burned over 10,000 acres of the hand planted forests, along with several buildings on the Bessey District administrative site, because the trees, even thirty years ago, were too thick and in need of thinning. Protection of these forests will require multiple entries as forests are thinned to healthy structures, and fire is applied to maintain them.
    - **Bessey Nursery and Administrative Site** – The Bessey Nursery, (est.1903) is considered here as a sub-set of the Bessey District of the Nebraska National Forest because if it's historic value The original 40 acres, and many structures on them are listed on the National Register of Historic Places. The nursery, along with the Bessey Administrative site occupies 300 acres and is adjacent to the hand planted forests. Protecting these sites will require adjacent forested acres to be treated.
- **National Grasslands** – The grasslands administrated by the NNF span the range from short to tallgrass. Grasslands are perpetuated by a combination of natural disturbances, particularly drought, grazing, and fire. Each of these plays a unique role in maintaining a diverse mosaic of seral stages. Fires knocks back invasive wood species, such as Eastern Red Cedar (*Juniperus virginiana*) and Ponderosa pine, removes or decreases litter, improves vigor of native shrubs, forbs, and grasses (depending on the type of grassland and the timing of the burn), recycles nutrients, increases the growing season, changes the rate of infiltration and evaporation, and has numerous other effects which can not be imitated by haying or grazing. Generally, wildfires do little damage to grasslands. Management actions following wildland fire or prescribed fire will dictate the response of the grasslands. Fires may be used to maintain and expand Black Tailed Prairie Dog habitat (*Cynomys ludovicianus*) as well, in turn, maintaining habitat for the federally endangered Black-footed Ferret (*Mustela nigripes*).
    - **Buffalo Gap, and Oglala National Grasslands** – These grasslands represent almost 700,000 acres of mixed and short grass prairie. Fires spread rapidly on most of these acres, threatening ranches, livestock, and communities. Fires on these grasslands can be difficult to access but, once access is achieved, control is possible in a relatively short time. These grasslands are primarily fuel Model 1 – fast moving, but a low resistance to control. Annual Bromes are pervasive in many parts of these grasslands, and have a negative effect on forage quality and quantity, as well as changing the characteristics of fires that burn through these areas. Maintaining the desired mix of seral stages can best be achieved by coordinating grazing and fire with environmental conditions to mimic natural cycles.

- **Ft. Pierre National Grasslands and the Sandhills** – These grasslands support greater fuel loads and taller fuels than those further west, and fire were as frequent as anywhere on the continent. Large fires have occurred in the vicinity of Ft. Pierre NG of over 210,000 as recently as 2000. The largest documented fire in South Dakota occurred in the same area in 1947, covering 384,000 acres. Small communities located in grasslands are at risk from these fast moving grassfires. In 1999 a 74,848 acre wildfire in the surrounding grasslands caused the entire town of Thedford, NE to be evacuated.



✍ **Figure 6. Blue = Hwy 385 corridor; Red = structures; Green = federal land; light blue = HzFuel project; Yellow = state; orange = Deadhorse fire**

✍ **Highway 385 Corridor** This area includes the town of Chadron, Chadron State Park, and several housing subdivisions. The State Park, and many of the housing developments are

surrounded by NF on almost every side (Figure 5). We are working with state and private landowners to decrease the risk of catastrophic fire by strategically placed treatments on NF land Agreements are also in place with state and private landowners. Fire starts within the corridor average at least one per year. In 1972 the 3,300 acre Deadhorse fire skirted the edge of several housing developments just south of Chadron, burning through about 500 acres of Chadron State Park (Figure 5). The Park began a thinning program in 2001, which is scheduled to be completed in the next couple of years. A significant portion of the forested acres of the Pine Ridge Ranger District is within the geographic priority area

- **Municipal Supply Watersheds** (FSM 2500) – The NNF manages over 20,000 acres lying within two watersheds that provide the principal source of water for one or more communities.
    - **Soldier Creek Watershed**: The NNF manages 7,800 acres within the Soldier Creek watershed. This watershed provides water for the town of Crawford (population ~1,200), and Ft. Robinson State Park. Ft. Robinson occupies 22,000 acres, bounded on the west by the Soldier Creek Wilderness. Fort Robinson has great historic value, as well as a variety of recreational facilities. In 1989 the Ft. Robinson fire burned 50,000 acres, including the majority of the Soldier Creek watershed. Within a year, the lakes supplying water to the town of Crawford were no longer able to supply the town with water as a result of the accelerated erosion and sedimentation produced by the fire.
    - **Chadron Creek Watershed**: 10,444 acres of this watershed are administered by the NNF. The watershed provides a major portion of the water supply for the city of Chadron (population ~6,000). This also within the Highyway385 Corridor geographic priority area.

- **Pine Ridge Escarpment** - The Pine Ridge is an escarpment of mostly sandstone bluffs that extends from Wyoming, through northwestern Nebraska, and into South Dakota. This escarpment supports extensive tracts of ponderosa forest and savanna and is increasingly popular for summer homes and cabins as well as permanent homes. It is estimated by the State Forester that it now carries 10-20 times the trees/acre that were growing there historically (Nickerson, 2001). The remainder of the forested portion of the Pine Ridge Ranger District lies within this geographic priority area.

Priorities

Priority areas for treatment are based on a combination of the following risk factors:

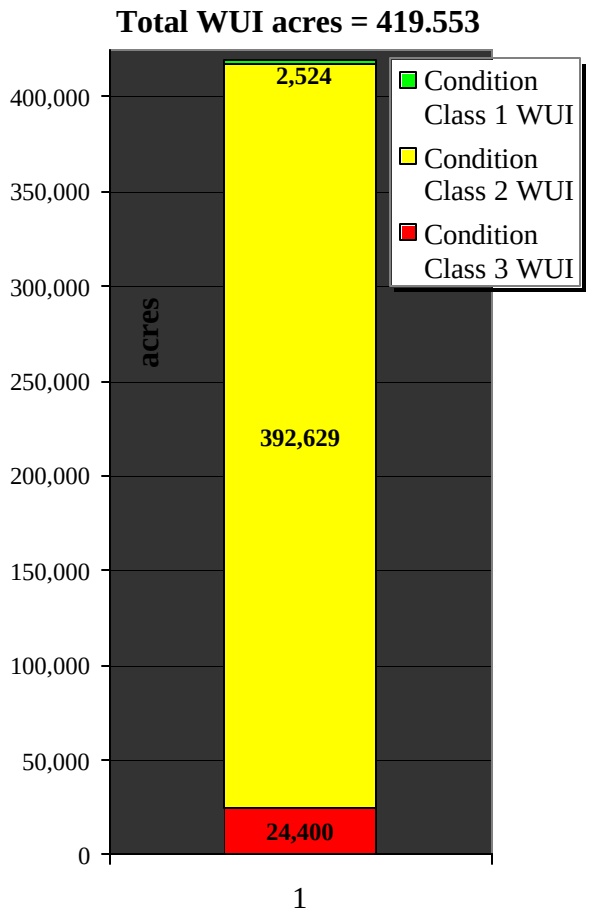
1) Safety
2) WUI
3) Municipal Watershed
4) Non-WUI Condition Class 2 and 3

The NNF manages large areas of federal lands which are interspersed and fragmented with state and private lands, necessitating cooperation between adjacent landowners, and significantly increasing the WUI area.

1) Public and Firefighter Safety

The safety of the public and firefighters is a top priority at all times during the planning and implementation process.

Figure 7 WUI/Condition Class acres, NNF, 2003



Safety of firefighters is included indirectly and directly at all times as well. The reduction of the potential for extreme fire behavior that is an expected outcome of fuels treatments decreases the hazards to firefighters. Considerations of access and egress help determine which areas are or problematic and dangerous. Methods used include landscape analysis and treatments strategically placed treatments to slow fire behavior (Finney, 2001). The boundaries of treatment units are placed in such a way as to give fire personnel safe options for placing firelines when implementing prescribed burns.

2) WUI

Our first priorities are high hazard WUI acres (Figure 7). Of the 27,300 acres considered high hazard on the NNF, 97% are in the WUI. These areas will often require more than one treatment before they can be effectively moved to a healthier Condition Class. First entries, requiring follow-up treatments include:

?? Commercial timber sales

?? Thinning

?? Slash piling

Follow-up treatments to first entry mechanical treatments will play an increasing role as mechanical treatments render broadcast burning appropriate in more locations and for larger areas. These treatments include:

?? Pile burning

?? Broadcast burning

Prescribed burning in grassland WUI may be included at this priority level because it:

?? May provide an effective fuel break for as long as 8 – 10 months and

?? Can effectively widen the burn window for adjacent timber units while

?? Complementing adjacent treatment

Small communities and ranch headquarters on the national grasslands are at risk of fire and are areas where we receive considerable contribution and cooperation from VFDs.

3) Non-WUI Condition Class 2 and 3

Although there are few urban resources at risk in these areas, there is potential for significant loss of natural resources. Wildland fires may cause damage to forage, range improvements, timber, streams and riparian areas, and produce severely burned areas giving a foothold to invasive weeds and producing accelerated erosion in the event of a wildland fire. These at risk resources are significant, and treatment of these areas will be a part of our plan. When broadcast burning is a desirable option, these areas can often be treated at less cost, because of the decreased complexity of prescribed burns.

In grasslands, a series of strategically placed burns on an alternating schedule can break up an area and make it easier to stop a wildland fire. Roadsides are of particular concern along heavily traveled routes, and mowing or haying decreases the fire danger. Treatments may include:

- ?? haying,
- ?? mowing,
- ?? grazing,
- ?? burning.

Consideration of the priorities listed above are the criteria by which the NNF prioritizes exactly where to place our emphasis.

4) Municipal Watersheds

The NNF does not manage any land within a congressionally delegated Municipal Watershed, but there are two watersheds of interest that supply water for two communities. These include:

- ?? Soldier Creek, supplying water to the town of Crawford
- ?? Chadron Creek, supplying water to the town of Chadron

THE VEGETATIVE SITUATION

The NNF is moving towards a healthy, sustainable landscape where natural processes, including fire, can move through doing little harm to watersheds, ecosystems, and the communities that depend on them. Reducing fuels in order to reduce the risk of catastrophic fire is a definitive and effective step in that process. This section describes in more detail than earlier ones the current condition of the vegetation (fuels) that affect our actions and priorities.

The primary focus for the NNF fuels reduction programs is the Pine Ridge RD and the Bessey RD, representing over 176,000 acres of Condition Class 3, of which 32 % (24,400 acres) is also WUI. Some of these Condition Class 3 areas are in grasslands, and the fire

risk and hazard between the three Condition Classes in grasslands varies little.

Bessey

The Bessey Ranger District is unique both for the Sandhills ecosystems, and the 24,500 acres of hand planted forest. 22,000 acres of this forest is on the Nebraska National Forest, and the remaining 2,500 is on the McKelvie unit, along the Niobrara River. This forest is distinguished as being the largest plantation forest in the United States. The hand planted forest is an historic resource identified for retention in the LRMP. Planted 70-90 years ago, these forests are mostly Ponderosa Pine (*Pinus ponderosa scopulorum*), with some Jack Pine (*Pinus banksiana*) and some Eastern Red Cedar (*Juniperus virginiana*).

Ecosystem Health

The forests on the northern unit (McKelvie NF) are mostly native, with a small portion hand planted 2,500 acres). The forests on the southern unit (Nebraska NF) are all hand planted, although the Ponderosa is regenerating in areas with an open canopy. The health of these forests is, at this time, dependent upon management actions to move them to a condition where they can withstand low intensity burns. Their current condition is such that a crown fire could destroy them in a single event (Figure 8).

Jack Pine is a species that is not native to Nebraska or the surrounding area, its native range being further north and east (Little, 1979). The approximately 600 acres of Jack Pine at this point are mostly decadent, with little regeneration, almost certainly due to the lack of fire. Mature individuals have only a moderate tolerance of fire, but populations survive because of delayed seed release from serotinous cones, early reproductive maturity, fast growth rates in full sun, and preference for mineral soil seedbeds. Serotinous cones opened by the heat of fire release Jack Pine seeds onto seedbeds exposed by fire. Regeneration failures are associated with low-severity surface fires that result in little crown involvement or in little duff removal (McCune, 1998; Clark, 1991). Jack Pine establishment is limited primarily by the depth of organic matter and, therefore, progressively increases with greater fire severity (Chrosiewicz, Z. 1974).

Ponderosa Pine in the Bessey District has matured to become a closed canopy forest in many areas because mortality of seedlings and saplings has been far lower than was expected at the time they were planted. The low intensity surface fire generally associated with Ponderosa pine have been largely suppressed, so the current tree densities are in excess of 570/acre, only a small percent of which exceed 10" DBH. Regeneration in these dense forests is almost non-existent, and there is little understory vegetation as there are few, if any, upland understory forest species native to the Sandhills.

Eastern Red Cedar is native to the area, but not at the current densities. Despite its native status, it is considered somewhat of an invasive species in the absence of the fires that kept it in check historically. Seedlings and saplings of Eastern Red Cedar are providing ladder fuels in the Ponderosa and Jack pine forests, and the progressive encroachment into the surrounding grasslands continues to degrade the condition of the grasslands, both for wildlife habitat and forage.

Figure 8. 1920 and 2004. Bessey Ranger District

Insect and Disease

The Jack pine has become over mature and decadent, with little regeneration. Much of it was infested with Jack pine budworm 4-5 years ago, and now is damaged or dead. Following the budworm outbreak was an infestation of *Ips*. Trees that were stressed and not killed by the budworm were susceptible and attractive to *Ips*. There are occasional Ponderosa pines killed, but nothing like the larger spots of mortality in the Jack pine. It can be assumed that mortality in ponderosa will increase as the Jack pine hosts start to run out (Allen, 2003).

Inn addition to the Budworm and *Ips* concerns, there is currently a fairly extensive branch dieback occurring throughout the forest, largely due to western gall rust (Allen, 2003).

The condition of the hand planted forests at Bessey pose a threat to the forests themselves, as well as being a serious risk to those towns and structures nearby.

Fire Regime/Condition Class

The Bessey District is a unique resource. Historically, the entire region was Sandhills Prairie (a unique combination of tall, mixed and short grasses), with woody growth restricted to riparian corridors and draws. In the case of the hand planted forest, identified in the LRMP for retention, these plantations will be managed in such a way that it will mature into a forest with a more natural appearance.

For the plantations, and the forested areas of that part of the Nebraska National Forest that is administered by the Bessey District, a Condition Class 3 will be determined to be the desired condition of a healthy, open forest, dominated by Ponderosa, with some Jack pine and Eastern Red Cedar mixed in.

At this time, we do not know for certain what the fire regime will be for this forest, because the dominant tree species (Ponderosa and Jack pine, and Eastern Red Cedar), have very different responses to fire. The success of producing a forest that contains both

Ponderosa and Jack pine is still unknown. Estimates of fire intervals in Jack Pine forests are generally less than 50 years, and hot fires are required to produce sufficient regeneration to replace over mature trees. Jack pine is one of the most fire dependent pines, requiring the heat of a fire to open its cones and release seeds. Ponderosa pine prefers frequent (<25 year), low intensity fire to keep individual trees 'fire proofed', by keeping the crown base height high, keeping competition at a healthy level, preventing the buildup of ladder fuels, and promoting low intensity surface fires by allowing surface vegetation to be dominated by species with a relatively low height.

The Pine Ridge

The geographic area associated with the Pine Ridge escarpment encompasses over 145,000 acres of National Forests and Grasslands in northwestern Nebraska. This escarpment and the areas influenced by it are home to extensive tracts of ponderosa forest and savanna, grasslands, and deciduous vegetation in riparian areas and woody draws.

Ecosystem Health

The desired condition for the Pine Ridge District will be a mosaic of ponderosa pine and open, mixed grass parklands. A diversity of healthy and vigorous ponderosa pine forest, old growth stands of large, old trees with open branches intermingled with standing dead and down trees, and mixed grasses and forbs would provide a mosaic of varying grassland structure.

One hundred years of grazing, logging, and fire suppression have impacted the health of ecosystems along the ridge. The sub-species of Ponderosa that grows on the Pine Ridge (*Pinus ponderosa scopulorum*) reproduces prolifically as a result of frequent seed crops and dependable precipitation in late spring and early summer (Boldt, 1973). Ponderosa canopies can intercept up to 28% of all precipitation (rain and snow combined), so that the increased canopy cover not only shades out surface vegetation, but dries out the vegetation, litter and soil beneath as well (Dunne and Leopold, 1978). The state forester estimates that there are 10 to 20 times the tree densities on the Pine Ridge now than there were historically. The FS estimates that the total acreage acreage of high density trees is increasing by 11% (~9,000 acres) each decade (Nickerson, 2001). Most shrubs found on the NNF, are well adapted to fire and many, such as Chokecherry (*Prunus virginiana*), benefit from the removal of decadent growth. Some, such as Snowberry (*Symphoricarpos occidentalis*), sprout more vigorously after a fire than at other times of growth. By removing decadent growth from grass and rhizomatous shrub species, well timed fire will improve the health and vigor of plants and plant communities. Many riparian areas and woody draws on the NNF benefit from broadcast burning, as the decadent above ground vegetation is removed, and below ground plant parts are thinned, providing for increased root health and sprouting

Insect and Disease

Based on current stand exam data about 76 % of the forested acres are at moderate to high hazard for mountain pine beetle (*Dendroctonus ponderosae*) infestation. Dense stand conditions, combined with drought are also contributing to outbreaks of pine engraver beetle (*Ips, spp.*).

. Heavy western gall rust infestations (*Endocronartium harknessii*) are also causing damage across the Pine Ridge. Infestations occur in all canopy levels, impose limitations on short-term stand treatment options, and affect long-term stand heath.

Table 2. Current and historical fire characteristics and effects

Historical fires	Current fires
Usually surface fires with little potential for active crown fires in timber	Often surface fires, but good potential for active crown fires in timber
Killed most, but not all seedlings	Good potential to kill all seedlings
Kept tree densities at a level that allowed those remaining to be healthier by decreasing competition	Good potential to kill most/all saplings
Occasionally killed large trees	May kill all trees
Opened up some mineral soil, allowing germination of seeds	Good potential to open up large areas of mineral soil, allowing germination only if seeds survive, and accelerated erosion does not occur first
Probably burned in a patchy manner, leaving a mosaic of seral stages and habitat types	May burn in large, solid blocks, decreasing the potential for local habitat diversity species
Removed most grass litter and some pine needle litter, allowing more light and precipitation to reach the surface and returning nutrients locked up in the litter to return to the system.	Removes all litter, often severely burning the soil as well, so roots and seeds are not present to revegetate, and soil cannot provide nutrients to nourish germinating seeds.

Fire Regime/Condition Class

The fire regimes on the Pine Ridge have shifted, so that areas that were historically Fire Regime 2 have shifted to Fire Regime 1, and areas that were Fire Regime 1 have shifted to Fire Regime III or IV. Stand replacing fire events are occurring across the Pine Ridge with increasing frequency, and increasingly large areas of contiguous fuels allow these fires to burn across larger areas than they could have historically. These changes are widespread along the Pine Ridge and have rendered many ecosystems dysfunctional in terms of ecosystem health and, therefore, not sustainable (Table 2).

FOREST VEGETATION PROJECTS – PAST PROGRAM LEVELS

Wildlife/Vegetation

Wildlife programs on the NNF have steadily improved habitat structure and ecosystem functioning each year. The majority of the projects that have been accomplished in fuels have provided benefits for wildlife habitat as well. Vegetative treatments change not

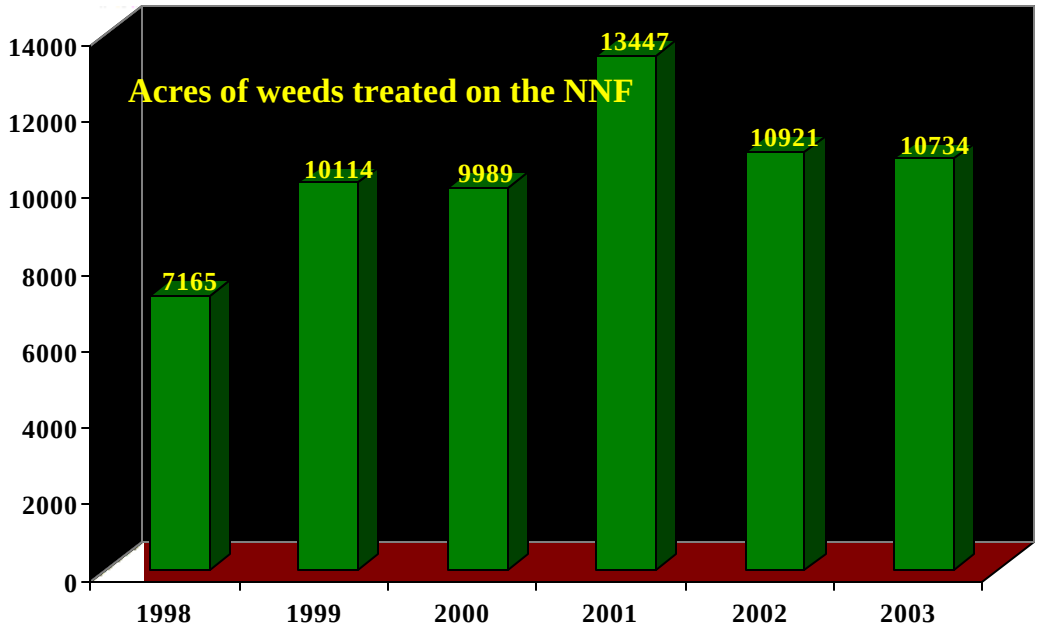
only the current condition, but the response of flora and fauna to other disturbances such as wildfire and drought.

Invasive Species

The NNF has an active weed program (Figure 9). We are continually updating our GIS coverage of noxious weeds to enable employees and persons contracting on the forest to be aware of potential problems before entering an area. We monitor management areas visually, seed, and/or treat as necessary depending on the potential of the site for infestation. Contractors working on the forest follow SOPs, including washing equipment before they move into a work area and reporting infestations they come across.

NNF monitoring data has identified over 2,000 aces of a noxious weed *Falcaria vulgaris* (Sickleweed) on Ft. Pierre NG. Research by Chadron State College has indicated that prolific reproduction occurs both rhizomotouosly and by seed, making it a potential candidate for designation as a Primary Noxious Weed in South Dakota, and adding a level of urgency to the weed program on the Ft. Pierre NG. In a collaborative effort with Chadron State College, we are doing a study to determine if fire could be an effective tool to slow down the spread and/or decrease density and vigor.

Figure 9. Weed treatment on the NNF.



Another study, begun in of FY03 by Chadron State College, in cooperation with NNF is being done to determine the potential of burn pile locations to initiate weed infestations.

Initial monitoring data from Buffalo Gap show a decrease in *Bromus japonicus* (Japanese Brome) following a prescribed burn in April of 2002 (Figure 10). This supports results from earlier studies (Whisenant and Uresk, 1990) and monitoring data from nearby Badlands National Park.

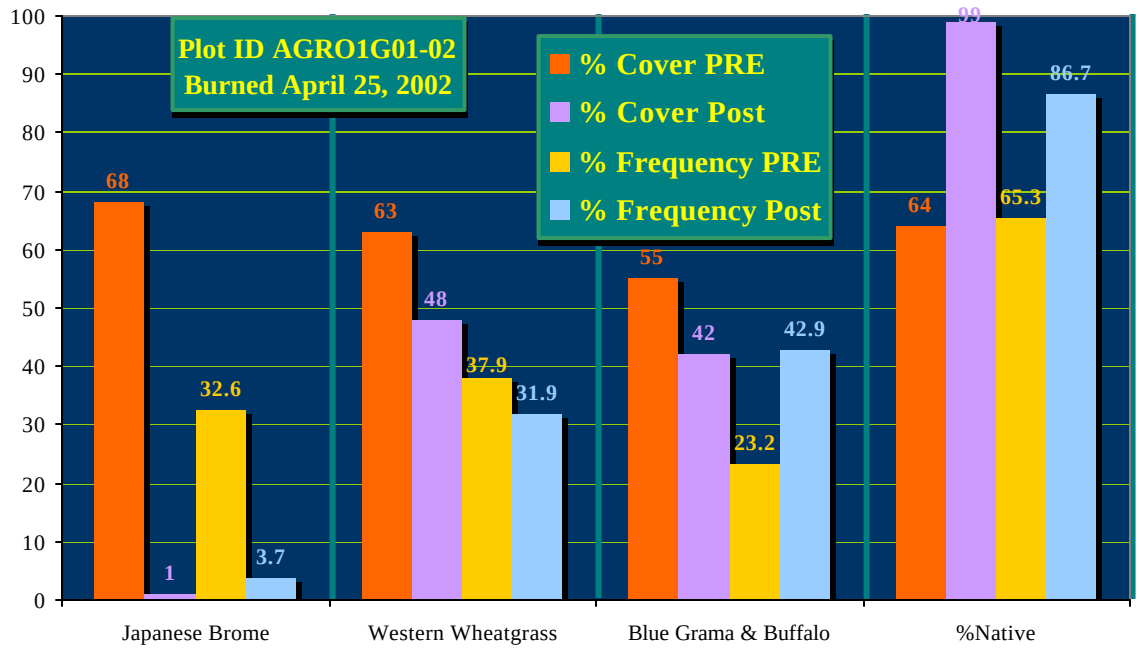


Figure 10. Monitoring data, Buffalo Gap NG.

We are currently awaiting results from study by Carolyn Hull Sieg (RMRS, Rapid City) that was completed last year on Buffalo Gap NG to determine the results of fire and grazing on the introduced species *Agropyron cristatum* (Crested Wheatgrass).

Hazardous Fuels/Timber

Fuels management on the Nebraska National Forest has become more active since implementation of the National Fire Plan, and direction in the new Forest Plan has supported increased efforts to manage fuels as a priority in conjunction with timber, wildlife, and recreation programs when possible.

MONITORING AND ADAPTIVE MANAGEMENT

Effective application of adaptive management requries a good monitoring program. Emperical data from the field, input from the public, and an awareness of economics and political trends allow the NNF to adapt strategies that can be effectively implemented.

The Forest Service Manual states: *"provisions for post-burn evaluation to enable resource managers and line officers to determine if project objectives were met"* (FSM 5100).

The Interagency Wildland and Prescribed Fire Management Policy Implementation Guide states: *"monitoring: Provisions for post-burn evaluation to enable resource managers and the agency administrator to determine if project objectives have been met. Document burn-day conditions, fire behavior, smoke dispersal, first order fire effects, and cost per acres of treatment…in addition to short-term monitoring to document the result of a burn, long-term monitoring is strongly recommended. Permanent photo*

points, transects, or plots that are revisited in years following a burn will provide information on successional trends that results from the burn. Longer term monitoring may be necessary to determine if objectives were met." (Interagency, 1998).

Further direction from the Code of Federal Regulations and the NNF LRMP makes it clear that a good monitoring program for evaluating management actions is not optional.

Protocols

The USFS does not currently have standard protocols in place for fire effects and fuels monitoring. There are some standard protocols available and most of them are being used in one form or another. There is a need nationally to standardize how and what the USFS requires for monitoring of fire, fire effects and fuels.

In the last three years, a number of protocols have surfaced, although the National Parks Service's Fire Effects Handbook (FMH) is the only one with a track record at this point. FMH has almost completed the testing phase of an updated version of FMH that will include a spatial component, linking the data with ArcMap.

In 2002, the NNF began to develop a comprehensive fire/fire effects/fuels monitoring program using primarily FMH protocols. At that time, FIREMON was not yet functional and FIREMON developers assured the NNF that the two programs (FMH and FIREMON) would be compatible, so we proceeded with FMH protocols because they were already functional and in use by Badlands National Park, with whom the NNF shares over 100 miles of boundary. At a workshop in 2003, FIREMON developers informed attendees that they had been instructed to make compatibility with NRIS a priority at the expense of FMH compatibility, so they had ceased work on FMH compatibility for the time being. As of January, 2004, FIREMON had received no further direction from NRIS folks.

NNF Rx Fire Monitoring

For all prescribed fire, weather conditions are monitored throughout the burn periods involved. For Broadcast Burns, at least one Fire Effects Monitor (FEMO) is included on the crew in order to guarantee at least one person is dedicated to monitoring and documenting fire behavior, fire weather, and prescription parameters throughout the burn. The FEMO is responsible for keeping the burn boss informed on these as well. Immediately after the burn is completed, the FEMO writes up a summary of fire behavior and fire weather, including showing prescription parameters along with observed as shown in Table 4 (also see appendix D for sample write-up).

NNF Post Fire Monitoring

As a part of the evaluation, the FEMO will do an initial evaluation of how well the objectives of the burn were met insofar as primary fire effects are concerned. A more specific evaluation is done on burn severity where there are long-term monitoring plots and/or Brown's lines in order to correlate primary and secondary fire effects with fire characteristics.

	Prescription parameters.		Observe d parameters	
Fire Behavior	**Lower Limits**	**Upper Limits**	**Lower Limits**	**Upper Limits**
Flame Length*	1 ft.	10 ft.	n/a	junipers 20'; grass 12'
Spotting distance	0 miles	.3 miles	none observed	
Ignition Probability	50%	70%	30	50
1 Hr Fuel Moisture	5%	20%	8	6
Calculated ROS	12 ch/hr	65 ch/hr	n/a	n/a
Relative Humidity	13%	60%	24	38
20 ft. Winds **	0 mph	20 mph	***	***
Mid-flame Winds	0 mph	15 mph	gust to2***	gust to 13***
Wind Direction***	none	NE	NE	NW, S, E, SE, NE, upslope
Smoke Dispersal	Fair	Excellent	Fair	Excellent

* Average flame lengths. Longer flame lengths are permitted and can be expected, especially in areas of cedar and dense clumps of vegetation. Flame lengths can be controlled during ignition by adjusting the fire pattern.

** Average wind speed. Winds may have gusts up to 25 MPH for no longer than 15 minutes. For this burn, 20' winds are equated with mid-flame winds as monitored on the fire because the dominant fuel type was grass.

*** Wind direction. The areas could be burned with any wind component except a northeast wind, if possible. A northeast wind will drive the smoke into Redshirt Village, which is to be avoided if possible.

Table 3. Prescribed Fire Weather and Behavior Report

For long term monitoring, we are using high intensity plots in clusters, to allow for more comprehensive data from a given site that can be extrapolated to some degree to similar sites. We combine a fewer of these with a larger number of less intense plots, including range data and Common Stand Exam data which provide less data, but allow data to be collected from a larger area.

Brown's Planer Intercept Transects are a common standard for evaluating fuel loading, but there have been very few options for a complete set of protocols for fire/fuels effects monitoring available.

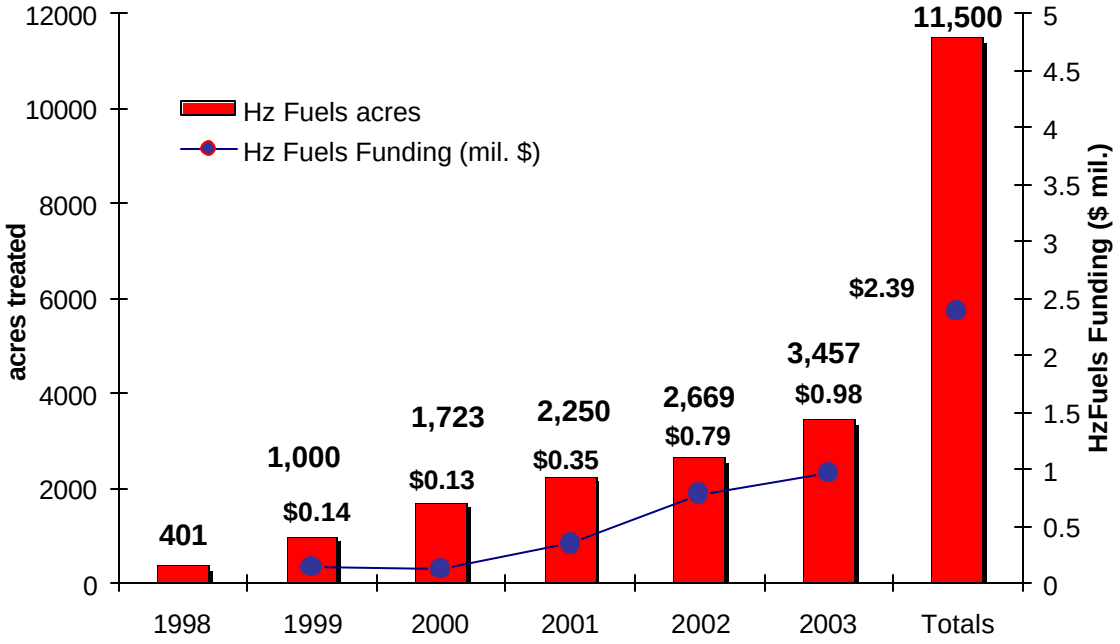
As of fall, 2002, we are monitoring fuel moisture in our timber to determine the normal seasonal range on the NNF (Figure 11). This will allow us to better define extreme conditions, as well as potential fire behavior and drought stress. In the grasslands we have begun a soil moisture program to help evaluate the degree of drought and the corresponding response of the grasslands to management activities such as fire, mowing, or grazing.

We are on track for summer of FY04 to train fire personnel to take over the fuel moisture monitoring and some of the fuels monitoring.

Figure 12 shows the increase in the hazardous fuels program funding and output for the past six years. In the last six years, the NNF has increased annual acres treated by over eightfold, while funding has been increased by sevenfold. Initial treatments included

areas that were difficult and expensive to treat due to proximity to structures or difficult terrain. After these first entries, additional treatments and maintenance treatments should allow more extensive use of broadcast burning, lowering our cost per acre and increasing the number of acres treated each year.

Figure 12. Past program levels for Hazardous Fuels



TEN YEAR STRATEGY

The National Fire Plan provided the impetus for the NNF to begin planning on the watershed level. In the next ten years, we will be combining watersheds to work at the landscape level, allowing more efficient use of funding and efforts.

The combination of our Geographic Priorities and our Treatment Priorities, directed our initial focus for treatment on the Pine Ridge, and the Bessey Ranger Districts. We have had good cooperation from the state with the Pine Ridge District with complementary thinning projects on private and state lands adjacent to current and projected treatments.

To prioritize our treatments, we looked first for areas where multiple priorities intersected (Table 3). Treatments on forested land have a greater impact for a longer period of time, and a crown fire in a forest has a significant resistance to control, so that it makes sense, if all else is equal, to treat the forested acres first. We looked at where the forested acres were a Condition Class 2 or 3, and where it also fell into WUI and Hazard Acres. This gave us our priorities within the Bessey and Pine Ridge Ranger Districts. Table 3 summarizes briefly the geographic and treatment priorities. These criteria indicate that

Table 4. Geographic and Treatment Priorities

	Bessey's Hand Planted Forests **Nursery, Admin Site**	**Buffalo Gap, and Oglala National Grasslands**	**Ft. Pierre National Grasslands & the Sandhill Prairies**	**Highway 385 Corridor**	**Soldier Creek & Chadron Creek Watersheds**	**Pine Ridge Escarpment**
WUI	?? WUI in and near timbered areas ?? Hand planted forests are of special concern	Scattered ranches and communities. These grasslands are highly fragmented, leaving a great deal of private/federal land boundaries	These grasslands are also highly fragmented. They are sparsely settled, with scattered communities and ranches.	Dense housing developments, a state park, and the City of Chadron are all located along this Corridor.	**Soldier Creek** provides water to the town of Crawford **Chadron Creek** provides water to the City of Chadron.	The Pine Ridge Escarpment has scattered homes as well as some more dense communities.
Condition Class	Bessey's hand planted forests are almost all Condition Class 3. A wildfire on the right day could destroy much of the forest.	These grasslands are mostly Condition Class 2, with large areas of 3 and only a little 1. Wildfires will not usually damage the resource, but may damage structures.	The same comments apply as for the Buffalo Gap and Oglala, but the fires that burn here are larger and faster.	Mostly Condition Class 3 with a little 2.	Soldier Creek: Condition Class 2 with some 1 and a little 3. Chadron Creek: mostly Condition Class 3 with some 2	Most of the timber on the Pine Ridge is a Condition Class 3, and under the right weather conditions, a wildfire could do serious damage to the ecosystems.
Hazard Acres	Bessey's hand planted forests are so dense that they can easily support a crown fire.	These grasslands do not have a great deal of high hazard acres, consisting mostly of Fuel Model 1.	We rated most of these acres as high hazard grassland acres in areas that represent tallgrass prairie	Lots of high hazard acres in this area – interspersed with housing developments and roads.	Chadron Creek drainage has a lot of hazard acres in it. Most of the timber is a Condition Class 2 or 3, and there are steep slopes on all sides.	Ponderosa forests on the Pine Ridge have over 10 times as many trees as they did historically. This combines with steep slopes as an almost unbroken bed of fuel for over 40 miles.
Wildland fire Risk	More fires starts are documented on McKelvie than any other unit. The Pine Ridge and Bessey Ranger Districts receive 70% of starts each year.	These grasslands receive a lot of lightning strikes each year, but the fires can be caught, they are quickly put out.	Fires exceeding 200,000 acres have been documented in this area, although lightning strikes are not as evident as in timbered areas to the southwest.	See Pine Ridge Escarpment	Most of the timber in Soldier Creek burned in 1989. Chadron Creek is part of the Pine Ridge Escarpment.	The Pine Ridge Escarpment receives numerous lightning strikes with each storm.

the Pine Ridge and Bessey should be initial priorities, because crown fire in timber is more destructive and harder to stop than most grassfires.

The Pine Ridge Ranger District began implementation of the 8565 acre Chadron Creek Hazardous fuels project in FY03, and is planning on beginning implementation of the 14850 acre Bordeaux Hazardous Fuels Project as soon as fall of FY04. Two additional EA's are lined up for a total of four that will progress to cover all NF lands on the Pine Ridge. By the time the last EA is completed, we will have begun second entries on Chadron Creek and begin to cycle through the watersheds until we have moved to a maintenance mode (see maps in Appendix C). At that time, we expect to maintain healthy forests and grasslands using prescribed fire, commercial timber management, grazing, and wildlife management.

The Bessey Ranger District completed a Hazardous Fuels EA in FY02 to address the overgrown hand planted forests. Implementation began in FY03 and over a thousand acres have already been thinned. Planning areas have been laid out for additional EA's, covering both the McKelvie and Bessey Units to manage the remaining hand planted forest as well as the native ponderosa pine forest at McKelvie.

Grasslands require different treatments because of the quick recovery of the fuel load. Annual mowing along major travel routes and parking areas; strategic grazing and burning can improve the health of grasslands and providing effective firebreaks for up to 10 months. The tall and mixed grass prairies of the Sandhills and Ft. Pierre are high hazard acres for grasslands, and the NNF mows annually increasing the effectiveness of roads as firebreaks and minimize the likelihood of an ignition from the road.

Ten year strategy at current program level

At current budget and target levels we expect about 75% of our hazard acres in the timber to have received at least one treatment within 10 years. Treatment acreage does not include the 6,726 acres burned by wildland fire annually.

The NNF has ramped up its fuels program, and currently has 37% of our constrained budget in NFVW and WFHF. Implementation of our HzFuels program at the rate indicated in Table 4 below will require some increase in the Forest budget to support an increase in NFTM, WFHF, NFWF and the use of NFVW funds for pre-commercial thinning. Gearing up our HzFuels projects has and will continue to result in decreased outputs from other programs. At current funding levels, it will take over 10 years to complete a first entry on all of the acres needing treatments.

Assistance needed from others

in order to accomplish the goals as stated, the NNF will need to have personnel to assist with layout, marking, and cruising for timber and thinning contacts, as well as assistance in writing contract. The lack of a hydrologist, botanist or soil scientist on the forest has also had a detrimental effect on schedules and costs for many projects. Assistance from the RO or adjacent forests in this area would have a significant impact on the schedule for

completion of fuels projects on the NNF. More specific details are included in the final section of this report.

Five year plans at current and increased funding

The NNF has aggressive schedules set up for both current and increased funding levels. Both plans will involve collaboration between BLIs, and both plans will involve working cooperatively with federal, state, and local partners to achieve our goals.

We can get mechanical treatments completed under contracts. There are two sawmills in the vicinity (Black Hills). NNF did get some bids on the National IDIQ contract, and there are additional contractors that were not on the National bid contact list. There is also some potential for local labor – rural areas tend to have folks with the ability to use chainsaws, but they may not have thought of contracting themselves out, so there will be a learning process.

We are looking at using machines on the Pine Ridge RD for some areas instead of hand thinning to keep costs down and decrease the time needed for completion.

We are completing more burn plans in order to have more on the shelf to take advantage of more burn windows.

Five year plan at current levels

Table 4 displays our current plan for treating vegetation at current funding levels. Details may be found in Appendix A. We project 75% of hazard WUI acres will receive at least one treatment in 5 years. Grasslands and forests have different needs for vegetation management, and the costs vary significantly as well. These costs are broken down for our five year plan in Appendix B.

Five Year Action Plan - Current Funding - NNF

	Fuel Treatment		Vegetation Treatments		Wildlife		Timber			Total Acres Treated
	(WFHF)		(NFVW)		(NFWL)		(NFTM)			
FY	Acres	Funds (mil. $)	Acres	Funds (mil. $)	Acres	Funds (mil. $)	Acres	Funds (mil $)	Vol. (MCF)	
2004	2,897	$1.080	750	$.029	0	$0	20	$.066	8.4	3,667
2005	4,500	$1.450	150	$.141	280	$.018	100	$.066	42	5,030
2006	5,239	$1.490	1550	$.200	200	$.013	115	$.076	48	7,104
2007	5,920	$1.520	825	$.085	280	$.018	131	$.087	55	7,156
2008	6,350	$1.550	1350	$.180	200	$.013	148	$.100	62	8,048
	24,906	**$6.815**	**4,625**	**$.635**	**960**	**$.062**	**514**	**$.395**	**215**	**31,005**

Table 5. Summary of five year action plan at current funding levels*.

***These numbers do not include cost pools**

Five year plan at increased levels

With increased funding, the NNF could implement at least one entry treatment on all of our hazard timber acres in 5 to 7 years. An estimated 49,000 acres in Condition Class 2 and 3 would be treated over the next five years. This will complete the first entry for all 31,000 acres of forested land presenting a significant hazard, and allow second entries to begin on thousands of acres (Table 6). Agency and contractor capability would have to significantly increase to handle this program.

Table 6. Summary of five year plan at increased funding levels*.

	Fuel Treatment (WFHF)		Vegetation Treatments (NFVW)		Wildlife (NFWL)		Timber (NFTM)			Total Acres Treated
FY	Acres	Funds (mil. $)	Acres	Funds (mil. $)	Acres	Funds (mil. $)	Acres	Funds (mil $)	Vol. (MCF)	
2004	5,470	$2.000	1,500	$.058	160	$.010	20	$.066	8.4	7,150
2005	9,000	$4.000	300	$.282	280	$.018	334	$.072	140	9,914
2006	10,478	$4.400	3,100	$.400	400	$.074	600	$.079	252	14,578
2007	11,840	$4.600	1,650	$.170	500	$.074	600	$.088	252	14,590
2008	12,700	$4.700	2,700	$.360	400	$.076	350	$.097	147	16,150
	49,488	**$19.700**	**9,250**	**$1.270**	**1,740**	**$.252**	**1,904**	**$.402**	**799**	**62,382**

***These numbers do not include cost pools**

Collaboration - Partners

Collaboration and partnership projects with federal and non-federal agencies are standard operating procedure on the NNF. Partners provide not only funding for projects, but also support for fire prevention, input for projects and planning documents, help in hazardous fuels and invasive species reduction, and promote community awareness and understanding of wildland fire in urban interface areas.

Local Volunteer Fire Departments (VFDs) are heavily involved in NNF fire management. They have worked extensively with the forest during recent and ongoing planning and implementation of Hazardous Fuels Projects. They provide input and information annually for the annual update of the NNF Fire Management Plan. Cooperative fire protection agreements are in place with 26 fire districts, including VFDs, state, and other federal agencies.

The NNF involves **permittees** in the NEPA and other planning processes. Currently, the NNF is working with **permittees** to retard and reverse encroachment of Eastern Red Cedar into the grasslands. In FY03, a permittee on the Bessey RD contracted to cut down all the cedar within ¼ mile of the south border of his permitted land, about 250 acres.

The Pine Ridge RD has worked with the **Nebraska Forest Service** and the USFS Stevens funds to award the state supporting funds for treating WUI areas along the Pine Ridge. This grant helps private landowners create a defensible space between structures and undeveloped wildland for the purpose reducing wildland fire risk in land adjacent to

the NNF. Over the past three years, a total of 1,500 acres have been treated.

- ?? 2002: $90,750 for 500 acres of thinning in Chadron Creek,
- ?? 2003: $100,000 for 500 acres in Bordeaux,
- ?? 2004: Applied for $100,000 for 500 acres Deadhorse/Ash Creeks

The **Wild Turkey Federation** has pledged $3,000-6,000 to assist with vegetation management in FY04. Pledged dollars will go towards riparian enhancement on the Pine Ridge RD.

The **Rocky Mountain Elk Foundation** has indicated it has an interest in assisting with elk habitat on the Pine Ridge, and funding will likely be forthcoming for projects that are currently in the planning stage.

Nebraska Game & Parks is a frequent partner with the NNF. Projects include Bighorn sheep and Pronghorn management as well as forest management, including common stand exams, on the Pine Ridge. Nebraska Game & Parks has obligated $3,000 to assist in a habitat program for FY04 on the Pine Ridge District.

Foundation for North American Wild Sheep. The Bordeaux Hazardous Fuels Project includes a special use area to be set aside for Rocky Mountain Sheep, and the Foundation has expressed and interest in assisting once the implementation stage is reached.

Black Hills National Forest assists the NNF in many aspects of planning and implementation. They work closely with the Pine Ridge and Bessey RDs on hazardous fuels reduction including marking and cruising stands, acting as the Contracting Officer Representative (COR) for timber sales, providing assistance with fire, and many other areas.

Pine Ridge Job Corps is a regular partner each year, providing crews for thinning, prescribed and wildland fire operations, and putting on several training sessions annually for fire personnel. During the winter months they also assist in pile burning.

The Bessey District and the Pine Ridge District completed close to 2,000 acres of thinning in FY03 using local and 8a **Timber Contractors** when possible.

Chadron State College produces heating and cooling via a biomass generator which runs off of wood chips. These wood chips are supplied locally, and are plentiful. We also have two research projects with CSC: one to determine the degree to which burn piles may give invasive species a foothold and the second to look at the new weed, Sickleweed (*Falcaria vulgaris*) and methods to treat it, including fire.

The **Crow Butte Uranium Mine**, located between the towns of Crawford and Chadron, is currently installing a biomass generator as well, providing additional opportunity to utilize small diameter timber from the Pine Ridge.

The **Rocky Mountain Research Station** in **Rapid City** has two current studies on the

NNF, one looking at the effect of Smooth Brome on nutrient cycling in Mixedgrass prairie; the second is comparing the effects of fire, grazing, and combinations of both on Crested Wheatgrass (*Agropyron cristatum*). We are in the initial stages of setting up a research proposal with the RMRS in **Ft. Collins** to look at climate/drought histories across the Great Plains, using ridges, such as the Pine Ridge, for tree ring data collection.

Implementation tools

These additional tools have allowed faster implementation of fuels projects, and will continue to be an asset for current and future projects.

IDIQ was used in 2003 for large thinning contracts, and will continue to be used in 2004.

Stewardship Contracts

The Pine Ridge District is expecting to awarding a Stewardship Contracts for up to 800 acres of WUI in FY04. Two hundred acres will be for hazardous fuels thinning, and the rest will be for sawlogs. We will continue to assess the potential for Stewardship in our upcoming projects.

CE

Currently, the NNF has a CE covering 5 years of broadcast burns on 2270 acres. The NNF will be using CEs for upcoming fuels reduction projects.

Challenges

The NNF will need to have their capabilities augmented, both internally and externally, to meet the potential of the NNF. Internally, we need to improve our skills and abilities in:

- ?? NEPA
  - Hydrology
  - Soils
  - Botany
- ?? Layout and prep of sales/thinning
- ?? Contracting officers and reps
- ?? GIS

We need to gain or exchange skills, expertise, and capabilities in:

- ?? Contractors
- ?? Layout and prep of sales/thinning
- ?? Contract burning
- ?? Chips for electric cogen plants
- ?? NEPA
  - Hydrology
  - Soils
  - Botany

CONCLUSION

The NNF has a plan in place and ready to implement should an increase in funding be forthcoming. We have the ability to complete a first entry treatment on all of our forested acres which pose a significant risk in 5 to 7 years (Figure 13). This includes 31,000 acres of hazardous acres in forested areas, the majority of which are also in the WUI. Our plan will significantly change the Condition Class acres in our forested areas, decreasing the resources at risk.

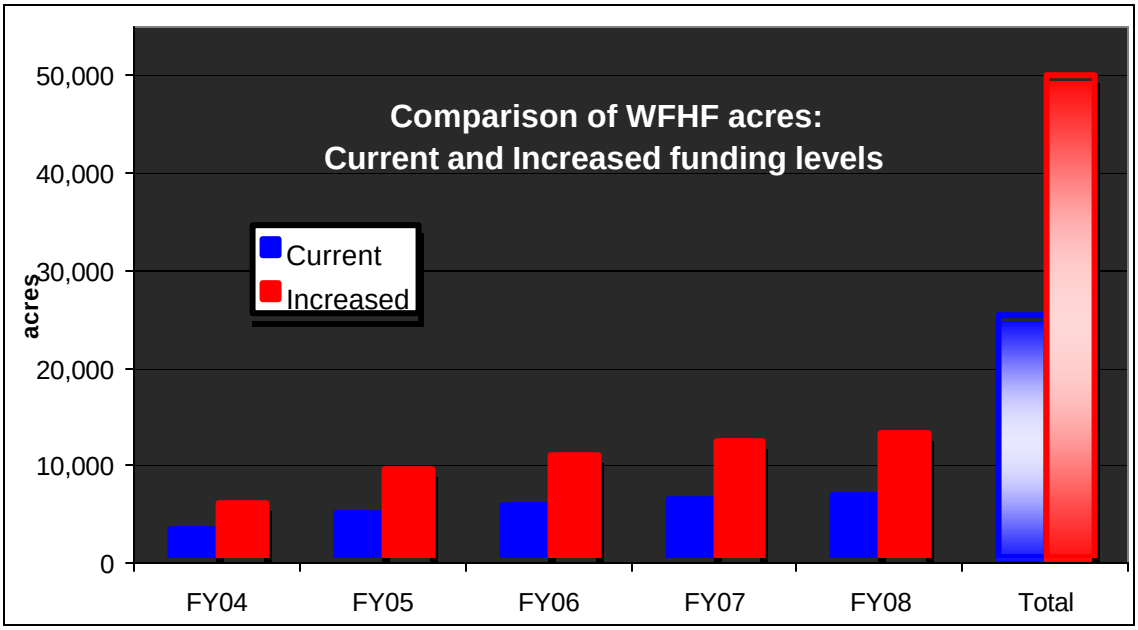


Figure 13. Comparison of WFHF five year accomplishments at current and increased funding levels

The NNF is prepared to respond to the challenge should increased funding become available.

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APPENDIX A – TREATMENT DETAILS

Current Funding Levels for FY04

Project	Purpose and Need	Output	EBLI	Partners	Forest Priority	Critical Paths
Chadron Creek 1 **PRRD**	Fuels - reduce fire risk, improve Condition Class	**Primary** 860 acres - WUI	WFHF	VFD, State Forester	H	Completed
		Secondary 0.84 MCF 20 acres WUI	NFTM			
Bessey 1	Fuels - reduce fire risk, improve Condition Class	**Primary** 1300 acres WUI	WFHF		H	Completed
West SS **BRD**	Decrease encroachment of cedar into grasslands, and improve Condition Class	**Primary** 250 acres non-WUI	WFHF	Wally Collier (Permittee)	H	Done
Mowing **All Districts**	To decrease fire risk along travel corridors	**Primary** 500 acres WUI	WFHF	Contracted on some districts	H	n/a
West SS **BRD**	To decrease encroachment of cedar into grasslands, and improve Condition Class	**Primary** 600 acres non=WUI, 300 acres non-WUI	WFHF		H	Done
Complete Bordeaux EA **PRRD**	Determine needs and treatments for 15,000 acres		WFHF	State Game & Parks, State Forester, VFDs		In progress

Current Funding Levels for FY05

Project	Purpose and Need	Output	EBLI	Partners	Critical Paths
Chadron Creek 2: **PRRD**	Fuels - reduce fire risk	**Primary** 900 acres WUI	WFHF	VFD, State Forester	Done
		Secondary 0.76 MCF 100 acres WUI	NFTM		
Bordeaux pre-commercial thin 1: **PRRD**	Improve Forest heath-ponderosa pine restoration	**Primary 150** acres WUI	NFVW	State Game & Parks, Fdn. for N. Am. Wild Sheep	SHPO
Ash Creek Planning EA **PRRD**	Evaluate needs and determine treatments for 14,000 acres		WFHF	VFDs, State Game & Parks, State Forester	10% of SHPO requirements completed
Mowing **All Districts**	To decrease fire risk along travel corridors	**Primary** 500 acres WUI	WFHF		n/a
Bessey 1:**BRD**	Fuels - reduce fire risk	**Primary** 1200 acres, WUI	WFHF		Done
Richland East EA **FPRD**	Evaluate needs and determine treatments to improve habitat and Condition Class on 15,000 acres		NFVW		

Camp III East Broadcast Burn **BRD**	To reduce regeneration and decrease fuel loads	**Primary** 700 acres WUI	WFHF		Done
Hardpan Broadcast Burn **FRRD**	To enhance native grasses in the riparian area and improve forage	**Primary** 800 acres non-WUI			
Strong Canyon Broadcast Burn **PRRD**	To reduce fuel loads and improve Condition Class	**Primary** 200 acres WUI	WFHF		Done
Adm. Broadcast Burn	To decrease litter, fuels, and regen around the administrative site.	**Primary** 200 acres WUI	WFHF		Done
Rejuvinate grassland habitat in long term exclosures **FRRD**	Burn decadent grasses inside long-term exclosures	**Primary** 40 acres non-WUI	NFWF		Done
Bighorn Sheep habitat Enhancement	Reduce pine encroachment, open pine stands	**Primary 80 acres WUI**	NFWF		Done

Current Funding Levels for FY06

Project	Purpose and Need	Output	EBLI	Partners	Critical Paths
Chadron Creek 3: **PRRD**	Fuels - reduce fire risk	**Primary** 959 acres - WUI	WFHF	VFD, State Forester	Completed
		Secondary 14.0 MCF	NFTM		
Bordeaux pre-commercial thin 2: **PRRD**	Improve Forest heath-ponderosa pine restoration	**Primary** 150 acres WUI	NFVW	State Game & Parks	SHPO
Ash Creek: Pre-commercial Thinning	Fuels - reduce fire risk	**Primary** 500 acres WUI	WFHF	VFDs, State Game & Parks, State Forester	
Mowing **All Districts**	To decrease fire risk along travel corridors	**Primary** 500 acres WUI	WFHF		n/a
Bessey 1: **BRD**	Fuels - reduce fire risk	**Primary** 1600 acres WUI	WFHF		Done
Soldier Creek Planning **PRRD**	Evaluate needs and determine treatments for 12000 acres		WFHF	VFDs, State Game & Parks, State Forester	
Ft. Pierre Brdcst Brn **FPRD**	Enhance native grassland habitat, improve Condition Class	**Primary** 600 acres WUI, 600 acres non-WUI	NFVW		
Gamet Brdcst Burn **FRRD**	Enhance prairie dog habitat, improve Condition Class	**Primary** 800 acres non-WUI	NFVW		
McKelive EA **BRD**	Evaluate needs and determine treatments for 63,000 acres		WFHF	VFDs, State Game & Parks, State Forester	
Alkali West **FPRD**	Reduce invasive species, reduce Sickleweed	**Primary** 1200 acres non-WUI	WFHF		Done

Chester Middle Broadcast Burn **BRD**	Enhance native grassland habitat, improve Condition Class	**Primary** 480 acres WUI	WFHF	Done	Done
Rejuvinate grassland habitat in long term exclosures **FRRD**	Burn decadent grasses inside long-term exclosures	**Primary** 40 acres non-WUI	NFWF		Done
Bighorn Sheep habitat Enhancement	Reduce pine encroachment, open pine stands	**Primary 80 acres WUI**	NFWF		Done

Current Funding Levels for FY07

Project	Purpose and Need	Output	EBLI	Partners	Critical Paths
Bordeaux Fuels: **PRRD**	Fuels - reduce fire risk	**Primary 900 acres WUI**	WFHF	VFD, State Forester, State Game & Parks	SHPO, Landline locations, right of ways
		Secondary: 12.6 MCF	NFTM		
Bordeaux pre-commercial thin 3: **PRRD**	Improve Forest heath-ponderosa pine restoration	**Primary 225 acres WUI**	NFVW	State Game & Parks	Done
Bessey 1: **BRD**	Fuels - reduce fire risk	**Primary** 1050 acres WUI	WFHF		Done
Mowing **All Districts**	To decrease fire risk along travel corridors	**Primary** 500 acres WUI	WFHF		n/a
Soldier Creek: Pre-commercial Thin	Fuels - reduce fire risk	**Primary** 250 acres WUI, 250 acres non-WUI	WFHF	VFDs, State Game & Parks, State Forester	
Ash Creek: Thinning	Fuels - reduce fire risk	**Primary** 500 acres WUI	WFHF	VFDs, State Game & Parks, State Forester	
Buffalo Gap Broadcast Burn **FRRD**	Enhance, reinvigorate woody draw vegetation	**Primary** 600 acres non-WUI	NFVW		
MeKelvie Thin **BRD**	Reduce fire risk in and around the hand planted forest	**Primary** 1100 acres thinning	WFHF		
Nels Middle **FPRD**	To enhance native grassland habitat, and improve Condition Class	**Primary** 510 acres non-WUI	WFHF		Done
Cookstove NW **FPRD**	To enhance native grassland habitat, and improve Condition Class	**Primary** 160 acres non-WUI	WFHF		Done
Camp III West Broadcast Burn **BRD**	To reduce regeneration and decrease fuel loads	**Primary** 700 acres WUI	WFHF		Done
Prairie Chicken Habitat enhancement **BRD**	Burning/cutting cedar in/near priority habitat	**Primary** 160 acres non-WUI	NFWF		Done

Rejuvinate grassland habitat in long term exclosures **FRRD**	Burn decadent grasses inside long-term exclosures	**Primary** 40 acres non-WUI	NFWF		Done
Bighorn Sheep habitat Enhancement	Reduce pine encroachment, open pine stands	**Primary 80 acres WUI**	NFWF		Done

Current Funding Levels for FY08

Project	Purpose and Need	Output	EBLI	Partners	Critical Paths
Bordeaux Fuels 2: **PRRD**	Fuels - reduce fire risk	**Primary** 900 acres WUI	WFHF	VFD, State Forester, State Game & Parks	Done
		Secondary 12.6 MCF	NFTM		
Bordeaux pre-commercial thin 4: **PRRD**	Improve Forest heath-ponderosa pine restoration	**Primary** 600 acres WUI	NFVW	Neb Game & Parks	Done
Chadron Creek Broadcast Burn	Decrease regeneration, reduce fuel load	**Primary** 400 acres WUI	WFHF	Neb Game & Parks	Done
Bessey Broadcast Burn	Decrease regeneration, reduce fuel load	**Primary** 1400 acres WUI	WFHF	VFDs	Done
Mowing **All Districts**	To decrease fire risk along travel corridors	**Primary** 500 acres WUI	WFHF		n/a
Ash Creek: Thinning	Fuels - reduce fire risk	**Primary** 800 acres WUI	WFHF	VFDs, State Game & Parks, State Forester	
Soldier Creek: Pre-commercial Thin	Fuels - reduce fire risk	**Primary** 350 acres WUI, 400 acres non-WUI	WFHF	VFDs, State Game & Parks, State Forester	
MeKelvie Thin	Reduce fire risk in to the hand planted forest	**Primary** 600 WUI acres, 400 non-WUI	WFHF		
Ash Creek Broadcast Burn	Decrease regeneration, reduce fuel load	**Primary** 600 acres WUI	WFHF	VFDs	
Hardpan Broadcast Burn **FRRD**	To decrease litter buildup and improve vigor in native species	**Primary** 750 acres non-WUI	NFVW	VFDs	Done
Rejuvinate grassland habitat in long term exclosures **FRRD**	Burn decadent grasses inside long-term exclosures	**Primary** 40 acres non-WUI	NFWF		Done
Bighorn Sheep habitat Enhancement	Reduce pine encroachment, open pine stands	**Primary 80 acres WUI**	NFWF		Done

APPENDIX B – PROGRAM FUNDING DETAILS AT CURRENT FUNDING LEVELS

	FY04								
	Grassland				Forested				
	WUI		non-WUI		WUI		non-WUI		
	Acres	$	Acres	$	Acres	$	Acres	$	
WFHF	1340	$64,480	1460	$47,120	2250	$685,000	0	$0	
NFVW			750	$28,500					
NFTM					20	$60,000			.84 MCF
Totals	**2270**	**$64,480**	**2210**	**$75,620**	**2270**	**$745,000**	**0**	**0**	

Total FY04 WUI acres =	**2,270**
Total FY04 non-WUI acres =	**2210**
All FY04 acres =	**4,480**

	FY05								
	Grassland				Forested				
	WUI		non-WUI		WUI		non-WUI		
	Acres	$	Acres	$	Acres	$	Acres	$	
WFHF	500	$30,000	800	$40,000	3200	$920,400			
NFVW				$100,000	150	$41,550			
NFTM					100	$66,000			4.2 MCF
NFWF			200	$13,000	80	$5,000			
Total	**500**	**$130,000**	**1000**	**$53,000**	**3530**	**$1,027,955**	**0**	**$0**	

Total FY04 WUI acres =	**3,530**
Total FY04 non-WUI acres =	**1000**
All FY04 acres =	**4,530**

FY06									
	Grassland				Forested				
	WUI		non-WUI		WUI		non-WUI		
	Acres	$	Acres	$	Acres	$	Acres	$	
WFHF	500	$30,000	1200	$30,000	3539	$927,000			
NFVW					1550	$200,000			
NFTM					115	$76,000			14 MCF
NFWF			200	$13,000					
Total	**500**	**$30,000**	**1400**	**43000**	**5204**	**$1,203,000**	**0**	**$0**	

Total FY04 WUI acres =	**5,204**
Total FY04 non-WUI acres =	**1400**
All FY04 acres =	**6,604**

FY07									
	Grassland				Forested				
	WUI		non-WUI		WUI		non-WUI		
	Acres	$	Acres	$	Acres	$	Acres	$	
WFHF	580	$32,500	590	$14,500	4500	$830,780	250	$38,780	
NFVW			600	$20,000	225	$65,000			
NFTM					131	$87,000			12.6 MCF
NFWF			200	$13,000	80	$5,000			
Total	**580**	**$32,500**	**1390**	**47500**	**4936**	**$987,780**	**250**	**$38,780**	

Total FY04 WUI acres =	**4,936**
Total FY04 non-WUI acres =	**1640**
All FY04 acres =	**6,576**

	FY08								
	Grassland				Forested				
	WUI		non-WUI		WUI		non-WUI		
	Acres	$	Acres	$	Acres	$	Acres	$	
WFHF	500	$30,000			5050	$1,003,430	800	$224,570	
NFVW			750	$28,500	600	$180,000			
NFTM					148	$100,000			
NFWF			200	$13,000					12.6 MCF
Total	**500**	**$30,000**	**950**	**41500**	**5798**	**$1,283,430**	**800**	**$224,570**	

Total FY04 WUI acres =	**5,798**
Total FY04 non-WUI acres =	**1750**
All FY04 acres =	**7,548**

APPENDIX C – PLANNING AREA MAPS

APPENDIX D – BURN SUMMARY

Postburn Report for: Hardpan Burn Unit
Fall River Ranger District
Nebraska National Forest

Ignition was at ~0945 on the NW corner of Block C. Conditions at that time were well within prescription and stayed that way throughout the day, the exception being the wind direction in the late afternoon. Wind direction from ~1330, became less variable and more steady out of the east, shifting to the NE around 1530, and staying that way throughout the remainder of the time Block B burned. Winds were monitored through and including 1630, and remained fairly steady out of the NE at 6 mph with gusts to 12. The burn plan stated that a NE wind could cause smoke to be a problem for the town of Red Shirt, about two miles SW of burn unit A. As a result, it was decided not to burn Block A because of the wind, and only blocks B and C were burned for a total of about 700 acres.

Generally, 1-hour fuel moistures remained fairly steady, decreasing by only 2% throughout the burn period. RH and temperatures fluctuated somewhat, but generally decreased through the burn period. RH decreased from 38% at ignition to a low of 24% at 1600 hours; temperatures rose from a minimum of 43°F at ignition to a maximum of 58°F at 1515 hours. BTUs/ft/sec increased through the day as RH and FDM decreased. Low Btus/ft/sec were around 80 at 0825 and high at 500 at 1330 and 1600. Upslope winds dominated much of the fire behavior in Block C, particularly earlier in the day when 20' and midflame winds were more variable. Some 20' and mid-flame winds were likely augmented somewhat by 20' and surface winds from the same general direction

The spot weather forecasts given at 0930 and again at 1330 were fairly accurate in predicting the wind shift and speeds and RH, and slightly underestimated the maximum temperature. Max being predicted as 53, and maximum recorded as 58°.

Initial burn assessment indicated that many of the objectives of the burn were met, including:

*the removal of dead vegetation
*releasing available nutrients in dead grass and ground litter into soils

Initial post burn observations are good, and further post burn monitoring will include photopoints, plot surveys, and transect surveys to more precisely quantify and qualify the fire effects.

Burn prescription parameters.			Observed parameters	
Fire Behavior	Lower Limits	Upper Limits	Lower Limits	Upper Limits
Flame Length*	1 ft.	10 ft.	n/a	20' in junipers; 12' in grass
Spotting distance	0 miles	.3 miles	none observed	
Ignition Probability	50%	70%	30	50
1 Hour Fuel Moisture	5%	20%	8	6
Calculated Rates of	12 ch/hr	65 ch/hr	n/a	n/a

Spread				
Relative Humidity	13%	60%	24	38
20 ft. Winds**	0 mph	20 mph	***	***
Mid-flame Winds	0 mph	15 mph	gust to2***	gust to 13***
Wind Direction***	none	Northeast	NE	NW, S, E, SE, NE, upslope
Smoke Dispersal	Fair	Excellent	Fair	Excellent

***** Average flame lengths. Longer flame lengths are permitted and can be expected, especially in areas of cedar and dense clumps of vegetation. Flame lengths can be controlled during the ignition by adjusting the fire pattern.

****** Average wind speed. Winds may have gusts up to 25 MPH for no longer than 15 minutes. For this burn, 20' winds are equated with mid-flame winds as monitored on the fire because the dominant fuel type was grass.

******* Wind direction. The areas could be burned with any wind component except a northeast wind, if possible. A northeast wind will drive the smoke into Redshirt Village, which is to be avoided if possible.