

FIRE MANAGEMENT PLAN

J. CLARK SALYER NATIONAL WILDLIFE REFUGE

UPHAM, NORTH DAKOTA

***REGION 6
U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR***

September 9, 1999

FIRE MANAGEMENT PLAN

for

J. CLARK SALYER NATIONAL WILDLIFE REFUGE COMPLEX

Upham, North Dakota

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I. INTRODUCTION

Prior to the 20th century the role of fire in the northern Great Plains had been one of continued restoration of the prairie ecosystem (Wright and Bailey 1980; Pyne 1982). Fire restored vigor to plant growth, increased seed production, released nutrients, and reduced accumulated litter. This included the area now designated as the J. Clark Salyer National Wildlife Refuge Complex (Complex).

Since the early 20th century and the establishment of the Refuge in 1935, the majority of fires within or near the refuge boundaries have been suppressed. Due to changing land use and the establishment of road systems, residences, and agriculture, habitat adjacent to the refuge has been fragmented. These activities have significantly reduced the role of fire within the prairie ecosystem. Research has fostered increased understanding of fire's role in the mixed grass prairie within the past 20 years, and has proven fire has historically influenced every native upland vegetative ecosystem in North America (Pyne, 1982).

The recognition of the natural role of fire and the need to manage our public lands more actively have promoted a push towards increased use of prescribed fire as a management tool throughout Federal land management agencies. The J. Clark Salyer Complex is in the process of expanding its fire management program for identical reasons.

A primary objective of the US Fish & Wildlife Service (FWS) is to maintain ecosystems and their dynamic processes, of which fire is an important component. This plan provides direction for the fire management program in the J. Clark Salyer Complex, and will help achieve resource management goals and objectives for the Complex as directed by the Station Purposes, Mission, Goals, and Objectives statement (Appendix A).

This plan addresses the use of prescribed fire as a management tool. The original Complex fire management plan was submitted in April of 1960. In July of 1983, an updated plan was completed and approved, along with an environmental assessment (EA) addressing the use of prescribed fire.

In September of 1994, an **environmental assessment (EA)** and **Finding Of No Significant Impact (FONSI)** were completed for

upland management within the Complex (**Appendix B**). These documents identify prescribed fire as one of the management tools used to manipulate vegetation, improve biological productivity and diversity, control noxious weeds, reduce litter, remove vegetation favoring early successional stages over later successional stages, create habitat diversity by creating a mosaic of habitats, habitat interspersion and "edge", and increase breeding bird densities. A new fire management plan (FMP) is necessary to meet new NEPA/NHPA and Service requirements, however the Environmental Assessment completed for the Management of Upland Habitat (1994) meets NEPA requirements.

A separate EA for prescribed fire will not be completed due to new regulations published in the Federal Register (62 FR 2375) on January 16, 1997. The new regulation categorically excludes prescribed fire (when used for habitat improvement purposes and conducted in accordance with local and State ordinances and laws). Wildfire suppression actions and prescribed fire are both now categorically excluded, as outlined in 516 DM 2 Appendix 1.

Authority and guidance for implementation of this plan are found in:

1. Protection Act of September 20, 1922 (42 Stat.857;16 U.S.C. 594).
2. Economy Act of June 30, 1932.
3. Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471 et seq.).
4. Reciprocal Fire Protection Act of May 27, 1955 (69 Stat. 66, 67; 42 U.S.C. 1856, 1856a and b).
5. National Wildlife Refuge System Administrative Act of 1966 as amended (80 Stat. 927; 16 U.S.C. 668d-668e).
6. Disaster Relief Act of May 22, 1974 (88 Stat. 143; 42 U.S.C.5121).
7. Federal Fire Prevention and Control Act of October 29, 1974 (88 Stat. 1535; 15 U.S.C. 2201).
8. Federal Grants and Cooperative Act of 1977 (Pub. L. 95-244,

as amended by Pub. L. 97-258, September 13, 1982. 96 Stat. 1003 31 U.S.C. 6301-6308).

9. Wildfire Suppression Assistance Act of 1989, (Pub. L. 100-428, as amended by Pub. L. 101-11, April, 1989).
10. Departmental Manual, Parts 620 DM-1, Wildfire Suppression and Management (April 10, 1998).
11. United States Fish and Wildlife Service Fire Management Handbook (December 28, 2000)
12. United States Fish and Wildlife Service Manual, Part 621 FW1-3, Fire Management (February 7, 2000).
13. National Wildlife Refuge System Improvement Act of 1997.

II. COMPLIANCE WITH FWS POLICY

A. Purpose

The Lower Souris National Wildlife Refuge (now the J. Clark Salyer NWR Complex) was established under the authority of the Migratory Bird Conservation Act and Executive Order 7170 dated September 4, 1935. The refuge was designated to act "...as a refuge and breeding ground for migratory birds and other wildlife" (45 Stat. 1222; 16 USC 715-715d, 715e, 715f-715k, 715l-715r). The Migratory Bird Conservation Act further defined the refuge purposes by declaring the refuge "... for use as an inviolate sanctuary, or for other management purposes, for migratory birds."

The J. Clark Salyer Wetland Management District (WMD) was established as part of the Small Wetlands Acquisition Program (SWAP) under the authority of the Migratory Bird Conservation Act (16 U.S.C. 715d) "as... Waterfowl Production Areas" subject to" ... all of the provisions of such Act except the inviolate sanctuary provisions..." (16 U.S.C. 718 © (Migratory Bird Hunting and Conservation Stamp).

U.S. Fish and Wildlife Service (Service) policy requires that an approved Fire Management Plan must be in place for all of Service lands with burnable vegetation. Service Fire Management Plans must be consistent with firefighter and public safety, protection values, and land, natural, and cultural resource management plans, and must address public health issues. Fire Management Plans must also address all potential wildland fire occurrences and may include the full range of appropriate management responses. The responsible agency administrator must coordinate, review, and approve Fire Management Plans to ensure consistency with approved land management plans.

Service policy allows for a wildland fire management program that offers a full range of activities and functions necessary for planning, preparedness, emergency suppression operations, emergency rehabilitation, and prescribed fire operations, including non-activity fuels management to reduce risks to public safety and to restore and sustain ecosystem health.

B. Goals and Objectives

Fire is an important historic factor that shaped Complex lands

for the past 10,000 to 12,000 years. The use of fire as a management tool must continue to be utilized on Complex lands to fulfill the purpose and mission of the Complex and to achieve established goals and objectives.

The goal of wildland fire management is to plan and make decisions that help accomplish the mission of the National Wildlife Refuge System. That mission is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. Fire management objectives (standards) are used in the planning process to guide management to determine what fire management responses and activities are necessary to achieve land management goals and objectives.

The primary goal is to provide for firefighter and public safety, property, and natural resource values. Service policy and the Wildland Fire Policy and Program Review direct an agency administrator to use the appropriate management response concept when selecting specific actions to implement protection and fire use objectives. The resulting Appropriate Management Response are specific actions taken in response to a wildland fire to implement protection and fire use objectives. With an approved Fire Management Plan, the Refuge staff may use wildland fire in accordance with local and State ordinances and laws to achieve resource management objectives (habitat improvement). This plan comprehensively addresses the fire management program on the Complex and how it will be used to achieve these goals and objectives.

The Mission of the Complex is to "conserve, restore, and enhance the biological communities representative of the prairie wetland, riparian, and upland habitats of the Northern Great Plains." Goals identified for the Complex as outlined in the Refuge Management Information System include:

GOAL 1

Migratory Birds/Other Wildlife: Preserve, restore and enhance habitats to meet the life requirements for migratory birds and other wildlife by providing habitats representative of prairie wetlands, riparian lands, and uplands of the Northern Great Plains.

GOAL 2

Threatened/Endangered Species: Conserve, restore, and enhance habitats for listed and candidate endangered species.

GOAL 3

Environmental Quality: Preserve and enhance environmental quality, wild character, and natural beauty of habitats representative of the Northern Great Plains.

GOAL 4

Fisheries and Aquatic Resources: Conserve and enhance the habitats of fish and other aquatic plant and animal life.

GOAL 5

Technical Services/Partnerships: Provide cooperative assistance and technical expertise to and develop partnerships with other offices, agencies, organizations, and private landowners to develop and implement wildlife conservation practices.

GOAL 6

Environmental Education/Public Use: Provide a wide range of opportunities for compatible wildlife/wildlands-oriented interpretation, education, and recreation.

To promote these goals, the refuge has developed several objectives which relate to habitat management including:

OBJECTIVE 1

Maintain approximately 18,000 acres of native grasslands in good to excellent ecological condition to provide the seasonal life requirements of migratory birds.

OBJECTIVE 2

Provide and maintain approximately 10,000 acres of dense nesting cover (DNC) to provide highly attractive nesting habitat for waterfowl and other migratory birds.

OBJECTIVE 3

Protect the integrity of native grassland by preventing the plowing of virgin prairie or conversion of prairie to other habitat types.

OBJECTIVE 4

Initiate actions which will reverse the spread of exotic perennial species into native vegetative types.

OBJECTIVE 5

Provide and maintain approximately 3,600 acres of seeded native grasses to provide attractive nesting habitat for migratory birds.

OBJECTIVE 6

Maintain approximately 4,800 acres of forest in good condition to provide the seasonal life requirements of migratory birds.

The use of fire as a management tool will significantly assist managers in attaining refuge goals and objectives. Periodic use of fire helps to cycle nutrients in grassland ecosystems by removing dead and decadent vegetation and proliferating native grass species. Fire can be used to stimulate native species while inhibiting or removing invading exotic species. Fire use, when timed correctly, can also increase production of seeded native grass stands and is vital to maintaining areas planted to dense nesting cover, subsequently improving available nesting habitat for waterfowl and other migratory birds. The wise and prudent use of fire can also help to maintain forest cover types by reducing hazard fuel loadings and prompting woody regeneration in decadent hardwood forest areas.

Proper upland management integrating fire management programs will help attain the habitat objectives intended to fulfill the major purposes for which units of the Complex were established. These habitats provide nesting cover for thousands of shorebirds, waterfowl, songbirds and raptors each year, and provide feeding habitat for many bird species at various times during their life cycles. Good vegetative cover promotes the health and longevity of wetland bird habitat by filtering runoff and controlling erosion into wetland basins, and preserves and maintain native plant and animal diversity including numerous unique and representative ecosystems.

Service fire management policy is based on the Departmental Manual(620 DM 1) and the Federal Wildland Fire Policy and Program Review. Wildfires will be suppressed using appropriate management response strategies. Management actions taken on wildland fires must consider firefighter and public safety, be cost effective, consider benefits and values to be protected, and be consistent with natural and cultural resource objectives. The Service will employ prescribed fire whenever it is an appropriate tool for managing Service resources and to protect against unwanted wildland fire. This plan is a detailed program of action to implement the above fire management policies and objectives, providing fire management guidelines for the Complex. Departmental Manual sections DM-1 and DM-2 can be found in Appendix T.

At present the Complex does not have an approved Master or Comprehensive Conservation Plan. Various operational plans for the Complex include objectives which pertain to fire management.

The Complex Safety Plan objectives are to:

- provide safe working conditions for employees
- provide a safe environment for the visiting public
- protect and ensure safety of government equipment
- define safety related responsibilities of station personnel

- promote a safety attitude

The Fire Management Plan will provide direction to accomplish safety objectives during wildfire suppression actions and prescribed fire activities.

III. DESCRIPTION OF AREA AND FIRE EFFECTS

A. General Description

The J. Clark Salyer National Wildlife Refuge Complex is located in McHenry, Bottineau, Rolette, Renville and Pierce Counties, a 6,540 square mile area of north-central North Dakota. Fee title land in the complex consists of the 58,693 acre J. Clark Salyer National Wildlife Refuge and 29,184 acres in 126 Waterfowl Production Areas in the J. Clark Salyer Wetland Management District (see **Figure 1**). An additional 129,440 acres of wetland easements are administered out of this office as well as 42 Farmers Home Administration (FMHA) tracts totaling 6,912 acres. The Service has no upland management authority on the wetland easements.

The Complex lies within the Prairie Pothole Region, a heavily glaciated zone having a variety of glacial land forms, among the most important of which are the various shallow wetlands and prairie lakes.

The Complex includes prairie communities with various types of native grasslands, riparian areas, and scattered woodland thickets. The Turtle Mountains and the southern half of the refuge (including the sandhills and Souris River oxbow areas) comprise the only contiguous areas of eastern deciduous forest within the state. Other dominant features within the Complex include wetlands ranging in degree of water permanence, water depth, salinity, and land use. Agriculture is the predominant land use throughout the Complex and includes croplands, haylands, grasslands, shelter belts, tree plantings, and large areas of Conservation Reserve Program lands (CRP).

FIGURE 1 - Broad Scale Map of JCS Complex

Table 1 lists the land type inventory for the Complex, all acreage totals are estimates.

TABLE 1: LAND TYPE INVENTORY OF J. CLARK SALYER NWR COMPLEX			
Land Type:	JCS-NWR Acres:	JCS-WMD Acres:	Total Acres:
Seasonally Flooded Basins	-----	1,000	1,000
Fresh Meadows	756	3,247	4,003
Shallow Fresh Marshes	210	1,046	1,256
Deep Fresh Marshes	19,730	6,600	26,330
Open Saline Marshes	-----	1,075	1,075
Rivers and Streams	1,353	-----	1,353
Croplands	1,183	800	1,983
Native Grasslands	4,848	7,580	12,428

Introduced Grasslands	12,443	2,750	15,193
Dense Nesting Cover	3,514	4,486	8,000
Woodlands	12,235	600	12,835
Brushlands	2,350	-----	2,350
Administrative Lands	71	-----	71
TOTALS:	58,693	29,184	87,877

B. Physiography and Geology

Pleistocene glaciation shaped the landscape, dividing North Dakota from southeast to northwest into three major geological areas. These areas are 1) the Red River Valley, 2) the Drift Prairie and 3) the Missouri Coteau. The majority of the Complex lies in the Drift Prairie. Elevations vary throughout the Complex from 1100 to over 2300 feet

Much of the J. Clark Salyer NWR lies within what once was glacial Lake Souris. Approximately one-fourth of the refuge lies within a sandhills complex formed by wind and wave action on Glacial Lake Souris. The northern portion of the Refuge consists of impounded river valley wetlands bordered by a narrow strip of upland vegetation.

Part of the eastern edge of the WMD lies in another ancient lake, glacial Lake Cando. A twelve township area in southwestern Rolette County and north-central Pierce County in the east-central portion of the WMD contains wetland habitat similar to the Missouri Coteau. This area has irregular terrain with an interspersed of wetlands, native prairie, hayfields, and a variety of grain crops. Glacial stagnation caused the rugged topography of the area, with pothole depressions between hills, knobs, and ridges. Soils are loamy, formed in glacial

till.

The Turtle Mountains is a wooded moraine in the northeastern part of the WMD running approximately 60 miles from east to west and 30 miles from north to south. This ancient ridge line rises 1000+ feet above the prairie with elevations exceeding 2400 feet and is split from north to south with portions in both Canada and the United States. This is primarily a wooded expanse with steep elevation changes, poor access, numerous lakes and heavy fuel concentrations.

Soil erosion resulting from wildland fire suppression or prescribed fire actions is generally not a problem anywhere in the Complex. A standard fire control tactic among local cooperators is the use of disc lines. Disc lines on Complex land for suppression purposes is not recommended due to noxious weed invasion and soil erosion on slopes.

C. Historical Landscape

Most of the Complex was once native mixed grass prairie. Prairie grassland evolved in response to several natural agents, acting collectively. Climate (Clements 1916; Wedel 1956; Hastings and Turner 1966; Costello 1969), topography and wind (Wells 1965, 1970), large ungulate herds (Roe 1970), drought (Albertson and Weaver 1945) and fire (Sauer 1950; Stewart 1951, 1953; Wright and Bailey 1980; Pyne 1982) are often cited as the primary natural agents favoring grasslands over woodlands. Fires were either caused by lightning or started by Native Americans and were quite common, limited only by rainfall and natural firebreaks such as rivers and lakes (Higgins 1986).

Grasslands were broken and converted to cropland beginning in the 1890's. With settlement and fragmentation of the prairie, wildfires were eventually controlled, further modifying the historic influences on the native grasslands. Fire on prairie habitats has been essentially eliminated on private lands and much reduced on public lands.

The herbivore with the greatest impact on prairie grasslands was the bison. Herds of bison, estimated at over six million, once roamed across the prairies impacting grasslands. The grassland evolved with this impact and requires similar influences to maintain diversity and vigor. When the railroad arrived in the 1870's, it spelled the end for the bison. Commercial hunters eliminated all the large herds between 1870 and 1873. Disease carried by domestic cattle reduced bison numbers even more after 1880. Only about 500 bison remained when North Dakota became a State in 1889. Domestic cattle continue to impact grasslands with grazing. This impact differs from that caused by free ranging bison, because cattle grazing usually occurs on the same area through an entire season. This practice also allowed woody species such as western snowberry or buckbrush to invade. Some grass and forb species increased with annual grazing and became more common components of the prairie.

D. Contemporary Landscape Description

Settlement of the area began in the late 1800's and with it began the destruction of the prairie grasslands and wetlands. Over 70 percent of the privately owned land adjacent to the Complex boundary are classified as cultivated cropland. Approximately 25 percent of the privately owned land is classified as native prairie. The remaining 5 percent is in public ownership. Wetland drainage has been extensive, but wetlands are still a prominent feature of the landscape.

E. Fish and Wildlife Service Land Interests

The Complex is located entirely within the Prairie Pothole Region of the Upper Midwest. It is part of the Prairie Pothole Joint Venture area, a regional designation of the North American Waterfowl Management Plan. The Fish and Wildlife Service has management or administrative responsibilities on five different land categories. Acreages of each are listed in Table 2.

Table 2: U.S. Fish and Wildlife Service Land Interests in the J. Clark Salyer National Wildlife Refuge Complex, North Dakota

Interest Type	Acres
National Wildlife Refuges (fee title)	58,693
National Wildlife Refuges (easement)	8,176
Waterfowl Production Areas (126 total)	29,184
Wetland Easements	129,440
FmHA Conservation Easements	6,912

The land categories are described as follows:

1. National Wildlife Refuges

There are eight National Wildlife Refuges within the J. Clark Salyer National Wildlife Refuge Complex. Of these, seven are easement refuges, and only one, J. Clark Salyer NWR, is owned in fee title by the Service. The Service has acquired the right to control hunting and maintain water levels on the seven easement refuges. All other management rights, including upland management, are retained by the landowner.

2. Waterfowl Production Areas

Waterfowl Production Areas (WPAs) are purchased by the

Service under provisions of the Migratory Bird Conservation Act, and are Service fee title lands. The sale of Migratory Bird Hunting and Conservation Stamps, commonly known as the "Duck Stamp", provides the funding for purchasing WPAs. The Complex staff have fire management programmatic responsibilities on these lands.

3. Wetland Easements

The wetland easement program was authorized by Congress in 1958 and is financed by the sale of Duck Stamps. The Service pays landowners a one-time, lump sum payment to protect wetlands from draining, leveling, filling or burning.

The easement is perpetual and covers only the wetlands on the land. Normal farming practices such as cropping, haying or grazing when the wetlands are dry from natural conditions are not restricted by the easement. The Service has no other management authority on these lands. Burning may be permitted on wetland easements once every three years, and requires a permit issued by the Complex.

4. Farmers Home Administration Conservation Easements

The Farmers Home Administration (FmHA), an agency of the U.S. Department of Agriculture, is required by Executive Order 11990 to preserve and protect all wetlands in FmHA ownership. The 1985 and 1990 Food Security Acts (Farm Bill) subsequently gave instructions pertaining to how and by whom this should be done. The Service has recommended conservation easements on FmHA properties, and, when these properties are sold, assumes enforcement and management responsibilities of the easement.

The restrictions of each easement may vary. At a minimum, wetlands are protected from draining, filling or burning. Some easements also protect upland habitats including native grassland, tame grassland and trees.

Figure 2 - JCS NWR Map

Figure 3 - JCS-WMD Bottineau County

Figure 4 - JCS-WMD McHenry Co.

Figure 5 - JCS-WMD Pierce CO.

Figure 6 JCS_WMD Rolette Co

Figure 7 JCS-WMD Renville CO

F. Climate

The area's climate is classified as semiarid to subhumid continental. It is characterized by long, cold winters, moderately warm summers and rapidly changing weather patterns. The average growing season ranges from 98 to 106 days. The average daily summer temperature is in the mid to upper 60's (°F) with the average high temperature in the upper 70's to low 80's. The average winter low temperature ranges from -1 to -5°F. The coldest temperatures vary from -40 F to -60 F with summertime highs up to 112 F. Average annual snowfall ranges from 30 to 40 inches. The average annual precipitation ranges from 16.7 to 17.5 inches with almost 80 percent occurring between April and September. The Complex is a National Fire Danger Rating System (NFDRS) climate class 1 area (semiarid).

Intense thunderstorms occur frequently in summer. In the winter, snow and high winds bring frequent blizzard conditions to the area. The frost free season generally runs from May 20 - September 15. January is the coldest month and July is the warmest. The prevailing wind flow is from the northwest with an average daily speed of 10+ mph. Winds are usually sustained strong breezes rather than occasional gales. Wind speeds are usually highest during the afternoon and lowest at night. Winds of 25-30 mph or more often last for over six hours and have been recorded for several days, sustained gusts of 35-50 mph are not uncommon.

Green up of cool and warm season grasses is dependent on temperature, precipitation and soil moisture. Drought years often produce little or no green-up for the entire year. Year to year variations in green up and curing of grasses affect fire danger throughout the growing season.

Typical cycles in the area include a transition from cured to green up in April and early May, with late May, June and much of July in a green state. The late summer-fall transition period from green to cured starts in middle to late July and continues until early September. The onset of frost in mid September generally brings about full curing of vegetation, remaining in this condition until the spring transition to green up occurs.

G. Soils

The soils in the 5-county Complex are of two major categories; recent alluvium and glacial deposits. The alluvium is in the Souris River valley where it generally exceeds 30 feet in thickness. Glacial deposits consist primarily of glacial till and glacial lacustrine sediments. The soils formed in glacial till are loam or clay loam with thin seams and lenses of sand and gravel, ranging in thickness from 50 to 200 feet.

There are 18 individual land capability classes and subclasses consisting of over 300 soil types. The soils have been inventoried by the Natural Resource Conservation Service,

formerly the Soil Conservation Service, an agency in the U.S. Department of Agriculture. Soil surveys and maps for all five counties are kept on file at the Complex headquarters and are used when planning upland management to help determine which management practices are appropriate on particular tracts or portions of tracts.

H. Water Resources

The wetlands in the Complex are extremely productive and very attractive to migratory waterfowl and resident wildlife. They serve as breeding and nesting areas for many migratory birds and as wintering habitat for many species of resident wildlife. Approximately 35,000 acres of wetlands exist on Complex lands, most of which are potentially burnable at one time or another.

Glaciated "prairie potholes" are one of the most obvious water resources in the Complex. Wetland densities exceed 270 wetlands per square mile in some portions, particularly the Turtle Mountains and Missouri Coteau. These wetlands are extremely productive and are used as breeding and nesting habitat for many species of migratory birds.

The Souris River is the other major water resource. It drains an area of about 24,000 square miles in Canada and North Dakota. The Souris originates in Canada, entering the United States northwest of the Complex and returning to Canada through the J. Clark Salyer NWR. There are approximately 360 miles of the Souris River in North Dakota, with 75 miles of the River within the boundaries of the refuge. Most of the native riparian woodlands in the Complex are found along the Souris River. Major tributaries to the Souris River within the Complex include the Wintering River, Deep River, Willow Creek, Cut Bank Creek, Stone Creek and Boundary Creek.

Portions of eastern Rolette County and southeastern Pierce County are outside the Souris River watershed. The remainder of the Complex is within the watershed for the Souris River. The various river systems within this watershed, along with the numerous wetlands throughout the Complex, allow for the use of these areas as natural barriers in both suppression and prescribed fire planning when sufficient water levels exist. During drought years or following impoundment or wetland drydown in the late summer and fall, these wetland and riparian areas supporting heavy mats of cattail or phragmites (fuel model 3) have the potential to cause wildfire control difficulties.

Many of the prescribed burns conducted in the Complex are adjacent to water resources; some, such as cattail reduction burns, may take place over water or ice. Post fire erosion and wind born ash deposition impacting water resources is not a concern for the type and scale of burns conducted on the Complex. Burn size is generally small (average 80-600 acres) and grass fuels do not produce heavy volumes of ash as compared to forest fuels.

Terrain and slope also effects fire management impacts on water resources. Terrain and slope on Complex lands are mostly flat to gently rolling, with little or no slope present, or areas of slope with short vertical distances. Furthermore, the mixed grass prairie is an adaptive fire community, and will significantly revegetate within one to two weeks of burning throughout the growing season (May 15 through September 15). Thus soil erosion is of little concern on most of the lands managed by the Complex. Supporting documentation regarding fire effects on water resources can be found in Effects of Fire on Water: A State of the Knowledge Review (1979).

I. Vegetation

With 126 Waterfowl Production Areas covering over 29,000 acres, and over 58,000 acres of Refuge fee title lands, completion of comprehensive vegetative surveys has been impossible. All WPA's have undergone basic site classification surveys consisting of walk through vegetation composition surveys, classification of habitat type (native prairie, dense nesting cover (DNC), meadow, wet meadow, wetland and wetland type, seeded native grassland etc.) and have recorded histories of management including the use of prescribed fire and wildfire occurrence.

Vegetational resources on the Complex are diverse. A refuge plant listing was compiled in 1947, documenting over 300 species on refuge lands. This was prior to the establishment of the Wetland Management District, covering lands throughout five counties and potentially increasing the overall species occurrence list. Numerous additional vegetative surveys have been conducted since 1947 on lands contained within the Complex, and several are ongoing as this plan is written. Due to vegetation composition changes over time, vegetation covers needs to be re-mapped in the future to provide accurate estimates.

In 1997 the Complex herbarium was updated, documenting a total of 265 different plant species in 73 families (**Appendix D**). This herbarium is located at the Complex headquarters and is available for use by individuals conducting fire management monitoring and other research.

In general, both the range condition and vegetative condition of the Complex are in fair to poor condition based on the species composition and general vigor. The primary reason the grasslands are not in better condition is the lack of correct periodic treatments on these grasslands. A review of past management of Service lands indicates that treatment has been sporadic and many units have received from 5 to 15+ years of rest. This lack of treatment, formerly described as the "rest is best" theory of management, occurred due to many factors. Complex staffing has never been at the level necessary to conduct the management actions necessary to maintain ideal grassland conditions, and it was easier to have a permittee hay or graze the land, or just keep it in an elongated rest cycle,

than to intensely manage the area with a combined management style.

1. Native Grasslands

Approximately 12,400 acres in the Complex are classified as native grassland. This represents 14 percent of the total upland acreage in fee title ownership. The Complex is located in the transition zone between the western short grass and eastern tall grass prairies. The primary species typical of this mixed grass prairie are green needle grass, western wheat grass, blue grama and prairie junegrass with little bluestem, big bluestem and switchgrass found in wetter sites with more moisture. Prairie sandreed and sand bluestem are found in the sandhills portion of the refuge.

Extensive invasion of native prairie by exotic species including Kentucky bluegrass, smooth brome, leafy spurge, Canada thistle and crested wheat grass has occurred. Aspen, willow and western snowberry have increased within native grasslands located in the southern portion of the refuge.

The majority of fee title grasslands in the WMD had been converted to cropland at some point in their history prior to Service acquisition. In most cases the area was farmed long enough to destroy the native plant species that existed, or was seeded to tame grass.

Remnant native prairie tracts can still be found in portions of the WMD to a degree that represents native biotic communities. However, these native prairie tracts are scarce and isolated, and many of these tracts have also been heavily invaded by smooth brome grass, Kentucky bluegrass, quackgrass and leafy spurge.

One of the simplest and least expensive practices to improve and restore grasslands is prescribed burning. Prescribed burning can be used to target individual species or categorical grassland components (native vs. exotic). Selective suppression or promotion of a particular species depends on the date of the fire in relation to the phenology of the particular species (Higgins, Kruse, Piehl 1986). Appropriately timed prescribed burning will be used to manage Complex grasslands. Research conducted on the Arrowwood NWR Complex in central North Dakota found a marked increase in species diversity after prescribed burning (Kirsch, Kruse 1972).

Prescribed fire will also be a major component of management efforts to restore areas of native prairie in the sandhills section of the refuge. Many of these areas are already too far gone to reclaim from their current state of predominantly woody vegetation coverage. Prescribed fire will be utilized where feasible in areas on

the fringe of continuous aspen/mixed hardwood forest and internal zones consisting of wet meadows or small areas of native prairie to eliminate woody intrusion and maintain grasslands.

Depending upon the time of year, drought conditions and other physiological plant characteristics, large wildfires could have positive and/or negative effects on both native and exotic grass species. These effects can be predicted with some accuracy based upon available research and local knowledge. National fire policy now allows for management of wildland fires for resource benefit, and also allows modified suppression strategies to take advantage of beneficial wildland fire. Where applicable, these types of fire management applications may be used on the complex to further Complex management goals and objectives. When possible, Complex managers will utilize suppression strategies to benefit the native grassland component on Complex lands.

2. Seeded Native Grasses

Some areas of former cropland, approximately 1,200 acres, have been seeded to native grass species including switchgrass, big bluestem, little bluestem, sideoats grama, western wheat grass, and green needle grass. In general, areas that were seeded in the 70's and early 80's have relatively poor stands of native grass due to improper seeding methods that did not place seed at the proper depth and compaction, seed varieties that were not adapted to northern North Dakota, lack of management after seeding, and poor weather conditions following seeding. Later seedings utilized northern adapted varieties and show better success rates.

Prescribed fire is the primary management tool used on seeded native grasses in the Complex. Without a fire treatment, litter accumulation increases until there is very little ground surface receiving sufficient light for new growth. Cool season exotic species such as Kentucky bluegrass, quackgrass and smooth brome establish themselves early in the spring before the warm season natives, filling whatever free space is available. By the time the ground warms sufficiently for the warm season natives to sprout, they are effectively shaded out by the cool season exotics. In many areas of the Complex, the native component is only visible upon close inspection under the litter layer where they are hanging on in stunted growth.

Periodic prescribed burning of seeded native grasses areas can have incredible effects on native grass vigor and composition. Timed burning after the cool season exotics are actively growing but before the warm season natives are well developed will significantly reduce the exotic grass vigor and open up the ground surface to allow the natives to expand, often exponentially. On decadent plantings,

just the removal of the dense litter layer through burning will aid the native component for the following year or two. Maintenance burning in native seedings are most effective when burned on a one to three year rotation, and Kentucky bluegrass can often be nearly eliminated by three or more consecutive year burns (Kirsch and Kruse, 1972).

3. Dense Nesting Cover

Approximately 8,000 acres of former croplands have been planted to a mixture of grasses and legumes which produce a "dense nesting cover" (DNC) that is particularly attractive to upland nesting waterfowl. This mixture usually includes tall wheat grass, intermediate wheat grass, alfalfa and sweet clover.

DNC is very important to upland nesting birds, especially ducks, making a major contribution toward achieving the waterfowl production objectives of the Complex (Duebbert 1969; Duebbert and Lokemoen 1976; Higgins and Barker 1982). Some of these stands provide excellent nesting and winter cover. Many have declined in productivity due to the tendency of smooth brome grass to invade and predominate the stand and then to become sodbound without proper management. Other problems associated with DNC areas is the tendency to become heavily intruded by leafy spurge and other exotic plant species. Current management techniques used to rejuvenate DNC include prescribed burning, mowing, haying, mowing or haying with scarification, grazing, interseeding and conversion to cropland to prepare seedbeds for eventual reseedling.

Prescribed fire is a useful tool in DNC areas, but its use as a management tool has several limitations. Fire in DNC areas must be completed either before initiation of legume growth (alfalfa and sweet clover), or after these species have gone into dormancy in the fall. Fire during their growth state can severely impact plant vigor. Fire prior to the growth spurt in the spring can open up the area for increased intrusion by leafy spurge and other exotic plant species. The application of fire is used to reduce litter layers, rejuvenate DNC plantings, and to remove the heavy collection of surface detritus to allow for ease of inter or reseedling.

4. Tame Grass

Approximately 15,000 acres of upland are classified as tame grass. These areas were once cropland but have been seeded to grass. Most is smooth brome, but there are also areas of crested wheat grass, quackgrass and mixtures of grasses and alfalfa. Much of this land was seeded 20-50 years ago.

Some areas were allowed to revert to whatever vegetation

would grow after being abandoned as cropland while privately owned or shortly after Service acquisition. Management options on these areas are limited by species composition and soils. Some tracts are so completely dominated by decadent stands of undesirable grasses that reseeding to more desirable species may be the best management technique to use. Prescribed fire is used to promote this management tactic by removing the heavy accumulated litter mat allowing ease of working and reseeding the area.

Grassland species of the northern great plains evolved under periodic disturbance and defoliation from several factors, with the primary influences being buffalo (Roe 1970) and fire (Wright and Bailey 1980; Pyne 1982). Proper management of these grassland areas requires a mixed management style incorporating the needed components of fire, grazing, and/or haying in the proper distribution and correct timing to imitate the natural cycles and ultimately produce the landscape changes needed to perpetuate this dwindling natural ecosystem.

Fire is an important grassland management tool and is vital to the health and vigor of grassland ecosystems. Fire reduces litter and increases grass stand vigor and diversity. Fire can be used to manipulate plant species composition, reduce the intrusion of exotic species, and reduce or eliminate woody vegetation. Periodic application of fire to grassland ecosystems is the best and most economical method available to managers for managing Complex grassland ecosystems. The use of prescribed fire to manage Complex grassland ecosystems is and will continue to be a primary management tool on the J. Clark Salyer NWR Complex.

5. Woodlands/Forests

The Complex contains approximately 12,800 acres classified as woodlands, with the majority of these acres (12,200) located within the J. Clark Salyer NWR, primarily in the riparian and sandhills areas. Woodland areas on the Complex can be broken into five distinct categories.

a) Riparian Gallery Forest: Woodlands consisting of hardwood species of green ash, cottonwood, American elm, box elder and oak. Typically these areas are found adjacent to the Souris River and associated feeder streams. This forest type is fire intolerant and normally will only support fire during drought conditions and in early spring or late fall when overstory leaf coverage is absent.

b) Oak Savannah: The oak savannah forest type has been nearly eliminated from the complex. Typified by scattered park like open grown oaks interspersed in

areas of native prairie, much of this forest type has been lost by agricultural practices and lack of fire. Oak savannah is a fire maintained ecosystem. The majority of historic oak savannah areas on the Complex have been overcome by aspen.

c) Aspen Parkland: Aspen has increased on upland sites which once supported only scattered oak. Today, some 10,000 acres of aspen parkland exist on the Complex. This forest type has been rapidly increasing over the past 50 years. The increase in aspen can be at least partially attributed to the elimination of wildfire and bison, two major factors which controlled woody plant invasion in prairie grasslands (Higgins 1986).

d) Brushlands: Complex brushlands consist of mixed hardwood brush areas on the north facing slopes of ancient sandhill ridges, buckbrush and choke cherry intrusion in grasslands, and willow establishment in wet meadow areas. Brushlands have expanded rapidly over the past 20 years. Much of this can also be attributed to lack of fire. Increased litter depth in areas absent of periodic litter removing fire serves to change the natural moisture regime of the area, thus favoring brush species over grass. Prescribe burning will be used to address this problem within the Complex.

e) Plantings: Various areas on the Complex have received tree plantings in the past 50 years. Typically these areas can be broken down into plantings for erosion control (shelter belts), and ornamental plantings around old farmsteads prior to the land being purchased by the Service. Less than 100 acres of these sites exist on the Complex. Non-native tree plantings are managed as part of the adjacent upland habitats and do not receive special management. Many of these areas are valuable for wildlife, providing food, shelter and breeding areas throughout the year. These areas typically are not adapted to fire, and efforts must be made to exclude them from all wildland fire. Some planted species, specifically Russian olive and Siberian elm, are invading grasslands and require management attention. Prescribed burning is a useful tool in controlling these exotic invader species.

Woody vegetation has increased on the southern portion of the refuge by an average of 60 percent since 1938, with much of the change occurring since 1968. Aspen have so completely dominated some areas that those areas may now be best managed as forest rather than attempting to return them to their pre-settlement grassland condition. Willows have also increased, mainly in the floodplain meadows, and choke cherry, sumac and other brush species are also

increasing. Prescribed burning, mowing and shearing help control the spread of these species, but mechanical treatments are expensive and quite labor intensive. Without active management, willows can quickly replace grasses as the dominant plant species, and many meadows on the south end of the refuge are rapidly being overcome.

The WMD has approximately 600 acres of woodlands. Eight WPAs in the Turtle Mountains contain most of the native forest which consists of bur oak, green ash and aspen. The remaining woodlands are found scattered around old farmsteads or shelter belts established when the land was privately owned. Invasion by undesirable tree species is occurring on some WMD grasslands, similar to what is happening on the refuge.

6. Wetland Vegetation

Wetlands comprise about 40 percent of the land within the Complex. The four major wetland classes are temporary, seasonal, semi-permanent and permanent (Stewart and Kantrud 1971). Permanent wetlands contain a deep water zone which does not normally support aquatic vegetation. Wetland or aquatic vegetation refers to those plants which have evolved to grow in anaerobic soils which are saturated for most of the growing season. Wetland vegetation is divided into four major categories based on their growth form and wetland zone they inhabit. The categories are free floating, submergent, emergent and amphibious plants. Individual wetlands commonly have representatives of all four categories of wetland plants present.

Often, short term management of fuel model 3 wetland areas can be accomplished by prescribed fire. Thinning out cattail and bullrush stands and creating open water for indigenous and migratory bird species is a management option under certain weather trends. Fire alone will not manage these resources for more than the first growing season, but fire in conjunction with water level management can be very effective.

7. Endangered Plants

Currently there is one federally listed plant in North Dakota, the western prairie fringed orchid. There are also 5 species listed as sensitive in the state including Hayden's yellow tress, wolf's spikerush, Dakota wild buckwheat, handsome sedge and elk sedge. The elk sedge is the only species that may occur on the Complex. The elk sedge has been identified in fen habitat in McHenry County about twenty miles south of the refuge. No status report on the elk sedge has been done, and its abundance in North Dakota is unknown. Federally listed endangered species for North Dakota can be found in Appendix E.

There are 43 plant species listed as Natural Heritage State listed species that may occur on Complex lands. Of these, 25 are listed as S-1 species (critically endangered in the state), and 18 listed as S-2 (endangered in the state). The number and distribution of these species on Complex lands is currently unknown. The North Dakota state species of concern listing can be found in Appendix G.

8. Noxious Plants

Several plant species included on North Dakota's noxious weed list are found on Service land in the Complex. The most widespread is leafy spurge, but Canada thistle, absinth wormwood and perennial sow thistle are also present. These plants often compete with and have a negative effect upon native and desirable introduced vegetation. The control of noxious plants is important to benefit native plant communities and is required by State law.

Leafy spurge presents the greatest threat to Service uplands, because it is nearly impossible to eradicate, has no natural enemies native to North America, has several methods of spreading and adapts to a wide variety of sites and soil types. Several species of insects (flea beetles) that control leafy spurge have been imported from Europe and released at numerous insectaries throughout the Complex as a biological control method.

Once established, these insectaries can be vulnerable to fire if burned during the season of insect activity. Fire should be avoided in these areas between June 15 and September 1. Prescribed fire can also be used as a tool to proliferate the spread of the flea beetles by removing excessive litter layers in areas adjacent to release sites to provide quality expansion habitat for the beetles. Excessive litter layers reduce the overwintering capabilities of the flea beetles, in some cases completely destroying insectaries during long winters with heavy snowfall. Selectively prescribed burning areas adjacent to insectaries on a yearly basis is a management tool the Complex uses to assist in the establishment and expansion of flea beetle spurge control sites.

Purple loosestrife has not been documented as occurring in the Complex. Purple loosestrife has been found along the Souris River in Minot, south of the Complex. Organize control began in 1997. Since the Souris River flows through Minot before entering the Complex, the potential for purple loosestrife to invade Complex lands in the near future exists.

Fire can be a useful tool in the management of some of these exotic invader species, but generally must be used in conjunction with other management devices to achieve good results.

J. Wildlife

1. Endangered, Threatened, and Species of Special Concern

The Complex contains a number of threatened and endangered species and species of special concern. The Complex will implement its fire management program within the constraints of the Endangered Species Act of 1973, as amended, and will take appropriate action to identify and protect from adverse effects any rare, threatened, or endangered species located within the Complex. Service policy requires that State and Federal threatened and endangered species and species of special concern will be incorporated into any planning activities. Appendix E, F and G contain lists of Endangered and Threatened Species and species of special concern occurring in the Complex.

Common Name:	Scientific Name:	Classification:
Eskimo Curlew	<u>Numenius borealis</u>	Endangered
Bald Eagle	<u>Haliaeetus leucocephalus</u>	Threatened
Peregrin Falcon	<u>Falco peregrinus</u>	Endangered
Gray Wolf	<u>Canis lupus</u>	Endangered
Whooping Crane	<u>Grus americana</u>	Endangered
Piping Plover	<u>Charadrius melodus</u>	Threatened

The bald eagle, peregrine falcon and whooping crane have been present during spring and fall migrations. With the exception of the bald eagle, these birds generally do not use Service lands for nesting or breeding areas. Reports of gray wolf sightings in the area have been received, but with the exception of the Turtle Mountains, these appear to be transient individuals and not resident animals. The North Dakota Game & Fish Department reported in November of 1998 that Gray Wolves had established a resident population in the Turtle Mountains.

Fire is a natural and essential part of the Complex ecosystems. Native wildlife evolved with fire and have developed means of tolerating and/or benefitting from fires. However, the sensitive nature of some of the above species requires that their habitats be protected from large wildfires especially where adjacent habitat is lacking. Prescribed burning in areas where threatened, endangered, and candidate species exist will be conducted such that small to medium size burns (10-300 acres) can be used to increase local habitat diversity, thus aiding these species of concern.

Studies conducted at Lostwood NWR, North Dakota found that piping plover nesting success increased as a response to prescribed burning on beaches (Smith, Murphy, Michaelson, Viehl 1993). Increases were attributed to the reduction of live and residual vegetation. Prescribed burning will be used where applicable to improve piping plover habitat and increase nesting success.

Baird's sparrows are a species of special concern that are found throughout many areas of the Complex. Baird's sparrows nest in extensive idle or lightly grazed mixed grass prairie in the prairie pothole region. Studies conducted at Lostwood NWR in northwestern North Dakota showed that Baird's sparrow populations increased on areas treated with at least three prescribed burns over a 12 year period at (Madden, Hansen and Murphy 1997).

The Service maintains a listing of Migratory Nongame Birds of Management Concern. Numerous species listed in this document are found on the Complex (**Appendix F**) including golden eagle, short-eared owl, Forster's tern, common tern, LeConte's sparrow, sharp-tailed sparrow, clay-colored sparrow, grasshopper sparrow, Sprague's pipit, eastern bluebird, upland sandpiper, willet, marbled godwit, McCown's longspur, orchard oriole, black-billed cuckoo, bobolink, lark bunting and others. These species use Service lands for either migration or breeding habitat, and many of them are grassland dependant species.

Many of these species need periodic fire in their nesting and breeding habitat to reduce litter buildup and woody plant intrusion to further habitat use and nesting success (Madden, Hansen and Murphy 1997).

An additional listing of North Dakota species of special concern is maintained by the State of North Dakota Parks and Recreation Department. Numerous species of state concern are found on Complex lands (**Appendix G**).

It is important to reiterate that these species are typical of mixed grass prairie areas and have evolved with fire as an integral part of their life cycle. The use of prescribed fire with correct life cycle timing is vital to these species. Wildfire at the wrong time could adversely impact some of these species as well, and fire managers must take this into consideration when planning appropriate management responses to wildland fire incidents.

2. Invertebrate Populations

Invertebrates are vital to the value of Service land as breeding areas for birds and other wildlife. Wetland and upland invertebrates make up part of the food base for almost all birds during portions of their life cycles. Because of the important role of invertebrates in the lives

of birds, management planning must consider potential impacts on the invertebrate community.

Siltation, erosion, and combustion of deep organic soils may be detrimental to these populations. Although siltation and erosion are uncommon byproducts of wildland fire in this area, fire during drought cycles in organic soil areas could adversely affect this important ecosystem component, potentially sterilizing the soil, thus reducing the invertebrate component for several years.

Insect life and range of occurrence of insects are not well documented on the Complex. Fire causes an immediate decrease in insect populations (except ants, other underground species, and flying insects), followed by a gradual increase in numbers as the vegetation recovers. The insects eventually reach a population level higher than adjacent areas, then decline to near present levels as vegetation and soil litter stabilize (Higgins, Kruse, and Piehl 1986).

Flea beetle Insectaries established to support leafy spurge control must also be considered in fire management activities. This is discussed in detail in section I-8 of this plan.

3. Fish

The majority of the Complex is found within the Souris River watershed. Numerous species of fish have been documented both in this watershed and in the 5-county WMD. The majority of these species occur in the Souris River, other perennial streams and deeper ponds and lakes of the WMD.

The only Federally listed species in North Dakota is the pallid sturgeon (Scaphirhynchus albus). There are an additional seven candidate species. None of these have been documented on Complex lands.

Since siltation and erosion caused by vegetative removal from wildland fire is generally not an issue in this area, the impact on local fishery resources is negligible.

4. Reptiles and Amphibians

Several species of reptiles and amphibians have been documented, but no comprehensive survey has been done. Tiger salamanders and leopard frogs are common amphibians. The red-sided garter snake is a common reptile. Several species of reptiles and amphibians have been documented in the WMD, but comprehensive surveys of all units have not been done. Based upon state lists, it is likely that a total of four snakes, four frogs, three toads, two

salamanders and two turtles may be found in the Complex.

Again, it is important to reiterate that these species are typical of mixed grass prairie areas and have evolved with fire as an integral part of their life cycle. Due to the life cycles, habitat use and abundance of the limited number of reptile and amphibian species in the area, it is unlikely that wildland fire has a significant negative impact on any of these resources.

5. Birds

A total of 293 bird species have been recorded in the Complex. Of this total, 151 have been documented as nesting species including colonies of Franklin's gulls, great blue herons, double-crested cormorants and black-crowned night herons. The "Souris Loop Bird List", included in Appendix H, provides a summary of the bird species found in the Complex.

The full range of passerine and other birds common to the Northern Great Plains prairie/wetland ecosystem, including many neotropical species, are found in the Complex during some part of their life cycle. Non-migratory birds include sharp-tailed grouse, gray partridge, ruffed grouse and ring-necked pheasant. Sharp-tailed grouse are good indicators of the health of upland grassland habitats since they are a native species that has evolved in grassland ecosystems. Their population has fluctuated in recent years, mainly due to adverse weather conditions during the nesting season which reduced reproduction. However, historic leks on portions of the refuge badly invaded by aspen and willows no longer exist. This indicates the value of these areas as grassland habitats has decreased, further exposing the role of fire in this ecosystem to maintain native flora and fauna components.

Bird species evolving with fire may show fire adapted behavior and responses, whereas other species exposed infrequently to fire in their evolutionary history may be severely inhibited by fire (Best 1979). Research conducted at Arrowwood NWR from 1969-1971 concluded a greater variety of nesting bird species were found on burned areas, duck and sharptailed grouse production was higher on burned areas, hatching success of ducks was higher on burned areas, and there was a marked increase in plant variety after burning (Kirsch and Kruse 1972). Other studies concluded that duck nesting success was significantly greater in fall burned plots than in spring burned plots for all duck species. Results suggested that vegetation structure and duck nesting response to spring and fall burns became similar after the third post fire growing season (Higgins 1986).

Studies conducted between 1979 and 1995 by Murphy and Smith

at Lostwood NWR on the effects of periodic prescribed fire on grassland passerine species abundance and composition on mixed grass prairie areas in northwestern North Dakota showed a dramatic increase in passerine numbers in the year immediately following a burn. This increase in some instances was up to ten-fold of preburn numbers. Typical trends depicted by the study show dramatic increases for the first three years after the burn, with numbers reverting back to preburn levels five to six years after the burn treatment.

6. Mammals

All mammals common to this portion of the Northern Great Plains are found in the Complex. Some of the most common include white-tailed deer, jackrabbit, coyote, red fox, raccoon, muskrat, beaver, striped skunk, and several species of small mammals including Richardson's ground squirrel, deer mice, red squirrels, voles, and shrews. Moose, elk and mule deer are occasionally observed on Complex lands. Service uplands are important for forage and cover for these species during their life cycle.

Comprehensive inventories of mammal species have not been completed for all units in the Complex. Generally, the direct impacts of fire on wildlife include disturbance or infrequent mortality of individuals or groups of individuals, particularly slow moving and or sedentary species. The Complex's larger mammals (deer, coyote, fox) will generally move away from fire. However the availability of suitable adjacent habitat is important for local populations. This factor is particularly important in the WMD where Service units are small and surrounded by intensively farmed cropland. Extensive fall prescribed burning is generally not conducted in the WMD for this reason.

Fire in the mixed grass prairie has been shown to generally favor deer and other mammals (Coppock and Detling, Herman and Wright, and others). Information concerning the effects of fire on wildlife can be reviewed in The Effects of Fire in the Northern Great Plains, prepared by Higgins, Kruse, and Piehl. Additional fire ecology information on hundreds of species is available in the Fire Effects Information System. This is a computer data base maintained by the federal government and is accessible through the Internet and the FWS Fire Management Home Page. The address of the FWS Fire Management Home Page is (<http://fire.r9.fws.gov>).

Uncontrolled wildfires have a potential for negative impacts on wildlife. Conversely, prescribed fire under the correct prescription can be used as a tool to improve habitat. The Complex has specific documentation of managing habitat with prescribed fire since 1970 (station files), and has station narratives describing prescribed

fire as a management tool back into the 1940's.

K. Recreational Uses

This area of North Dakota is rural and sparsely populated. Outdoor recreation, especially hunting, is a common activity. Hunting is the most common recreational use of Service lands in the Complex. Most WPAs are open to public hunting as specified in the Code of Federal Regulations and in accordance with State law. J. Clark Salyer National Wildlife Refuge allows public hunting on nine Public Hunting Areas and on other portions of the refuge at times of the year when the use will not conflict with the primary purposes of the refuge.

Other outdoor activities allowed include hiking, photography, picnicking, fire wood cutting, bird watching and fishing. Refuge public use brochures are included as references for this document in Appendix I.

Recreational use and fire management can interact in several ways. Obviously the more recreational use the Complex receives, the greater the likelihood of human caused wildfire. Since the lands within the Complex fall under regulation by the State of North Dakota Rural Fire Suppression Plan, regulated by the North Dakota Fire Marshall's Office, some recreational activities may be eliminated or restricted when the fire danger rating in the area hits the very high to extreme categories. Appendix J contains a copy of the North Dakota plan titled "Procedures for Coordinating Rural Fire Suppression/Mitigation Measures".

Prescribed fire programs may also be limited by recreational use patterns. Typically, prescribed fire in upland wooded areas in the southern half of the Refuge are curtailed prior to the initiation of the fall deer hunting season, and during the spring turkey season. These are management decisions based upon public safety. It would be nearly impossible to check certain units to insure no hunters are caught inside the burn perimeter prior to burn execution. Other areas of the refuge must be carefully checked, roads and trails closed or other measures taken prior to a burn to insure recreational user safety is not compromised.

L. Improvements

Wildfire damage to improvements on and off the Service land is a primary concern. While Service owned developments can generally be protected from fire damage, dispersed improvements, particularly fences, dikes and dams, predator exclosure barriers and adjacent private property is likely to be damaged by wildland fires. 95 percent of the land surrounding the J. Clark Salyer Refuge is under private ownership. Private improvements in these areas are numerous and are valued in the tens of millions of dollars. Crop, grazing, and haylands can have private resource values in excess of \$400.00 per acre, with

thousands of acres in potential threat from wildfire originating on the Complex, especially during the late summer/early fall cured stage prior to harvest.

The majority of Complex structures are found at the headquarters area, but numerous small buildings, miles of fences and other improvements are located throughout the 5-county WMD. The dispersed nature of the WMD creates many situations where escaped prescribed fires or wildfires could damage adjacent private structures, equipment, and grazing/hay/cropland. Wildfire damage to other public property can occur to wooden utility poles and utility junction boxes which are located on or adjacent to Service lands. Private landowners generally have a low tolerance for wildfire, but the use of prescribed fire is fairly well accepted as a habitat management tool in most areas of the Complex. The Complex relies heavily on volunteer fire protection districts (RFD's) for suppression at remote WPA's, and also utilizes these resources to assist with wildland fire suppression on the Refuge. RFD's are relied upon to suppress structural fires on the Complex.

Table 4 contains a synopsis of the Complex's real property. This listing is a summary of real property lists for the Complex compiled by the Regional Realty Office in July of 1997, and is the most current list available. The complete real property list can be found in the files located at the J. Clark Salyer NWR Headquarters building.

TABLE 4
J. CLARK SALYER NWR COMPLEX REAL PROPERTY INVENTORY SUMMARY

PROPERTY DESCRIPTION:	# UNITS:	TOTAL VALUE: (\$)
Boat Launch Facilities	3	14,100
Bridges (wooden)	5	266,700
Bunkhouse (seasonal housing)	1	150,000
Dams	21	5,634,900
Dikes	10	713,100
Fences (boundary)	298 MI	3,207,800
Fences (predator exclosure)	3	73,000
Fire Cache	1	110,000
Fuel Storage Facility	1	8,800
Garages (automobile)	6	226,700
Grain Bins	4	54,200
Headquarters Office (new)	1	564,000
Headquarters Office (old)	1	200,000
Headquarters Addition (1998)	1	135,000
Log Cabin	1	90,000
Observation Tower	1	20,000
Oil Shed	2	43,100
Public Restrooms - Outhouses	6	115,000
Radio Tower	1	26,900
Sewage Treatment Areas	11	167,000
Shop Buildings	2	553,100
Staff Residences	5	600,000
Storage Buildings	9	248,000
Stream Gaging Stations	2	20,700
Visitor Contact Stations	3	12,400
Water Control Structures	18	2,942,500
Water Plant	1	5,200
Weather Station (RAWS)	1	17,000
REAL PROPERTY TOTALS:	120	\$16,084,600.00

Real Property Totals: 120 improvements/298 miles of fence
\$16,084,600 TOTAL VALUE

M. Air Quality/Smoke Management

The management of smoke is incorporated into the planning of prescribed fires, and to the extent possible, in suppression of

wildfires. Sensitive areas are identified and precautions are taken to safeguard visitors and local residents. Smoke dispersal is a consideration in determining whether or not a prescribed burn is within prescription. Generally the fine grass fuels and small burn size (80-600 acres) generates low volumes of smoke for short durations (4-5 hours).

Fire management activities which result in the discharge of pollutants (smoke, carbon monoxide, particulates, and other pollutants from fires) are subject to and must comply with all applicable Federal, State, and local air pollution control requirements as specified by Section 118 of the Clean Air Act, as amended 1990.

The North Dakota State Department of Health, Environmental Health Section implements the requirements of the Clean Air Act. Permits for open burning are required under the authority of the North Dakota Air Pollution Control Rules (Article 33-15, North Dakota Administrative Code). Written requests are submitted by the Complex to the Department of Environmental Health for each planned prescribed burn. Requests must identify acres, location, approximate date and purpose of the burn. The State grants approval in letter form and also notifies local and district Environmental Health Practitioners. **Appendix K** contains a copy of the state of North Dakota Conditions/Restrictions Applicable to an Approval to Open Burn, and specific burn request forms to be submitted during the permit application process. Smoke complaints are also investigated by the State Department of Environmental Health. To date the State has received no complaints concerning smoke from prescribed fires or wildfires on Complex lands. Complex personnel also take special care to notify neighbors, fire departments, and local law enforcement agencies on burn day. These actions are specific requirements of individual burn plans, incorporated into the plan both in the planning document and with an attached phone contact listing.

Currently the State of North Dakota recognizes two categories of prescribed fire. Separate legislation addresses prescribed fire by state and federal land management agencies, and prescribed fire use by private citizens for agricultural burning. The stipulations for these two types of burning are quite different, with regulations almost non-existent in the private sector and quite stringent for governmental agencies. Efforts are currently underway to equalize this problem to enable all burn practitioners in the state to function under the same set of rules.

Due to the lack of smoke management regulations for private citizens, conflicts can arise pertaining to smoke complaints leveled against the Service but which are actually the result of private agricultural burning. Since we are mandated by the burn planning process to inform our neighbors when we are going to

conduct a prescribed burn, often these individuals will think all the smoke in their area is coming from our burn. Fire

management personnel at the Complex must be aware of this potential problem and document any probable conflict situations as they occur. The occurrence of other ongoing prescribed burns in the area and corresponding smoke trajectory and potential impacts should be documented by written text or photographs while the burn is ongoing. Fire weather and smoke management observations on Complex burns should be documented hourly while the burn is in progress. Fire management personnel should also work with their local RFD's, State and local Government Agencies, and area neighbors to insure a better understanding of smoke management policy and mitigation techniques.

Smoke from wildfires and prescribed fires is also a recognized health concern for firefighters. Prescribed burn bosses and wildfire incident commanders must plan to minimize exposure to heavy smoke by incorporating the recommendations outlined in the publication Health Hazards of Smoke (Sharkey 1997).

N. Complex Fire Environment and History

The Complex totals approximately 88,000 acres of fee title lands. Approximately 40% of this land, or 35,000 acres is comprised of a variety of seasonal and permanent wetlands. Most of these wetlands contain heavy fuel loadings of emergent vegetation including bulrush, cattail and other vegetation that when cured, will support a fire even over the top of the water. During dry years, many of these areas will completely dry up, burning with moderate to high fire behavior characteristics. Due to these factors, the total estimated burnable acreage for the Complex is 75,300 acres, or 85% of the total Complex acreage.

Fuel Types:

Fuel models found within the J. Clark Salyer NWR Complex are varied and include all four fuel groups (grass, shrub, timber and slash). Fuel modeling in wildland fire management has traditionally been accomplished using two fire behavior fuel model definition systems. The National Fire Danger Rating System (NFDRS) is comprised of 20 alphabetical models including A,L,S,C,T,N (grass models), B,O,F,Q,D (shrub models), H,R,U,P,E,G (timber models) and K,J,I (slash models). This modeling system is used in the NFDRS system to predict fire danger indices, and is also utilized in the FIREPRO (FIREBASE) system, the Service's computer based fire management budgetary system used to allocate wildland fire management resources. NFDRS fuel models are listed below for Complex lands.

A second system of wildland fire management fuel models has been developed for use in predicting fire behavior. This fuel model system is know as the Northern Forest Fire Laboratory or NFFL system. This fuel model system is also known as the FBO, or Fire Behavior Officer system. The NFFL or FBO system is used in running the BEHAVE computer program for estimating fire

behavior, and is the fuel model used in Service prescribed fire plans. The NFFL fuel model system contains 13 fuel models numbered from one to 13, and broken into the same four fuel groups as the NFDRS models.

NFFL fuel models are listed below concurrently with NFDRS models, and a listing of these models can be found in the National Wildfire Coordinating Group (NWCG) General Technical Report #INT-122, "Aids to Determining Fuel Models For Estimating Fire Behavior" (Anderson 1982). Page 18 of this publication also contains a comparison table showing NFDRS and NFFL fuel models and their relationships. A copy of this technical report has been included in **Appendix L**. Here is a breakdown of these groups, individual fuel models and their occurrence and characteristics on Complex lands.

NFDRS Fuel Model L (western annual/perennial grasslands; NFFL fuel model 1) Approximately 31,000 acres of the total burnable acres fit fuel model L. This model includes a variety of grasslands including savannas, cured cropland, stubble, short to medium height grasses and grass-shrub combinations. Perennial and annual grasses are the primary fuel, loadings are heavier than model A (annual grasses), and the fuel quantity is more stable from year to year. Decomposition rates of grass fuels are slow which leads to heavier than natural fuel loadings if fire is absent. Invading woody plants are mixed in the grasses throughout 30-50% of the units. This fuel model also fits some of the adjacent private lands including cured cropland, native prairie, grazed pastures and hayland. The 5-county WMD district also includes over 2,840,000 acres of cropland (1993 NRCS Data).

NFDRS Fuel Model N (tall grass; NFFL fuel model 3): Approximately 29,000 acres of the Complex fit fuel model N. Described as tall grass, perennial grasses, and or marshland grasses approximately 3 feet tall, one third of the aerial portion of the plant is usually dead. Invading woody plants are mixed with these fuels throughout 10-40% of many of the upland areas. Areas of the Complex fitting this fuel model include heavy tall grass vegetation found in seasonal basins, meadows, marshes (bullrush and cattail) and areas planted into dense nesting cover (DNC). This fuel model also fits adjacent private lands including some uncut hay fields, wetland basins and marsh vegetation, and areas enrolled in the Conservation Reserve Program (CRP). CRP is a major concern for fire suppression agencies in this area. CRP acres have risen in recent years, and currently total more than 354,000 in the 5-county WMD (Rolette County - 57,411, Renville County - 16,948, Pierce County - 63,797, Bottineau County - 96,560 and McHenry County - 120,061 {1993 NRCS data}).

NFDRS Fuel Model E/R (hardwood leaf litter; NFFL fuel model 8/9): Approximately 8,300 acres of the Complex fit this

fuel model. Much of the aspen stands and oak/mixed hardwood areas on the south end of the refuge are included in this model, along with riparian woodlands, wooded draws, and planted shelter belts. These areas usually are fairly fire resistant during the summer growing season (represented by NFFL model R and NFFL model 8), but can show explosive fire behavior including long distance spotting during the spring and fall months (NFDRS model E/NFFL model 9). Many of these areas are also in terrain that greatly limits access by fire equipment, and the combination of extreme fire behavior and inaccessibility often require indirect attack methods to be used.

NFDRS Fuel Model G (timber and litter with heavy dead and downed fuels present; NFFL fuel model 10): 4,000 acres of the Complex fit this model and are composed of overmature aspen stands and areas of riparian gallery forest (Dutch Elm Disease) with high to extreme loadings of dead and downed fuels in the 100 and 1000 hour size category. This model is found only in the south end of the Refuge and is intermixed with fuel model E areas. Suppression of this model is difficult and requires an indirect attack under most circumstances.

NFDRS Fuel Model F (intermediate brush, NFFL fuel models 5 and 6): The Complex contains approximately 2,350 acres of brushlands that fit these fuel models. Fuels include stands of young aspen, mixed hardwood brush, snowberry, and willow encroachment areas found in former meadows and along riparian zones. Fuel model F (NFFL model 6) is represented by areas of willow encroachment and snowberry due to the flammable characteristics of this fuel. NFFL fuel model 5 best fits the remainder of this shrub type, including the young aspen and mixed hardwood brush areas. There is no NFDRS fuel model that corresponds directly to NFFL model 5, but NFDRS models F can be used as a second choice.

Fire Behavior

Fire behavior runs have been completed for each NFFL fuel model on the Complex with the IBM PC based BEHAVE fire behavior prediction system. A variety of other non-standard fire prediction runs have also been completed for the Complex including dual fuel model runs (1 & 9) and a custom fuel model to address areas of overmature aspen/shrubland/grassland mix on the south end of the Refuge (custom NFFL fuel model 14). These BEHAVE runs are included in **Appendix M**.

NFDRS Fuel Model L/NFFL Fuel Model 1: (shortgrass)
Represented by native prairie, tame grass and cropland in the Complex, fire spread is governed by the fine, very porous and continuous herbaceous fuels that have cured or

are nearly cured. Fires are surface fires that move rapidly through the cured and nearly cured material. Fuel loading consists of mostly fine dead fuels in the 1 hour size category, but average 1.5-2 tons per acre. Fuel bed depth can reach a foot or greater, especially in areas that have not been burned in 10 or more years. Annual and perennial grasses are included, with very little shrub or timber present.

Fire behavior is directly related to the fine fuel moisture and wind speed. Spread rates with moderate to high wind speeds can reach 345 chains per hour (379.5 feet per minute), with flame lengths exceeding eight feet. Spot fires are generally not produced because fuels are consumed too quickly and thoroughly, although slopovers, organic soil combustion or fire whirls can cause control problems. Fire fronts tend to become irregular as topography, fuel loads, winds, and/or natural barriers speed up or slow movements. Resistance to control is low to moderate, depending on windspeed. Wildfire under high wind conditions often require indirect attack methods utilizing natural or human made barriers due to the intense rates of spread.

NFDRS Fuel Model N/NFFL Fuel Model 3: (tallgrass) This model displays the most intense fire behavior characteristics of the grass group, and is found as cattail/bullrush marshes and seasonal wetlands, DNC plantings, and CRP lands throughout the district. Indices include rates of spread under the influence of wind in excess of 530 chains per hour (583 feet per minute). Wind may drive fire into the upper heights of the grass and across standing water. Fuel loading consists of fine and coarse dead fuels, averaging 3 tons per acre, but can be in excess of 10 tons per acres in cattail areas. Flame lengths can exceed 28 feet, and fireline intensity can reach over 8,000 BTU/FT/S, higher than most timber and slash fuel models. Short range spotting (up to 500 feet) is common. Resistance to control is very high to extreme. Suppression response to wind driven fires in this fuel model will generally be limited to indirect attack methods.

Typically, wetland areas covered with fuel model 3 vegetation are not a significant fire factor during the spring high water period or during the growing season. During drought years or late in the season after the seasonal wetlands have dried, fire control difficulty in these zones can become both difficult and dangerous.

NFDRS Fuel Model E/NFFL Fuel Model 9: (hardwood litter). This model is typified by mature aspen and mixed hardwood stands and tree plantings in the Complex, and displays moderate to low fire intensity. Fires are carried by dead,

loosely compacted leaves. Concentrations of dead downed woody material will contribute to more intense burning as well as moderate spotting. Fuels consist of mostly 1 hour size class comprising 2.9 tons per acre with a small amount of 10 and 100 hour fuels averaging 0.6 tons per acre. Spring and fall fires in this fuel model when crown cover is absent and leaves have fallen may exhibit higher rates of spread due to spotting caused by rolling and blowing leaves. Spread rates are generally slow, less than 60 chains per hour (66 feet per minute - wind driven). Flame lengths average 2-4 feet, but can reach up to seven feet under extreme conditions. Concentrations of dead and downed woody material can contribute to possible individual tree torching and spotting. Resistance to control is low to moderate except during drought conditions.

NFDRS Fuel Model R/NFFL Fuel Model 8: (hardwood litter - summer) This model generally exhibits slow burning ground fires with low flame lengths, although occasional heavy fuel areas can cause short term flare-ups. Typical fuels in this model found in the Complex are young to mature aspen and mixed hardwood forest stands after the trees have leafed out, shading the surface fuels. Fuels are composed of compacted litter layers and may have a fuel bed up to three inches thick. Little undergrowth is found in these stands, and fuel loadings average five tons per acre. This fuel model generally offers little difficulty of control unless severe weather conditions including high temperatures, low humidities and high winds are present.

NFDRS Fuel Model G/NFFL Fuel Model 10: (timber and litter with heavy downed fuel present) Represented by overmature aspen stands in the Complex with high loadings of 100 and 1000 hour fuels, fires in this model burn with greater intensity than other timber-litter models. Dead and downed fuels include seven or more tons per acre of three inch or larger diameter limbwood and fallen trunks from over maturity, previous fire kill, or high wind events. Crowning out, torching and spotting is common, creating potential fire control difficulties. Under high winds and low fuel moisture conditions, rates of spread can exceed 30 chains per hour (33 feet per minute), flame lengths can exceed nine feet, and fireline intensities can exceed 730 BTU/FT/S, well above the limits for control by direct attack.

NFDRS Fuel Model F/NFFL Fuel Models 5 and 6: Fuel model 6 is represented by western snowberry and willow in the Complex and fuel model 5 by mixed hardwood brush and young aspen stands/regeneration. Fire can be carried by the surface fuels only (#5) or by the surface fuels and shrub layer where the vegetation is more flammable (#6). Fuel model #5 is characterized by low intensity fire as surface

fuel loads are light, shrubs are young with little dead material, and the composition of the living foliage is not volatile. Fuel model #6 contains greater loadings of 10 and 100 hour dead fuels and has more volatile vegetative characteristics. Combustion of the shrub layer usually required greater windspeeds, with fire dropping back to the surface when the winds diminish. Wind driven fire in fuel model 6 can reach rates of spread of 130+ chains per hour (143 feet per minute), flame lengths in excess of 11 feet and fireline intensities of over 1,000 BTU/FT/S, rendering direct attack impossible.

Fire Occurrence/History

A search of fire history contained within the Occurrence System of the Service's Fire Management Information System from 1985 to the present shows a total of 51 wildfires within the Complex for an average of 3.6 per year. The majority of the wildfires were human caused (vehicles, arson, and negligence). In recent years the highest occurrence has been attributable to escaped agricultural burning adjacent to the refuge by private residents, with equipment malfunction and roadside burning a close second.

Historic records describe huge prairie fires started by lightning or humans (Pyne, 1982). Fires burned millions of acres as there were few natural fuel breaks and no suppression. Wright, etal. (1978) believe that fire frequency in the prairie grasslands is on the order of 5-10 years. Other studies indicate that a longer frequency of 10-20 years may be more accurate (T. Bragg 1995). Local data exists for the Complex back to the early 1970's. However, this data does not indicate historic fire occurrence or frequency due to the heavy agricultural utilization and fragmentation of the area since European settlement.

Wildland fire has been an integral part of the prairie ecosystem for thousands of years, removing dead vegetation, releasing nutrients, and suppressing woody plants. Pyne (1982) states that since human influence began shortly after the Wisconsin glaciation of 10,000 to 12,000 years ago, this area has been perpetuated in the mixed grass prairie primary successional stage, and Anthropogenic fire played a major role in this long term vegetative structuring.

Estimates of fire cause in the pre-settlement northern great plains based upon available vegetative history and early encounters of Europeans conclude that as much as 85% of the fire occurrence was anthropogenic, with the remaining 15% of fires started by lightning (Hough 1926; Sauer 1963; Journal of American History 1990; Pyne 1982). Anthropogenic fire starts concentrated on the period from March through June and July through December, with maximum use occurring in April and October (Pyne 1982). Anthropogenic fire also reduced the number and size of lightning ignitions due to the increase of fire

barriers (recently burned areas) and reduction of fuels.

Fire records of the Complex exist from 1970 to the present, however detailed information is lacking. Past records indicate that the area usually has a high number of annual wildfires. Beginning in the mid-1980's, more complete records of wildfire occurrence were kept for the Complex. Many fires occur annually on the Complex that are either extinguished by local rural fire departments (RFD's), or are natural outs. We are confident that many more unreported wildfires have occurred on Complex lands than are included in the FMIS fire occurrence database.

Most agricultural field burning occurs during the spring and fall. Private landowners are not subject to the same burning regulations as government agencies. Farm fields are often ignited and left unattended, sometimes resulting in wildfires. Eight of the fires on record (18%) were not controlled during the first burning period. Many of the wildfires were suppressed either with the help of the RFD's or solely by them.

1985	3	22.0
1986	4	103.0
1987	2	240.0
1988	4	39.0
1989	5	389.3
1990	3	320.0
1991	3	305.6
1992	7	2,916.0
1993	0	0.0
1994	3	1,720.6
1995	2	2.0
1996	4	48.5
1997	4	2,970.1
1998	7	66.2
TOTAL 1985-1998 **	51	9,141.9

**** 14 YEAR AVE. 3.6 fires/year 652.9 acres/year
AVERAGE ACRES PER FIRE = 179.2**

Appendix N contains a detailed copy of all fire occurrence on the J. Clark Salyer Complex from 1985 through 1998.

The Complex has mutual aid agreements with several local RFD's. These agreements require the specific RFD's to respond to and assist in the suppression of fires on Service lands, and also require our assistance to the RFD's on lands adjacent to the refuge. To accurately gauge wildfire potential within this area, it is also necessary to review the occurrence records for wildland fires on lands adjacent to the Complex.

The following tables summarize wildfire statistics for the period 1992 through 1997 for the five counties included in the Complex. These records were obtained from the North Dakota State Fire Marshall's Office, and only include the fires that have been reported by local RFD's. The North Dakota Fire Marshall's Office and the North Dakota Division of Forestry readily admit that reporting of wildland fires in the state is poor, and that the majority of fires are never reported to their office (M. Sand, ND State FMO, 1998). From 1992 through 1997 there were a total of 217 wildland fires reported in the 5-county area. Of this total, 93, or 43% of these fires were caused by "inadequate control of open fires", specifically escaped agricultural burns on private property. Only four of these fires, or 2%, were attributed to lightning. **Table 6** lists these fires by ignition factor. **Appendix O** contains a complete copy of fire occurrence reports for the 5-county area surrounding the Complex.

TABLE 6 Wildfire Occurrence for 4 County Area; Bottineau, McHenry, Renville and Rolette counties, North Dakota. Pierce County does not report fire activity to the State Fire Marshall.					
Year:	# Fires:	Total Acres:	Largest Fire:	Date Span:	Total \$ Loss:
1992	34	2,635	2,100	5/6-10/29	18,025
1993*	19	1,047	600	4/3-10/23	575
1994	37	168	80	4/10-10/29	8,210
1995**	25	303	60	4/11-10/31	445
1996	29	356	160	4/26-11/2	2,550
1997	75	5,388	3,000	3/29-12/26	24,935
TOTALS:	217	9,897		3/29-12/26	54,740

Average # fires per year = 36
 Average Fire Size = 45.6 acres
 Average Dollar Loss per Year = \$9123
 * = only three counties reported
 ** = only two counties reported

Statistical analysis of wildfire cause on lands adjacent to the Complex can be useful in developing fire prevention programs and discerning fire management program needs. **Table 7** evaluates fire statistics by cause on lands adjoining the Complex during the period from 1992 through 1997.

TABLE 7 Wildfire Cause by Ignition Factor for the 4 County Area; Bottineau, McHenry, Renville and Rolette Counties, ND		
Ignition Factor:	Number of Starts:	Percent of Total Fires
Incendiary	3	1.4%
Suspicious - Unknown	1	0.5%
Smoking Materials	3	1.4%
Children	4	1.8%
Inadequate Control of Open Fire (AG. Burning)	93	42.9%
Electrical	2	0.9%
Catalytic Converters	2	0.9%
Fireworks	4	1.8%
Sparks	23	10.6%
Rekindle	4	1.8%
Lightning	4	1.8%
Spontaneous Combustion	2	0.9%
Other	10	4.6%
Unknown	62	28.7%

Examining fire occurrence date trends within counties included in the Complex can be useful in determining staffing requirements at various times of the year. **Table 8** provides this information for the period from 1992 through 1997.

TABLE 8
1992-1997 Fire Distribution by Month for Bottineau, McHenry, Renville and Rolette Counties, North Dakota.

	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec
% of Fires by Period	0.5%	18.9%	26.7%	15.2%	37.8%	0.9%
Total Fires by Period	1	41	58	33	82	2

IV. FIRE MANAGEMENT GOALS AND OBJECTIVES

The following considerations influenced the development of the Complex fire management goals and objectives. The previous sections of this plan have established that:

1. Fire was integral in shaping the native biotic communities within the Complex.
2. The absence of fire over the past 100 years has altered the natural landscape. Fire must be reintroduced on a landscape scale to rejuvenate native plant communities and associated animal species.
3. Positive or negative effects of prescribed fire on vegetation, wildlife, and cultural resources depend on burning conditions and plant phenology.
4. Uncontrolled wildland fire has the potential for negative impacts on and off Complex lands.
5. Rapid rates of fire spread, potentially long response times, and the large number of individual land units (WPA's) pose suppression problems and increase the likelihood of wildfire escape onto adjacent private lands.
6. Use of appropriate management responses that minimize environmental damage from suppression efforts is important throughout the Complex.

A. Complex Fire Management Goals

1. Protect life, property, and other resources from wildfire.
2. Use prescribed fire as a tool to accomplish habitat management objectives.
3. Maintain a wildland fire management program that is professional in nature and utilizes available resources both economically and efficiently.

B. Complex Fire Management Objectives

1. Safely suppress all wildland fires using appropriate management responses based on safety considerations, Complex objectives and values at risk.
2. Minimize the impact and cost of fire suppression activities through the professional use of preparedness processes.
3. Use prescribed fire for hazardous fuel reduction to the

fullest extent possible within or near Complex development zones, wildfire sensitive resources, and boundary areas to reduce the risk from wildfire damage.

4. Restore fire to the Complex on a landscape scale through the use of prudent prescribed fire to restore and perpetuate native species and communities.

5. Maintain a diversity of healthy plant communities at various successional stages to provide suitable habitat for all grassland species through the use of prescribed fire.

6. Utilize prescribed fire to suppress and control exotic invader species such as leafy spurge, smooth brome and Kentucky bluegrass.

7. Utilize prescribed fire to control woody plant invasion within the Complex

8. Educate the public regarding the role of prescribed fire within the Complex.

9. Work with adjacent landowners and cooperators to increase the use of prescribed fire in the public and private sectors within the Complex's sphere of influence and to foster increased understanding and cooperation between all entities involved in wildland fire activities.

10. Provide wildland fire management support to other agencies to the extent possible within the interagency fire management support network.

V. FIRE MANAGEMENT STRATEGIES

A. General:

The Complex's wildland fire management program is based on the Departmental Manual, (620 DM 1-2), the Service Manual 621 FW1-3, and the Service's Fire Management Handbook. Every wildfire on or threatening refuge lands will be suppressed by using an appropriate management response. A wildland fire situation analysis (WFSA) will be prepared to govern suppression actions for all escaped fires when it is determined that initial attack efforts will be unsuccessful. **Figure 8** provides a decision flow chart that will be employed by management to assist with fire decision making on the Complex.

Fire management strategies will be based upon "appropriate management response". The definition of "appropriate management response" is "specific actions taken in response to a wildland fire to implement protection and fire use objectives." The Complex will utilize this appropriate management response strategy incorporating all pertinent aspects of this fire management plan to establish individual suppression guidelines for each wildland fire occurrence on Complex lands. Suppression actions may vary from high intensity direct attack efforts to lower intensity indirect attack efforts, including monitoring and surveillance to ensure confinement within a designated area utilizing natural and human made barriers when appropriate. The level of response will be consistent with land use objectives, and will be executed to minimize suppression costs and resource damage. The Incident Commander will consider all factors when formulating a suppression response. **Table 9** is meant to show a range of options available to the Incident Commander.

The safety of firefighters and the public is the first priority. Persons engaged in fire suppression activities are exposed to a high element of risk. The Refuge Manager and fireline supervisors must make every effort to reduce the exposure to risk and enhance performance. One way is through formal and on-the-job training and improved physical fitness. The Service has adopted the training and fitness standards established in 310-1, and all firefighters must meet these and other standards established by the Service to participate in fire management activities.

Only trained and qualified people will be assigned to fire management duties. The Complex will adhere to qualification requirements listed in PMS 310-1, the NWCG Wildland Fire Qualifications Guide, and those agency specific qualifications guidelines outlined in the Service's Fire Management Handbook, the Departmental Manual (620 DM 1-2), and the Refuge Manual Part 621 FW1-3. All fire management personnel will be issued required personal protective equipment (PPE) and will be trained in its proper use. All staff members utilized in wildland fire operations are required to pass a physical fitness test and will

attend a Standards For Survival refresher course each year.

Table 9: Appropriate Management Response

SITUATION	STRATEGY	TACTIC
1. Wildland fire on Refuge lands which does not threaten life, natural or cultural resources or property values.	Restrict the fire within defined boundaries established either prior to the fire or during the fire.	1. Holding at natural and man-made barriers. 2. Burning out. 3. Observe and patrol.

<ol style="list-style-type: none"> 1. Wildland fire on Service property with low values to be protected. 2. Wildfire burning on to Service lands. 3. Escaped prescribed fire entering another unit to be burned. 	<p>Take suppression action, as needed, which can reasonably be expected to check the spread of the fire under prevailing conditions.</p>	<ol style="list-style-type: none"> 1. Direct and indirect line construction. 2. Use of natural and man-made barriers. 3. Burning out 4. Patrol and mop-up of fire perimeter.
<ol style="list-style-type: none"> 1. Wildland fire that threaten life, property or sensitive resources. 2. Wildland fire on Service property with high values to be protected. 3. Observed and/or forecasted extreme fire behavior. 	<p>Aggressively suppress the fire using direct or indirect attack methods, holding the fire to the fewest acres burned as possible.</p>	<ol style="list-style-type: none"> 1. Direct and indirect line construction 2. Engine and water use. 3. Aerial retardant 4. Burn out and back fire. 5. Mop-up all or part of the fire area.

B. Specific Fire Management Strategies:

The following will be employed to meet fire management objectives.

1. Suppress all wildfires in a safe and cost effective manner consistent with resources and values at risk utilizing appropriate management response. Minimum impact strategies and tactics will be used when possible.
2. Conduct all wildland fire management programs in a manner consistent with applicable laws, policies and regulations.
3. Cooperative fire agreements (MOU's) with state, federal and local fire agencies will be maintained to provide for cooperative suppression actions and ensure reimbursement is appropriately made. The Complex will provide assistance to local or federal cooperators under the "closest resources" and "total mobility" principles in accordance with Service policy.
4. Initial attack (IA) on lands within the Complex will be the primary responsibility of Complex fire management resources. Rural fire departments (RFD's) will be used to supplement Complex IA resources when necessary. Mutual Aid Agreements (MOU'S) with local RFD's to support IA actions

on Service lands will be reviewed on a yearly basis and renewed as needed.

5. MOU's with local RFD's will also be used to establish structural fire suppression capabilities in areas of the Complex where significant structural improvements are present. Complex wildland fire suppression resources do not have the training or equipment to safely suppress structural fires. Complex resources can be used to protect structural improvements from wildland fire, for external suppression efforts where deemed safe and consistent with personnel training and qualifications, and can be used to support RFD structural suppression resources where feasible, but Complex wildland fire resources will not be utilized in any internal structural fire suppression operations.

6. Due to the wide-spread land holdings within the WMD (5 counties, 126 units), RFD's will be utilized for initial attack on wildfires in remote areas. Complex initial attack equipment and personnel will be dispatched to all reported wildfires within the WMD, and will assume responsibility of the incident upon their arrival. Wildfires escaping onto state or private lands will be managed under a unified command system with local fire management agencies. Unified command structure will be fire specific and will be established onsite based upon resources available and fire situation.

7. Prescribed fire will be utilized as a management tool for achieving hazard fuel and resource management objectives. To the greatest extent possible, hazard fuel prescribed fires will be used only when they can compliment resource management objectives.

8. Cost effective fire monitoring will be initiated to provide a mechanism for managers to determine if objectives are being met. Monitoring programs will be coordinated between the fire management staff, refuge manager and staff biologist. Monitoring programs will include both short and long term processes, and will incorporate all previously available fire ecology information.

C. Limits

1. Smoke management will be carefully considered for all prescribed burns and will be addressed in all prescribed burn plans.
2. All fires occurring on the Refuge will be staffed or monitored until declared out.
3. Prescribed burning in areas where threatened, endangered, and candidate species exist will not be conducted if the prescribed fire will be detrimental to the species or any adverse impacts cannot be mitigated, Section 7 clearance

will be secured, as appropriate.

4. Heavy equipment (dozers, discs, plows, and graders) will not be used for fire suppression except in life or property threatening situations without the express approval of the Project Leader, Refuge Manager, or their designated representative.
5. The use of prescribed fire to achieve management objectives must be conducted in a cost effective manner.
6. Aerial Retardants and foams will not be used within 300 feet of any waterway as described in the Guidelines for Aerial Delivery of Retardant or Foam near Waterways.

D. Impacts of Fire Management Activities

Surrounding areas are a mix of cultivated crop land, grazed pasture, hay land, occupied and abandoned farmsteads, oil and gas production facilities and extensive areas of Conservation Reserve Program (CRP) lands. The effects of fire management activities on neighboring land owners are primarily attributable to wildfires and prescribed fires moving off of service lands and onto private land.

Cropland - Values at risk change seasonally based upon crop rotations. Typically early spring (March-early May) crop land is either stubble or tilled black. Tilled black ground will not support a fire. Crop stubble will burn but there is no economic loss to the land owner. During the active growing season for a particular crop the vegetation will not support a fire. However heat from fuels in fence rows and adjacent service lands could damage crops and reduce the yield to the landowner. Mature ripe standing crop and wind rowed crops would support fire spread. Fires moving off of service lands at this time would have an adverse economic impact to the landowner. Fires burning in this cured out vegetation would burn very rapidly.

Grazed Pasture - Values at risk include loss of forage, damage to fencing, and in extreme cases loss of livestock. Depending upon the level of grazing and how much green up there is fire spread can be rapid or slow. The ability of hay land to support fire spread will vary from pasture to pasture and season to season.

Hay Land - During the dormant season (early spring and late fall) these fields would support fire spread. Losses would be a reduction in that years hay production. An additional value at risk is stockpiles of harvested hay. In some cases these stockpiles may represent 2 or 3 years of production.

Buildings - Throughout the area occupied and abandoned farmsteads as well as churches and rural home sites are near by or adjacent to service lands. While the

urbanization of rural areas is not as wide spread or as intense as in some states, it is occurring. Losses to these dwellings and community buildings are the greatest values at risk.

Oil and Gas Facilities - Standard practices for oil and gas development and production facilities are to maintain a vegetation/fuel free area around the site. This has two functions; reduce clutter and allow ready access to the facilities, and reduce the threat of wildland fire from harming the facilities as well reduce the risk of a facilities fire from spreading to surrounding wildland fuels. These oil and gas facilities are on service lands and on lands adjacent to service lands.

CRP - Due to the management of these areas high fuel loadings are the norm. These areas are capable of supporting fire with rapid rates of spread and due to the amount of fuel they are difficult to extinguish. Values at risk are limited do to the non-production status of lands enrolled in this program. It should be noted that in some instances CRP can be an unbroken cover (fuel) for a number of miles leading the potential of wind driven fire runs several miles long.

E. Impacts of Neighbors Fire Management Activities on Service Lands.

Many of our neighbors practice active fire management by burning, crop stubble, road and drainage ditches, and CRP lands as a renovation practice. Traditional management of the stubble and CRP burns itsto disk a line 30-100 feet wide around the field to be burned. This greatly reduces the chance that a burn can escape onto neighboring land. Road and drainage ditch burns often do not have a good bare earth line around them. In addition they are often ignited with out consideration to smoke management, and many times go untended. These untended ditch fires are a significant threat to service lands and public safety.

VI. FIRE MANAGEMENT UNITS

The Complex will be broken up into two types of units; wildfire management units and prescribed fire management units.

A. Wildfire Management Units:

Consistent with FWS policy all wildland fires will be suppressed utilizing an appropriate management response. This response may vary including direct attack, indirect attack or monitoring and surveillance.

The Complex is divided into three wildfire management units based upon fuel type, topography, accessibility of fire management resources, and average response time. These three units are 1) the North Refuge Unit, 2) the South Refuge Unit, and 3) the WMD Unit. **Figure 9** provides a map outline of the Complex's wildfire management units.

All Complex fire management resources are located at the headquarters found in the North Refuge Unit. These resources will be dispatched to each unit as necessary for preparedness and initial attack actions.

1. North Refuge Unit:

The North Refuge Unit includes all areas of the Refuge from the Upham-Willow City Road north to the Canadian border. This area is predominantly located within Bottineau County, with a small section on the extreme south end located in McHenry County. The north unit includes the Complex headquarters and is characterized primarily by fuel models 1 and 3. The unit consists of the progression of impounded marshes along the Souris River and a buffer strip of upland grassland habitat between 1/4 and one mile wide on the east and west sides of the river. Initial attack response in this unit will primarily be conducted by Complex fire management staff and equipment, although some areas of the unit, particularly the northern most sections, may receive IA response from local RFD's due to excessive response time of Complex resources.

The North Refuge Unit is quite fragmented by private property, cropland and section line roads. There are numerous natural and human made barriers that assist in suppression actions including cropland, roads, heavily grazed pasture, hayland, and the Souris River system. Due to the close proximity to private property, values at risk along the border of the unit are many. The potential for wildfire to move on or off refuge lands in this unit is great due to the elongated and narrow nature of the unit. IA response in this area will include both direct and indirect attack dependant upon weather and fuel conditions, topography, management objectives and values at risk.

Monitoring or surveillance may also be used in some areas of this unit, but these are few and far between and would consist almost entirely of fire in marsh areas that are inaccessible to suppression forces and are separated from upland areas by open water or mud flats.

2. South Refuge Unit:

The South Refuge Unit consists of all lands within the Refuge from the Upham-Willow City Road south to County Road 17. This unit is completely within McHenry County and contains the sandhills and extensive areas of aspen and mixed hardwood forest. Typical fuel models include 1, 3, 5, 6, 8, 9, and 10, with 1, 6, 9, and 10 being dominant.

This area poses significant wildfire control problems and heightened holding needs during prescribed burning. Access by fire equipment is extremely limited. The unit harbors the areas of greatest elevation change on the Complex, with sand hills and ridges exhibiting slopes in excess of 70%. There are few trails through the area, limiting access by fire equipment, and fuel loadings are high to extreme in much of the unit with heavy 100 and 1000 hour fuel loadings due to heavy stands of overmature or previously fire killed aspen. There are numerous improvements inside the unit including wooden bridges and visitor use facilities, and protection of these improvements would be difficult and possibly unsafe for suppression forces. Past fire history has shown this unit to harbor significant areas of extreme fire behavior potential including crowning and long distance spotting.

Typical initial attack strategies in this unit involve direct attack under low to moderate fire behavior conditions, and indirect attack under higher fire danger indices. Indirect attack will significantly increase the average size of fires in this unit as often the closest natural or human made barriers that will support significant holding success are along the refuge border to the south, east and west, or along the Souris River running through the center of the unit. Monitoring or surveillance may be a management option in this unit under very low fire behavior conditions with similar long term predicted conditions only.

Initial attack in this unit will primarily be supplied by Complex fire staff, but support will often be needed from local RFD cooperators and other agency personnel. Past wildfire suppression operations in this unit have required significant assistance from other agencies with fires often escaping initial attack. Fires of 1,000 to 3,000 acres are common in this unit.

3. Wetland Management District Unit:

This unit incorporates a total of 126 Waterfowl Production Areas (WPA's) scattered throughout 5 counties and totaling over 29,000 acres of fee title lands. Due to the fragmented nature of this unit and the excessive response time to many of the individual WPA's, initial attack response in this unit is primarily supplied by local RFD units.

Risk of wildfires or prescribed fires escaping from refuge lands in the WMD is moderate to high. Farming, grazing and wetlands create barriers to fire spread in some areas. Access for light and medium engines is fair considering slope, wetlands, rocks, and limited access roads or trails. The rugged nature of the topography requires specific "local" knowledge of access routes for fire suppression actions throughout refuge and adjacent lands. Many of the boundary lines for refuge units are conducive to fire spread onto private land due to topography.

Fuel models vary widely throughout the unit, with the majority of lands coming under fuel models 1 and 3. Suppression strategies, management restrictions, fuels, fire environments, and values at risk are similar throughout the WMD Unit. Complex resources will be dispatched to any fire reported on or threatening WMD lands, although often wildfires are extinguished by local RFD's in this unit before we are notified that a fire exists.

Initial attack strategies in this unit will predominantly be direct and indirect attack. These areas are typically small, isolated units surrounded by section line roads, cropland, grazed pasture and haylands. Fire would benefit most of these areas, and indirect attack along the unit borders may be the preferred method of control. In areas of high public scrutiny or with high adjacent values at risk, a direct attack would be preferred. Monitoring or surveillance is a limited option in this unit due to surrounding private property, but isolated areas surrounded by water or marsh areas sealed off from uplands by open water or mud flats may be conducive to this management strategy.

The Turtle Mountain area of the WMD Unit poses one of the most potentially significant wildfire threats on the Complex due to the poor access, steep terrain, heavy fuel loadings and intense urban interface. A stand replacing fire swept through the entire Turtle Mountain area in the late 1800's, sparing only one small island in the center of Lake Metigoshe. The right conditions could prompt a similar incident in the future. Initial attack strategies in the Turtle Mountains area may include both direct and indirect attack. Monitoring and surveillance is not an

option in this area.

FIGURE 9 WILDFIRE MGMT UNITS MAP

B. Prescribed Fire Management Units:

The Complex has been separated into two main zones for prescribed fire purposes based upon current management. Zones are separated into lands administered by the J. Clark Salyer National Wildlife Refuge (JCS-NWR), and those administered by the J. Clark Salyer Wetland Management District (JCS-WMD). Management units have been further delineated within each zone by location.

1. J. Clark Salyer NWR Zone:

The refuge has been broken up into 6 management units including the Sandhills unit, Pool 320 unit, Pool 326 unit, Pool 332 unit, Pool 341 unit and Pool 357 unit. Much of the upland burnable acreage in these management units has been divided into individual burn units, but significant acreage still exists that will be identified and broken into burn units within the next few years.

Currently the refuge has a total of 62 individual burn units identified totaling 24,865 acres. Prescribed burn plans have been completed for most of these units to date, with work ongoing on the remainder. One goal of the fire management program is to have all possible areas of the refuge that may be treated with prescribed fire identified and prescribed burn plans completed and approved within the next three years. Prescribed fire management units within the JCS-NWR Zone are listed below. **Figure 10** depicts the JCS-NWR zone and associated management and prescribed burn units.

FIGURE 10 RX BURN MANAGEMENT UNITS MAP

a) Sandhills Management Unit:

This management unit encompasses the south end of the refuge and includes the sandhills aspen/mixed hardwood forest, aspen prairie, and riparian gallery components. The Sandhills Management Unit includes 18 burn units totaling 10,012 acres. Individual prescribed burn units contained within the Sandhills Management Unit are listed in Table 10.

TABLE 10		
PRESCRIBED BURN UNITS OF THE SANDHILL MGMT. UNIT		
Map Ref. # (Figure-10)	Unit Name:	Total Acres:
1	Sandhills Tower Aspen/Grassland	2,000
2	East Atkinson	110
3	Atkinson Gravel Pit	140
4	Aspen Clear-cut North	72
5	Nelson Prairie	500
6	West Nelson/H-22N	160
7	G-52a,b	630
8	N. Schaefer/G-50b	140
9	G-51 West-9/2/93	425
10	G-50b	150
11	G-50	630
12	East Natwick	700
13	Natwick/G-43b	110
14	G-48,H-22c,d	640
15	G-47/East Thompson Well	660
16	Thompson Well/H-18a	95
17	G-51,52	2250
18	North Nelson Prairie Openings	600
TOTAL ACREAGE		10,012

b) Pool 320 Management Unit:

The Pool 320 Management Unit includes 12 prescribed burn units totaling 4,677 acres and located within the area adjacent to and including pool 320. These units include areas of emergent marsh vegetation and upland areas between the 320 pool and the refuge boundary. Individual prescribed burn units contained within the Pool 320 Management Unit are listed in Table 11.

TABLE 11		
PRESCRIBED BURN UNITS OF THE POOL 320 MANAGEMENT UNIT		
Map Ref. # (Figure-10)	Unit Name:	Total Acres:
19	G-44	330
20	G-39 a,c/D-23	475
21	Rubble Masonry Unit	600
22	South State 80	780
23	North State 80	40
24	Pool 320 Cemetery	41
25	Benson Unit Cattails	1035
26	Refuge Dikes	206
27	Swearson's Point	410
28	G-37	160
29	A-36	300
30	Sandhills Potholes	300
TOTAL ACREAGE		4,677

c) Pool 326 Management Unit:

The Pool 326 Management Unit includes 6 prescribed burn units totaling 1,486 acres and located within the area adjacent to and including pool 326. These units include areas of emergent marsh vegetation and upland areas between the 326 pool and the refuge boundary. Individual prescribed burn units contained within the Pool 326 Management Unit are listed in Table 12.

TABLE 12		
PRESCRIBED BURN UNITS OF THE POOL 326 MANAGEMENT UNIT		
Map Ref. # (Figure-10)	Unit Name:	Total Acres:
31	North Freeman Bridge/G-34,36	660
32	Headquarters Natives	59
33	Gideon Brandt Natives	160
34	G-33a/b DNC	519
35	Nesting Islands	48
36	Lattendress	40
TOTAL ACREAGE		1,486

d) Pool 332 Management Unit:

The Pool 332 Management Unit includes 6 prescribed burn units totaling 1,254 acres and located between the north and south boundaries of pool 332. These units include areas of emergent marsh vegetation and upland areas between the 332 pool and the refuge boundary. Individual prescribed burn units contained within the Pool 332 Management Unit are listed in Table 13.

TABLE 13		
PRESCRIBED BURN UNITS OF THE POOL 332 MANAGEMENT UNIT		
Map Ref. # (Figure-10)	Unit Name:	Total Acres:
37	Hanson DNC/Switchgrass/A-30/A29b	268
38	Deep River/Pool 332 Native Seedings	86
39	Pool 332 Public Hunting Area	120
40	Stone Creek Prairie	180
41	332 Cattails	300
42	South Faa's Corner	300

TOTAL ACREAGE	1,254
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E) Pool 341 Management Unit:

The Pool 341 Management Unit includes 10 prescribed burn units totaling 2,550 acres and located between the north and south boundaries of pool 341. These units include areas of emergent marsh vegetation and upland areas between the 341 pool and the refuge boundary. Individual prescribed burn units contained within the Pool 341 Management Unit are listed in Table 14.

TABLE 14		
PRESCRIBED BURN UNITS OF THE POOL 341 MANAGEMENT UNIT		
Map Ref. # (Figure-10)	Unit Name:	Total Acres:
43	Soo Line Cattails	220
44	South Newburg gravel prairie	250
45	South Grassland Trail	350
46	North Grassland Trail	1010
47	Souris WPA/FmHA	120
48	D-37,38	180
49	North Soo Line	80
50	South Shefflo Road	180
51	CCC Camp North	80
52	CCC Camp	80
TOTAL ACREAGE		2,550

f) Pool 357 Management Unit:

The Pool 357 Management Unit is the northernmost unit within the JCS-NWR and has its north perimeter along the Canadian border. This unit includes 10 prescribed burn units totaling 4,886 acres and is located between the north end of Pool 341 dike and the Canadian Border. These units include areas of emergent marsh vegetation and upland areas between the 357 pool and the refuge boundary. Individual prescribed burn units contained within the Pool 357 Management Unit are listed in Table 15.

TABLE 15		
PRESCRIBED BURN UNITS OF THE POOL 357 MANAGEMENT UNIT		
Map Ref. # (Figure-10)	Unit Name:	Total Acres:
53	Zeretske Site South	335
54	D-48	490
55	G-13	608
56	D-41,42	300
57	A-9/Golf Course	100
58	357 Dike East River	273
59	357 Oil Wells	80
60	G-2	1,000
61	G-1	1,600
62	Zeretske North	100
TOTAL ACREAGE		4,886

2. J. Clark Salyer WMD Zone:

The JCS-WMD Zone is divided into five management units for prescribed fire purposes. These management units are divided along county lines, with each of the five counties in the district comprising a separate management unit. There are a total of 126 Waterfowl Production Areas (WPA's) within the WMD, totaling 29,184 acres. Due to the small average size of these WPA's, normally a single plan will be written to cover prescribed burning an entire WPA. Fire managers can burn the entire WPA, or can subdivide the WPA into smaller units, burning a certain amount of acreage at a time per management discretion. Currently, plans have been written and approved for approximately 25% of the WPA's. Within the next three years, plans for the majority of WPA units should be completed. **Table 16** provides a breakdown of WPS's and acreage per county within the WMD.

TABLE 16		
WPA BREAKDOWN PER COUNTY WITHIN THE JCS-WMD		
COUNTY:	TOTAL NUMBER OF WPA's:	TOTAL ACRES:
Bottineau	16	3,516
McHenry	30	5,882
Pierce	49	13,855
Renville	4	311
Rolette	27	5,620
TOTALS:	126	29,184

Figures 3, 4, 5, 6 and 7 show maps of the individual WPA's located within each of the five counties covered by the WMD. **Appendix P** contains lists of the five JCS-WMD prescribed fire management units listing each WPA, acreage, prescribed burn priority, required burning period, and current burn plan status. This appendix will be updated yearly to maintain currency of this Fire Management plan.

VII. FIRE MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

A. Current Fire Management Organization:

Wildfire assignments are made on the basis of individual qualifications and position requirements. The Complex fire management organization is comprised of permanent and seasonal fire staff including the ND/SD Zone Fire Management Officer (Zone FMO), the Complex Fire Management Officer (FMO), The North Dakota Interagency Dispatch Center Lead Dispatcher (DISP), the Complex Fire Control Officer (FCO), and the seasonal fire crew. Other non-fire staff are also important members of the Complex fire organization including the Project Leader, Refuge Manager, WMD Manager, Refuge Manager Trainee, Biologist, Administrative Officer, WMD District Biotech, Maintenance Foreman, equipment operators, and other seasonal station employees. Table 17 details the present fire management staffing allotted to the Complex, and the ideal fire management staffing plan as determined by Complex management based upon present and anticipated fire management workloads and FireBase analysis runs.

The following pages describe the duties and responsibilities of Complex staff involved with fire management operations.

1. Zone Fire Management Officer:

The Zone FMO position for the North Dakota/South Dakota Zone is stationed at the J. Clark Salyer NWR headquarters. This position is tasked with fire management program oversight responsibility for all FWS stations within North and South Dakota. The ND/SD Zone FMO also performs as the manager of the North Dakota Interagency Dispatch Center (NDC) located at J. Clark Salyer NWR. The NDC is the only interagency dispatch center in North Dakota and has interagency fire dispatch and reporting responsibilities for 34 federal and state agencies within North Dakota. Although this is a field level Regional Office position, the individual also maintains close ties to the refuge and has a variety of station level responsibilities as listed below. This is a secondary firefighter position for fire retirement purposes.

- * Works with Complex staff to improve the competency, effectiveness and safety of field personnel involved in fire management activities.
- * Reviews prescribed burn plans and conducts Complex fire management programmatic reviews.
- * Reviews and approves Complex staff fire experience and qualifications records using established guidelines.
- * Provides technical guidance to Complex staff in prescribed burning and wildfire suppression and preparedness operations including FireBase budgetary procedures, fire management planning and other fire specific topics to enhance program safety and operational efficiency.

- * Supervises the NDC Dispatcher and manages the NDC. Coordinates dispatch procedures with station staff.
- * Assists with the coordination of resource distribution and use on the Complex including the JCS prescribed fire district. Insures proper fire management funding use. Provides guidance to station FMO and Complex staff for yearly fire management budget requests.
- * Manages operations of the North Dakota Interagency Fire Cache located at J. Clark Salyer NWR.
- * Acts as the Service representative to the North Dakota Interagency Fire Council, the Northern Rockies Coordinating Group, and other interagency wildland fire management working groups.

2. Zone Fire Dispatcher

The fire dispatcher position is a Zone position and has responsibilities both within the ND/SD fire management zone and within the J. Clark Salyer Complex. This position runs the daily operations of the NDC, and has oversight responsibilities for equipment and supply distribution and re-stocking from the NDC Interagency Fire Cache. This is a secondary firefighter position for fire retirement purposes. Duties of this position are listed below.

- * Directs dispatch of Complex personnel, equipment and supplies for initial and extended attack wildfire suppression operations on the Complex and incident support on adjoining lands covered under cooperative or MOU agreements. Assists fire managers by plotting reported fire location on maps, determining routes of access to the fire, and coordinating the supply of personnel, equipment and supplies as requested. Receives resource requests from incident commander and mobilizes, orders and dispatches resources as needed.
- * Develops, maintains and applies current staffing plans including dispatch plans, mobilization plans, step up plans, detailed areas maps and specific guides for dispatching personnel and logistical support.
- * Monitors Complex and state radio systems keeping a log of all radio traffic on station system and all pertinent traffic on the state system. Maintains radio contact with fire crews and other refuge personnel in the field
- * Maintains up to date Complex fire situation reports. Supplies situation reports to FMO and Refuge Staff as requested.
- * Assists in the management of NDC operations. Contacts state cooperators on daily and/or weekly basis to acquire recent fire situation statistics for all land management agencies in North Dakota and all

FWS stations in South Dakota. Compiles daily/weekly reports as needed summarizing fire situation statistics and submits reports in a timely manner to Billings Dispatch Center (ND statistics), Custer Dispatch Center (SD FWS Statistics) and the Northern Rockies Coordination Center (NRCC) through the FAMWEB National Fire Situation Reporting Internet hub. Maintains zone statistical information on both prescribed fire and wildfire activity and available resources. Compiles and maintains lists of resource availability and tracks movement of all fire North Dakota fire resources and FWS resources in South Dakota.

- * Initiates, completes and tracks all resource orders utilizing interagency fire management resource ordering system guidelines.

- * Inputs individual fire reports (DI-1202's) and other fire management reports for the Complex and zone as required, and tracks zone fire management training budgets. Procures needed fire management equipment and supplies per requests from the FMO and refuge staff. Maintains database of fire management equipment and supplies including fire cache inventories. Establishes and tracks expenditures to specific wildfire and prescribed fire accounts.

- * Establishes and maintains specific fire management agreements including cooperative agreements, memorandums of understanding, and specific agreements with vendors for fire support including food, lodging, transportation and others. Tracks costs associated with all agreements.

- * Takes daily fire weather readings both manually and by computer link to the Complex's remote automated weather station (RAWS). Maintains station weather log database. Accesses daily weather forecasts from the NWS, Weatherbrief and other Internet sources to produce the most accurate fire weather forecast available for the area. Insures station weather data is uploaded into the Weather Information Management System database (WIMS) periodically. Provides daily and special weather information narratives to Complex employees via the station radio system.

- * Serves on Complex, zone, regional and national fire assignments as requested, and may be dispatched off station for project fire assignments.

- * Performs as supervisory dispatcher during periods of high activity in the NDC, overseeing the work of support dispatchers detailed to assist NDC operations.

- * Coordinates flight schedules for helicopter and fixed-wing aircraft operations within the Complex and zone. Provides flight following for all aircraft used on the Complex and for any aircraft requesting assistance in the ND zone within reach of Complex radio communication systems. Maintains accurate logs

of flight following and initiates emergency procedures according to station and Service policy.

- * Assists in annual fire training including communications procedures, weather observations, initial attack reporting procedures and other fire management topics as assigned.
- * Maintains staff fire qualifications databases for all Complex staff within the FMIS qualification module. Assists with input of qualifications updates for other FWS stations in the ND/SD zone as requested. Maintains fire job qualification (red card) system for all FWS employees in the ND/SD zone. Prints and distributes red cards to all zone fire personnel on an annual basis.
- * Maintains Service fire occurrence records for all stations in the ND/SD zone. Issues fire numbers as needed.
- * Coordinates and provides logistical assistance in support of prescribed fire details and resource movements to promote increased prescribed burn production in the ND/SD Zone and within the FWS Region 6 area.
- * Assists Complex administrative staff in timekeeping and travel management for fire management staff.

3. Complex Fire Management Officer:

The Complex FMO is responsible for oversight of the Complex and prescribed fire district fire management operations. The prescribed fire district includes the JCS Complex, Upper Souris NWR, and the Audubon NWR complex. Complex fire staff have prescribed fire support responsibilities for these stations. The FMO works closely with the Zone FMO and Zone dispatcher in support of Complex and zone fire management operations. The FMO is supervised by the Refuge Manager. This is a secondary firefighter position for fire retirement purposes. Duties of the Complex FMO are listed below.

- * Responsible for fire management program oversight for the Complex, and prescribed fire management assistance in the JCS prescribed fire district.
- * Insures that Department, Service, and Regional fire management policies are maintained and followed.
- * Insures sufficient collateral duty firefighters meeting Service standards are available for initial attack.
- * Responsible for insuring the maintenance and readiness of Complex fire vehicles, equipment and supplies.
- * Supervises fire management activities on land

management units within the Complex.

* Responsible for oversight of Complex prescribed fire

program including the planning, preparation, and implementation of prescribed burns. Reviews all prescribed burn plans for the Complex. Serves as prescribed burn boss, proposes annual hazard fuel reduction and resource management prescribed fire projects, tracks budgets and spending on all prescribed fire accounts, and completes individual fire reports (DI-1202) and yearly fire accomplishment reports.

* Responsible for planning, coordinating, and directing Complex fire preparedness activities including:

- fire training
- physical fitness testing
- fire weather station operation
- fire cache and equipment inventories
- insures step up plan is followed
- coordinates with cooperating fire agencies
- prepares annual FireBase budget request, approves and tracks use of FireBase accounts.

* Provides supervision to the Complex FCO, establishes work priorities for the seasonal fire management staff based upon input from the project leader, refuge and district managers, staff biologist and zone FMO, and relates these priorities to the FCO. The FCO is responsible for running the daily operations of the seasonal fire crew

* Prepares Complex fire prevention plan, and coordinates fire prevention with other employees.

* Maintains liaison with Regional Fire Management Coordinator and Zone Fire Management Officer.

* Updates the Complex Fire Management Plan, maintains fire records, and reviews fire reports for accuracy.

* Assists Complex biologist in development and implementation of Complex fire monitoring program to determine if resource management prescribed fires accomplish objectives.

* Maintains liaison with the North Dakota Interagency Dispatch Center and Fire Cache located at the Complex headquarters.

4. Complex Fire Control Officer:

The Complex is currently staffed with a career-seasonal fire control officer (FCO). This position is responsible for daily supervision of the Complex temporary/seasonal fire crew, and interacts closely with all Complex staff in fire management and project work. This is a primary

firefighter position for fire retirement purposes. Duties of the FCO are listed below.

- * The FCO has daily supervisory responsibility of the Complex fire crew, plans and directs daily work assignments, sets work priorities based upon direction of FMO, refuge and district managers and staff biologist.
- * Provides training and guidance to seasonal fire staff. Ensures training and experience occurrences are made available to staff to provide upward mobility opportunities, developing professionalism of employees.
- * Responsible for maintenance of issued personal protective equipment and physical conditioning.
- * Must qualify annually on the fire management physical fitness Pack Test.
- * Maintains accurate records and documentation in support of fire management operations.
- * Knows and adheres to Service and interagency fire management policy. Instructs subordinates in these issues.
- * Operates station fire engines, water tenders, ATV's, firing devices, chainsaws, pumps, foam systems and other specialized fire equipment during wildfire and prescribed burning assignments safely and within Service and fire management standard operating procedures. Trains subordinates in the operation and maintenance of same.
- * Insures fire staff maintains fire equipment and personal fire gear in a fire ready condition at all times. Supervises the performance of weekly equipment checks for fire pumps, chainsaws, engines, foam systems, fire hand tools and other specialized fire equipment and supplies, and documents checks per station guidelines.
- * Supervises and instructs subordinates in the operation of tractors, mowers, discs, rakes and other implements in construction and maintenance of firebreaks for wildfire preparedness, prescribed fire and other refuge programs.
- * Provides assistance with biological monitoring, resource management and other refuge projects to enhance the productivity of refuge operations.

5. Complex Biologist:

- * Responsible for biological program management on the Complex including determining areas and correct timing for prescribed fire implementation. Works closely with the FMO to establish yearly prescribed

burn targets.

- * Provides technical guidance for all resource management activities on land management units within the Complex including the selection of objectives and tools to be used in achieving objectives (including prescribed fire).
- * Provides support of fire management line operations including wildfire suppression and prescribed burning as qualified.
- * Coordinates fire monitoring program to determine if resource management prescribed fires accomplish objectives. Establishes monitoring protocols and conducts research in support of fire management operations.
- * Reviews all proposed units to be burned to ensure sound biological principles are being followed, resource management objectives are valid, and sensitive resources are not being negatively impacted.

6. Project Leader/Refuge Manager/WMD Manager

The project leader and/or their designated representative (refuge or district manager) is responsible for the following fire management program elements.

- * Responsible for the overall management of the Complex including the fire program.
- * Insures that Department, Service, and Regional fire management policies are maintained and followed.
- * Supervises the resource management activities on land management units within the Complex including the selection of objectives and tools to be used in achieving objectives (including prescribed fire).
- * Supervises the Complex fire management officer.
- * Insures tracking of fire management budgets are conducted in an accurate and timely fashion. Approves spending of fire funds and insures fire dollars are utilized in accordance with regional and national guidance.
- * Maintains liaison with Regional Fire Management Coordinator, Zone Fire Management Officer, and North Dakota Interagency Dispatch Center and Fire cache operations.
- * Reviews and approves fire management budget request submissions, prescribed burn plans, Fire Management Plan updates, and other fire management planning documents. Performs as approving official for prescribed burn plans within the "low to normal" complexity category.

- * Insures fire monitoring programs provide the level of monitoring to support fire management operations. Supervises and provides direction to Complex biologist.

7. Seasonal and Collateral Duty Firefighters:

This includes temporary/seasonal firefighters hired by the Complex during the fire season (usually from early April through early November), other no-fire seasonal employees hired by the complex, and permanent non-fire funded Complex employees not listed in the above sections.

- * Responsible for maintenance of issued personal protective equipment and physical conditioning.
- * Qualify annually on the Pack Test, Field Test or Walk Test before May 1, or within 2 weeks of EOD date.
- * Assist Supervisors in maintaining accurate records.
- * Know and adhere to Service and interagency fire management policy. Act professionally on all fire management details
- * Operates station fire engines, water tenders, ATV's, firing devices, chainsaws, pumps, foam systems and other specialized fire equipment during wildfire and prescribed burning assignments safely and within Service and fire management standard operating procedures.
- * Maintains fire equipment and personal fire gear (PPE and equipment) continuously insuring a fire ready condition at all times. Performs Weekly equipment checks for fire pumps, chainsaws, engines, foam systems, fire hand tools and other specialized fire equipment and supplies and documents checks per station guidelines.
- * Operates tractors, mowers, discs, rakes and other implements in constructing and maintaining firebreaks for wildfire preparedness, prescribed fire and other refuge programs in a safe and effective manner.
- * Work performed as a member of the station firefighting crew on preparedness, wildfire suppression and prescribed burning projects is conducted safely and within established fire management guidelines.
- * Provides assistance with biological monitoring, resource management and other refuge projects to enhance the productivity of refuge operations.
- * At times may act as crew foreman during daily fire management and refuge project work. Assists in ordering, storage, maintenance and inventory of fire

cache equipment and supplies.

B. Complex Fire Management Staffing Needs

Table 17 depicts the current fire management staffing and predicted fire staffing needs for the Complex to fully support wildland fire and prescribed fire programs based upon management goals and objectives. This list was derived from analysis runs in the FireBase budgetary program and through workload analysis by Complex management. This list also includes positions required to support the operations of the North Dakota Interagency Dispatch Center and Fire Cache. Interagency dispatch center positions should be proportionately funded by other federal and state agencies based upon workload share.

**TABLE 17
COMPLEX FIRE MANAGEMENT STAFFING**

Position Name:	Grade Level:	# Pay Periods:	Current Staffing: (# positions)	Ideal Staffing: (# positions)
Zone Fire Mgmt. Officer	GS-12	26	1	1
Complex Fire Mgmt. Officer	GS-09 (GS-11)	26	1	1
Prescribed Fire Specialist	GS-09	26	0	1
Fire Program Technician	GS-06 (GS-07)	20	1	1
Lead Dispatcher*	GS-06 (GS-07)	24 (26)	1	1
Support Dispatcher*	GS-05	13	0	1
Eng. Equip. Operator	WG-07	20	0	1
Fire Crew Leader	GS-6/7	20	0	1
Firefighter	GS-5/6	15	0	1
Seasonal Firefighter	GS-3/4/5	13 (15)	6	6

Items in () delineate ideal level for position.
 Items with a * delineate dispatch positions that require funding support from other federal and state cooperating agencies.

The **Figure 11** flow chart represents the current Complex fire management staffing plan and supervisory chain of command. **Figure 12** depicts the planned flow chart given full fire management staffing levels for the Complex.

██████████ ██████████ ██████████ ██████████ ██████████ ██████████ ██████████

C. Minimum NWCG Position Requirements:

The National Wildfire Coordinating Group (NWCG) establishes fire position qualifications for all NWCG member agencies including the FWS, National Park Service (NPS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and the US Forest Service (USFS).

Along with other land management agencies, the Service has adopted the National Interagency Incident Management System (NIIMS) Wildland and Prescribed Fire Qualification Subsystem Guide, PMS 310-1 to identify minimum qualification standards for interagency wildland and prescribed fire operations. PMS 310-1 recognizes the ability of cooperating agencies at the local level to jointly define certification and qualification standards for wildland fire suppression. Under that authority, local wildland fire suppression forces will meet the standards established for their agency or department. All personnel participating in prescribed fire management activities must meet Service fitness and training standards.

Qualifications are based upon fire training and experience requirements. The Service maintains a database of employee fire qualifications and experience that utilizes NWCG guidelines. NWCG fire position qualification requirements can be found in the NWCG 310-1 publication. Copies of 310-1 are kept in the Complex fire management office. In order to support Complex fire operations, minimum NWCG qualified position requirements have been identified. This information is available in **Table 18**.

**TABLE 18
COMPLEX NWCG POSITION REQUIREMENTS**

Position Name:	NWCG Mnemonics:	Number Required:
Incident Commander Type 5	ICT5	2
Incident Commander Type 4	ICT4	2
Incident Commander Type 3	ICT3	1
Prescribed Burn Boss Type 3	RXB3	4
Prescribed Burn Boss Type 2	RXB2	2
Strike Team Leader - Engine	STEN	2
Single Resource Boss - Engine	ENGB	5
Single Resource Boss - Crew	CRWB	1
Engine Operator	ENOP	4
Prescribed Fire Ignition Specialist	RXI2	4
Firefighter Type 1 - Squad Boss	FFT1	2
Firefighter Type 2	FFT2	6
Emergency Medical Technician - Basic	EMTB	2
Faller Class A	FALA	4
Faller Class B	FALB	2
Initial Attack Dispatcher	IADP	2
Expanded Dispatch Supervisory Dispatcher	EDSD	2
Dispatch Recorder	EDRC	2
Fire Cache Manager	FCMG	1

Table 18 includes positions required to support the operation of the NDC and the interagency fire cache located on the Complex. An individual staff member may fill more than one of the position needs outlined in the table.

The NWCG also publishes guidelines establishing standard duties and responsibilities for fire personnel involved in the management of wildfires and prescribed burns. This information is available in the NWCG Field Operations Guidelines, publication IC-420-1 and in the current NWCG taskbooks for all NWCG fire management positions. The PMS-410-1 and corresponding position taskbooks are on file in the Complex fire management offices. A short outline of duties and responsibilities for critical NWCG positions is included below.

1. Wildfire Incident Commander:

- * The incident commander (IC) will be responsible for the safe and efficient suppression of the assigned wildfire.

- * Fulfill the duties described for the IC in the Fireline Handbook (PMS-410-1).

- * Ensure that wildfire behavior is monitored and required data collected, and crews are briefed on the strategy and tactics to be used, expected fire behavior, historic weather and fire behavior patterns, impacts of drought, live fuel moisture, escape routes and safety zones, and radio frequencies to be used.

- * Ensure that personnel are qualified for the job they are doing.

- * Submit information needed to complete the DI-1202 (fire report) to the Regional Fire Management Coordinator within 3 days of the fire being out.

2. Prescribed Burn Boss:

- * Implement approved prescribed burn plans within prescriptions.

- * Assist with the administration, monitoring, and evaluation of prescribed burns.

- * Document necessary information to complete DI-1202 (fire report) and submit to Regional Fire Management Coordinator.

3. Fire Cooperators:

- * Provide assistance in suppression of wildfires and conducting prescribed burns as defined in cooperative agreements and memorandums of understanding.

VIII. WILDFIRE PROGRAM

A. Fire Prevention

The majority of the wildfires occurring on the Complex since 1985 were human caused and thus could have been prevented. Human caused fires have the potential to be the most damaging because they can occur at times of the year when fewer initial attack resources are available and fuels are cured.

Agricultural field and roadside burning seasons occur in the spring and fall. These burns have accounted for 43% of the fires recorded within the five county area of the Complex since 1992.

Objectives of the Complex fire prevention program are to reduce the threat of human caused fires through visitor and employee education, to support the North Dakota Forest Service's fire prevention program to the fullest extent, and to integrate the prevention message into interpretive programs conducted or sponsored by the Complex.

The public and visitors to the Complex are generally very aware of fire prevention. Still, it is evident that a problem persists. Much of the problem stems from the two phased system of fire mitigation that has been North Dakota law for many years. This system treats prescribed fire totally different between state and federal land management agencies and the private sector. Regulation for burning on state or federal lands are much more restrictive than those on private lands, and currently there is no system in place to educate private citizens about fire behavior and fire management in general.

The Fire Marshal's Office is currently taking a closer look at fire prevention in North Dakota, and is developing a basic four hour training course for the public on fire management and fire behavior. This course is still under development, and lawmakers are discussing elimination of the two phase fire mitigation system in place of a single system that would require all individuals burning in the state to follow the same set of rules.

Fire prevention activities the Complex will utilize include:

- signing
- area closures when necessary
- public contacts through press releases and verbal contacts
- enforcement of regulations and prosecution of violators
- employee training and awareness
- adherence to the step-up plan included in this document
- implementation of State regulations and restrictions
- contacts with area cooperators and neighbors
- attendance at local rural fire department meetings
- mowing of road shoulders and unpaved trails to reduce the incidence of vehicle ignited fires
- periodic presentations to local area schools

B. Fire Season

According to the Fire Management Information System and the

Service's FireBase budgetary system, the historic wildfire season for the Complex is 130 days. This is a split season and runs from April 11 through July 9, and from September 18 through October 27. The historic prescribed fire season runs from April 1 through June 19 and from August 19 through November 6. The prescribed fire season length has been determined to be 160 days. The combined fire season for the Complex is March 1 through November 6, a total of 250 days. Comparing the combined season to the North Dakota State fire occurrence statistics for the four county area surrounding the Complex and listed in Table 8, we see that the seasons match quite well.

C. Fire Behavior Potential

See previous sections and BEHAVE runs in Appendix M.

D. Fire Preparedness

1. Personnel

Provided sufficient funding is available, the Complex will employ a minimum of eight firefighters during the primary fire season to perform preparedness, emergency presuppression and wildfire suppression functions. All fire management staff will be assigned to report to the Complex headquarters area. A minimum of two seasonal/temporary firefighters will be housed in seasonal housing located at the Complex headquarters for initial attack purposes after normal business hours. The Complex and Zone FMO's will coordinate support of preparedness, emergency presuppression and suppression activities with the Project Leader, Refuge Manager and WMD Manager during the fire season, and will also assist other refuges within the zone (North and South Dakota) as needed.

Only red card qualified employees will be dispatched to fires. Non red-carded employees may assist in support capacities, but will not be permitted on the fireline. A minimum of 10 red carded employees should be available on the Complex during the established wildfire season.

Additional firefighters (emergency hire (AD)/casual firefighters) may be temporarily hired to supplement fire crews using severity or emergency presuppression funding when very high or extreme fire danger conditions warrant. Fire readiness guidelines are listed in Appendix R. This guide will be utilized on a monthly basis to insure program readiness throughout the year.

Physical Fitness

All personnel involved in fire management activities will meet the fitness standards established by the Service and Region. At this point in time, firefighters participating in wildfire suppression must achieve and maintain an **Arduous** rating. Firefighters participating in Prescribed Burns must achieve and maintain a **Moderate** rating. Information found in Appendix BB provides specific instructions to

administer the tests, a health screening questionnaire to aid in assessing personal health and fitness of employees prior to taking the test, an informed consent form, and safety considerations. A trained and qualified American Red Cross First Responder (or equivalent) who can recognize symptoms of physical distress and appropriate first aid procedures must be on site during the test.

Wildland fire fitness tests shall not be administered to anyone who has obvious physical conditions or known heart problems that would place them at risk. All individuals are required to complete a pre-test physical activity readiness questionnaire prior to taking a physical fitness test. They must read and sign the Par-Q health screening questionnaire, an informed consent form (**Appendix BB**). If an employee cannot answer NO to all the questions in the PAR-Q health screening questionnaire, or is over 40 years of age, unaccustomed to vigorous exercise, and testing to achieve a Moderate or Light rating, the test administrator will recommend a physical examination. As noted below, all individuals over 40 years of age **must** receive an annual physical **prior** to physical testing.

Physical Examinations

In keeping with Service Policy, a physical examination is required for all new permanent employees and all seasonal employees assigned to arduous duty as fire fighters prior to reporting for duty. A physical examination may be requested for a permanent employee by the supervisor if there is a question about the ability of an employee to safely complete one of the work capacity tests. All permanent employees over 40 years of age who take the Pack or Field Work Capacity Test to qualify for a wildland or prescribed fire position are required to have an annual physical examination before taking the test. The cost of examination will be born by the Service and the results sent to the Region Personnel Department.

2. Training

Service and NWCG policy establishes training, qualification, and fitness standards for all fire positions. All fire personnel (full time fire or collateral duty) will be provided with the training required to meet fire job qualification standards for the jobs they will be expected to perform. Personnel will not perform fire jobs they are not qualified for.

Annual Refresher Training

All personnel involved in Fire Management activities are required to participate in annual wildland fire management refresher training annually in order to be qualified for fire management activities in that calendar year. Refresher training will concentrate on

local conditions and factors, the Standard Fire Orders, LCES, 18 Situations, and Common Dominators. NWCG courses Standards for Survival, Lessons Learned, Look Up, Look Down, Look Around, and others meet the firefighter safety requirement; but, efforts will be made to vary the training and use all or portions of other NWCG courses to cover the required topics. Fire **shelter use and deployment** under adverse conditions, if possible, **must** be included as part of the annual refresher.

The Complex FMO will coordinate training for all station staff. Some training courses such as Standards for Survival, ATV Safety and Basic Aviation Safety may be conducted on site if warranted. Other training will be acquired through the interagency training calendars. The Complex FMO and Zone FMO will monitor course schedules, keeping updated on courses offered through the various interagency training lists. The ND/SD fire management zone also maintains contact with a variety of other wildland fire training opportunities including the Northern Training Center in Missoula, Montana, the National Fire and Aviation Training Calendar put out by the National Interagency Fire Center, the Rocky Mountain Interagency Fire Training Calendar, the Dept. of Interior Office Of Aircraft Services Training lists, the Colorado Wildfire Academy, Great Plains Wildfire College, the National Advanced Resource Technology Center course catalog, and the High Plains Fire Council training catalog.

Additional local training courses are hosted by various state and federal agencies in the ND/SD zone and are available to station staff. In addition, the Service provides numerous courses throughout the year in Region 6. All station employees who are base funded out of fire accounts will have a fire management training needs assessment completed for them outlining training and experience deficiencies and future position goals. It is recommended that a similar process be completed for all non-fire funded staff as well.

3. Equipment

The Complex has a Forest Technology Systems model FTS-11 remote automated weather station located in the headquarters complex area two miles north of the town of Upham. This weather station automatically calculates a wide range of fire weather data including temperature, relative humidity, wind speed and direction, precipitation and fuel moistures. The corresponding Fire Weather Plus IBM computer based software also calculates National Fire Danger Rating System (NFDRS) indices along with Keetch-Byram Drought Indices (KDBI) and several other fire weather and fire behavior factors. This station is also linked to the Weather Information Management System (WIMS) in order to produce daily fire danger predictions.

Engines are the primary initial attack resource used on the Complex due to the predominance of fine fuels and easily

accessible terrain, with the exception of the southern sandhills unit. Earth moving equipment is available but not recommended for use due to resource damage concerns. **Table 19** profiles the equipment needs of the Complex identifying both the current level of stocking and documented additional needs.

Table 19 J. Clark Salyer NWR Complex Normal Unit Strength - Equipment

Item	Year Purchased	% of Fire Funding	Have	GVW	Need	GVW
Engine Module(s) heavy (500-1000 gal) medium (200-400 gal) light (50-150 gal)	Ex. Prop. 1985,1996, 1998-ATV	N/A, N/A 100, 100 100	2 2 1	25,000/25,000 12,000, 15,000	2 4 2	same 15,000
Slip-on unit(s)	1985, 1989	25, 25	2		2	
Water Tender(s)	Excess Property	N/A	2	2,500 & 5,000 Gallon	2	N/A
Portable Pump(s) Standard float-a-pump	1995-1999 1997-1999	100 100	4 2		6 4	
Power Saw(s)	Various	100	4		6	
Mower(s) Bush Hog ATV Mowers	Various-old! 1994, 1998	Zero Zero, 100	2 2		3 3	
Tractor(s) Ford JD, Case	1998 Unknown-OLD	60 Zero	1 2		2	
Grader(s)	Excess Property	Zero	1		1	
Plow Unit/Disk	Excess Property	Zero	1		2	
ATV(s) 4 wheel 6 wheel	1996 1998	100 100	1 1		2 2	
Other List Drum Chopper	1998	60	1		1	
Radios Low Band Portable High Band Portable Low Band Mobile High Band Mobile	Various Various Various Various	50 Ex. Prop. 50 50	12 6 8 1		16 8 12 6	

All engines are outfitted with the required minimum gear to support local fire operations. The Complex has two Type 6 engine modules (Model 52) will are outfitted with a full accompaniment of equipment as outlined in the NWCG Fireline Handbook

(PMS 410-1) and the Northern Rockies Coordination Group interagency standards for Type 6 engines in this geographic area. These engines are intended to be used when interagency requests are received, and are the only engines that will be detailed out of North Dakota.

The Complex has numerous other vehicles that can be used in

support of fire operations if needed (pick-up trucks, farm tractors, farm implements), along with adequate supplies of firefighter personal protective equipment and miscellaneous fire management supplies. J. Clark Salyer also maintains the North Dakota Interagency Fire Cache. Currently this is a 50 person cache, with plans to expand the cache to a 100 person unit by the year 2,002. The Complex also has plans for establishing a 50 person cache van. To date the van has been acquired from the Minot Air Force Base, but stocking has not been completed.

Additional program needs include both heated and unheated storage space for fire equipment. Currently the majority of equipment is stored outside year-round. A six bay garage or pole shed with half of the bays heated would greatly increase operational efficiency and safety. Due to starting and ending fire season dates well within periods with local daily low temperatures below 32 degrees, our pumpers must sit without water to prevent damage from freezing, lengthening our response time to wildfires considerably. Because of inadequate storage space our fire equipment is stored in several locations on the refuge, making organization difficult and again increasing response time.

The Complex has instigated weekly preventative maintenance and readiness checks of all fire vehicles. This process begins several weeks prior to fire season and continues for several weeks after the close of the season in the fall. All fire equipment has established maintenance and readiness check files that are used to document when checks were completed and note any ongoing deficiencies or scheduled maintenance needs. Complete vehicle readiness checks are always completed prior to any prescribed burn or interagency detail as well.

E. Emergency Preparedness & Pre-Suppression

Staffing Class breakpoints were determined using a FIRE FAMILY analysis of 10 year fire weather data from a fire weather station at Theodore Roosevelt National Park in Medora, ND (200 miles southwest of Complex headquarters). This was the closest station to the Complex that had the required 10 years worth of data needed to establish accurate 90th percentile burning indexes and staffing class breakdowns. **Table 20** illustrates these staffing classes and associated burn index (BI) ranges.

Federal fire management funding is based on providing the required staff and equipment to successfully initial attack and control wildfires up to the 90th percentile Burn Index, or roughly 90 percent of the time. Conditions over the 90th percentile mark usually require additional resources from off station to manage. Staffing classes are often determined using burn index values, and are commonly utilized in the development of emergency preparedness Step-Up Plans. A Step-Up Plan outlines actions to be taken to insure full preparedness of fire suppression equipment and personnel during a range of potential fire occurrence and fire behavior conditions. Step-Up Plans are discussed in greater depth later in this section, and a complete copy of the Complex Step-Up Plan can be found in **Appendix S**.

TABLE 20
FIRE DANGER STAFFING CLASS AND ASSOCIATED BURN INDEX RANGE
NFDRS Fuel Model N - Tall Grass

STAFFING CLASS:	BURN INDEX RANGE
SC - I	0 - 21
SC - II	22 - 43
SC - III	44 - 88
SC - IV	89 - 109
SC - V	110+

In 1997 the Complex erected a Forest Technology Systems model FWS-11 remote automated weather station at the main office location in McHenry County. This station monitors and records pertinent weather data including fuel moisture, relative humidity, temperature, and wind speed and direction. The station is linked to a fire management computer via cellular phone, and includes computer software models to calculate National Fire Danger Rating System(NFDRS) indices. An additional software module was purchased that computes the Keetch-Byram Drought Index (KBDI) based upon local weather data. The system was installed in October of 1997, and will be used to track NFDRS indices over time to update staffing class burning index and other fire danger factors. In the future when sufficient history becomes available for an accurate statistical analysis, the staffing class and Step-Up Plans will be re-written to incorporate more valid local data.

The FWS-11 weather station information will also be periodically

downloaded into the Weather Information Management System (WIMS) for cataloging and use in establishing NFDRS trend analysis data and periodic re-calculation of 90th percentile burning index (BI) and other factors used in fire danger ratings. Ideally, 10 years of data are needed for accurate 90th percentile BI determination.

The NFDRS and WIMS systems are quite accurate for shrub, timber and slash fuel models, and can also be a large asset to fire programs in primarily grass fuel models when moderate to high complexities and fire occurrence are present. The Complex generally has low to moderate fire complexities and low numbers of ignitions, thus a step-up plan based solely on burning index would for the most part be significant overkill.

The State of North Dakota issues a Rangeland Fire Index that is calculated daily during fire season by the National Weather Service (NWS) in Bismarck, North Dakota. This system relies mostly on calculation of greenness factors of fuels and comparison to normal historic values for the identical day of the year. Greenness factors are calculated by an Advanced Very High Resolution Radiometer (AVHRR) onboard NOAA weather satellites. Satellite calculated greenness factors are combined with forecasted wind speeds and relative humidities to establish a daily fire danger rating by county for the State.

Although this process can provide useful information for fire managers, it does not adequately show trends in wildland fuel changes due to the significant amount of state land in cropland, pasture and hay lands. The profound difficulty the NWS has in producing accurate weather forecasts throughout much of the State adds to the problem. The Bismarck NWS Office does not have a fire weather forecaster on staff, further elevating accuracy problems.

Typically, rangeland fire danger ratings can go from extreme to low in a one day period entirely due to a single factor such as wind speed or relative humidity, without any measurable precipitation or change in fuel conditions. An additional complication arises from the fact that standard agricultural crops and lands being grazed or hayed do not come close to mimicking conditions in wildland vegetative communities.

In 1997 the North Dakota Fire Council met with North Dakota Forest Service and Bismarck NWS Office personnel to initiate changes in the calculation of daily rangeland fire danger index. Some valuable changes were incorporated into the system to utilize wildland areas more extensively in the rangeland fire danger index calculation process, but more work needs to be done to truly make this an accurate and reliable index for basing emergency pre-suppression and preparedness programs for Service fire management staffs.

In order to develop a truly accurate emergency pre-suppression and preparedness program on the Complex, a step up plan has been compiled that considers NFDRS ratings, specifically BI, daily Rangeland Fire Danger Index, and the Keetch-Byram Drought Index to produce what we consider the most realistic step-up and emergency pre-suppression policy possible at this time. The Complex Step-Up Plan can be found in Appendix S.

Fire managers will continue to experiment with a variety of methods in order to facilitate the further development of a more accurate fire danger rating and emergency preparedness program on the Complex due to the unavailability of a current system for North Dakota that has proven accuracy. Systems monitored may include the Palmer Drought Index, Keetch/Byram Drought Index, State of North Dakota rangeland fire danger index, and NFDRS indices including Burning Index, Energy Release Component and Ignition Component, along with other available systems. These factors will be computed either by on site RAWS stations, acquired from the NWS, the Billings Dispatch Center, or through Internet data acquisition.

It is important to recognize the Effects Drought can have on Fire Behavior and Smoke:

- Prolonged drought will cause drying of larger fuels and possibly litter, duff, and soil layers which do not normally burn. The FBPS fuel models do not account for these fuels burning so BEHAVE will not predict this. However, these fuels will burn and add to the intensity of the fire. If the area is in a drought situation, one can expect higher flame lengths, increased fireline intensity, increased resistance to control efforts, prolonged smoldering of large logs and duff layers, difficult mop-up, and lingering smoke problems.

- Prolonged drought may affect live fuel moisture. In normal conditions, live vegetation such as tree trunks and limbs may have a high enough moisture content so that they do not contribute to fire behavior. In drought conditions live fuel moisture may be abnormally low, which will lead to more extreme burning conditions than one would expect.

- FBPS and NFDRS (National Fire Danger Rating System) fuel models which contain 100-hour, 1000-hour, and live fuels will be more affected by cumulative drought. Drought will not have as much effect on grasses (FBPS fuel models 1 and 3) since fuels are composed mostly of 1-hour fuels which will be more affected by temp. and RH than prolonged drought. However, some Service grasslands (including FM 1) have a well developed duff layer (1 to greater than 3 inches thick) that will hold fire overnight when the soil moisture is low.

- Drought may have a profound effect on marsh-type and fuels since the organic soils may add to the intensity, mop-up problem, and smoke production if they are dry. Under extended drought conditions these will resemble a peat fire.

- In severe cases vegetation such as grasses and herbs may not even green up or may cure out earlier than expected.

How to tell if you are in unusually dry conditions:

- The KBDI, Palmer Drought Index (PDI), and Departure from Average Greenness are indicators that can be accessed for information on regional conditions, sometimes down to county level. This data and other useful information on fire danger can be found at the Wildland Fire Assessment System (WFAS) on the Internet (<http://www.fs.fed.us/land/wfas/>). PDI values below -3.0 indicate severe drought. It should be noted that -

4.0 PDI would correspond to the driest conditions previously recorded. Generally this would be the dust bowl days of the 1930's.

- The Keetch-Byram Drought Index (KBDI) is a measure of available soil moisture. It is calculated from precipitation and evapo-transpiration potential. It is a good measure of live fuel moisture as well as duff/litter moisture. Since it best measures live fuel moisture and soil moisture it does not accurately reflect dormant season conditions. KBDI values greater than 550 indicate you have been in a moderate drying trend and may be noticing more active fire behavior than in the past.

What you will do when you recognize that you're in a drought situation:

Appendix S "Step Up Plan" contains actions to be taken when drought and extreme fire behavior potential exists. The Step Up Plan references KBDI, NFDRS BI fire danger component and the North Dakota Range Land Fire Danger Index. In addition to these items when the PDI is less than -2.0 post prescribed burn patrols should be conducted for 3 days following the burn. This is especially critical when deep duff (greater than 1 inch deep) or when 1000 hour fuels are present in the unit. **This guideline does not replace the need to do pre-burn site analysis to determine individual site conditions and the probability of carry over fire in the duff layer.**

When conditions are warranted based upon approved Step-Up Plan guidelines, a request to establish an emergency pre-suppression account will be made to Regional Fire Management Coordinator (RFMC). Once this account (PE-06) is established the Project Leader, Refuge Manager or Fire Management Officer may authorize overtime for Very High or Extreme step up actions that cannot be met with regularly scheduled employees. Collateral duty firefighters may be assigned emergency pre-suppression duties if needed. Backfill behind employees may be authorized.

F. Severity and Emergency Presuppression Funding

Severity funding is different from Emergency Presuppression funding. Emergency Presuppression funds are used to fund activities during short-term weather events and increased human activity that increase the fire danger beyond what is normal. Severity funding is requested to prepare for **abnormally extreme fire potential** caused by unusual climate or weather events such as extended drought or strong windstorms. Severity funds and emergency presuppression funds may be used to rent or preposition additional initial attack equipment, augment existing fire suppression personnel, and meet other requirements of the Step-up Plan.

To provide adequate fire protection for the Complex during years with abnormally extreme fire potential or long term drought, a request for severity funding is made in writing to the RFMC stating specific needs for personnel, equipment and funds. The request is reviewed by the RFMC, then passed on to the Director of the Service through a formal request from the Regional

Director.

Emergency Presuppression and Severity funds will be requested in accordance with the guidance provided in the Service's Fire Management Planning Handbook. As a general guide, Severity funding will be requested if a severe drought is indicated by a Palmer Drought Index reading of -4.0 or less or a Keetch-Byram Drought Index of 625 or greater **and** a long-range forecasts calling for below average precipitation and/or above average temperatures. Drought Indices can be located at: <http://www.boi.noaa.gov/fwxweb/fwoutlook.htm>

G. Detection

The Complex relies on employees, neighbors, visitors, and cooperators to detect and report fires. In addition, the step up plan provides for increased patrols by refuge personnel during periods of very high to extreme fire danger.

There may be an occasion when unqualified personnel discover a wildland fire. When this occurs the employee should report the fire and request assistance before taking action to suppress or slow the spread of the fire. If the fire poses an imminent threat to human life, the employee may take appropriate action to protect that life before requesting assistance. The unqualified personnel will be relieved from direct on-line suppression duty or reassigned to non-fireline duty when qualified initial attack forces arrive.

H. Fire Suppression

Economic impact of past wildfires in the area have consisted of temporary loss of livestock forage, destruction of crops, stored hay and improvements, and temporary loss of recreational value. Fortunately, these past fires have generally not jeopardized life or personal property, although each year personal property losses outside the Complex on private lands have been significant, totaling more than \$50,000 in the past six years (**Table 6**). The potential for these kinds of damaging or disastrous fires always exist.

Wildfires have been a natural component of the Complex and surrounding ecosystems for thousands of years and any temporary loss of wildlife or wildlife habitats may be offset by fire's beneficial effects. Fire suppression activities over the years have to some extent ignored the fact that fire is a natural component of the environment. Consequently these activities have had negative effects. Generally, native species of vegetation that derive some benefit during their life cycle from fire have suffered while those species that are not fire tolerant (woody species and exotic invaders) have benefitted.

Another effect of past fire suppression activities has been the accumulation of fuels, including timber, shrub and grass habitat types. These accumulated fuels, when burned, tend to produce very hot fires which can damage vegetative species that normally would not be affected. They also make the possibility of larger, potentially disastrous fires much more likely.

Previous impact of past fire suppression activities include heavy equipment use to create fire breaks. In many of these areas the fire breaks are clearly visible while all evidence of the fire has long since disappeared. Fire breaks created with heavy equipment also tend to allow increased expansion of unwanted exotic invader species such as leafy spurge and Canadian thistle to establish, hampering control efforts. The use of heavy equipment to construct fire breaks is restricted in the Complex. These types of fuel breaks must be approved by the Project Leader or Refuge Manager, and will only be used when serious threat to life and property exists. The Complex will utilize **minimal impact suppression strategies** when possible.

All management decisions on the Complex should comply with the legislative authorities creating the Complex and established goals and objectives listed in Section II, parts A and B. Fire is part of the natural setting and **appropriate management response** should take this into account by utilizing indirect attack methods and monitoring/surveillance to the extent possible.

1. General

The J. Clark Salyer National Wildlife Refuge Complex is a full suppression area with suppression strategies and tactics based upon appropriate management response. Service policy requires the refuge to utilize the ICS system and firefighters must meet NWCG and Service qualification requirements for fires occurring on Service property.

All suppression efforts will be directed towards safeguarding life and property while protecting the Complex's resources from harm. If additional firefighters or other resources are needed, appropriate interagency resource ordering procedures will be followed to acquire resources through the interagency dispatch center located at the Complex, or through requests with the Billings Dispatch Center (BDC) or Northern Rockies Coordination Center (NRCC).

2. Initial Reporting and Dispatch

All fires occurring within or adjacent to the Complex will be reported to the Complex headquarters and NDC. The person receiving the report will be responsible for delivering the report to NDC staff for implementation if the fire occurs during normal NDC hours of operation. If the report occurs after normal NDC hours of operation, the individual receiving the report will be responsible for implementing the Complex Fire Dispatch Plan. Copies of this plan are available in the NDC office and a folder containing the plan and dispatch logs is kept next to the main Complex radio terminal at the headquarters front desk. **Appendix U** contains a copy of the 1999 Complex Fire Dispatch Plan.

Requests for assistance from cooperators on fires not threatening the refuge must be made to and approved by the Project Leader, Refuge Manager, FMO or designee. Only qualified and properly equipped resources will be dispatched to off station wildfire assignments.

The Fire Dispatcher will be responsible for coordinating the filling and delivery of any resource orders made by the Incident Commander (IC) including personnel, engines, aircraft, tools, supplies, meals, and other support items. IC's will place all resource orders through the dispatcher, and will specify what, when and where it is needed. The Dispatcher will promptly determine if the resource orders can be filled or procured locally and notify the IC. If a resource order cannot be filled locally the Dispatcher will place the order through NDC, BDC or NRCC channels per current mobilization guide policy. Current copies of the NDC Interagency Mobilization Guide containing all required information pertaining to resource mobilization in North Dakota are available in the NDC office.

3. Initial Attack

The FMO will serve as IC, or will appoint a qualified Incident Commander for each fire. The IC will be responsible for all aspects of the management of the fire. If a qualified IC is not available, one will be ordered through dispatch. All resources will report to the IC (in person or radio) prior to deploying on the fire. The IC will provide a size-up of the fire to the dispatcher as soon as possible, and determine the resource needs for the fire. Size-up information requirements can be found in the Dispatch Plan and also in the Fireline Handbook (PMSS-410-1). The IC will be responsible for placing or canceling resource orders for the fire.

The IC will receive general suppression strategies from the FMO and refuge management per the Refuge Fire Management Plan, but tactics necessary to suppress the fire will vary according to each on-the-ground situation encountered. It will be up to the IC to implement the appropriate management response to effectively suppress the fire. Minimum impact tactics will be used whenever possible. Dozers, plows, discs, or graders will not be used inside the Complex boundaries for fire suppression without permission from the Project Leader, Refuge Manager or designee.

Initial Attack Agreements:

The Complex maintains a variety of initial attack assistance agreements with local RFD's. These agreements allow RFD personnel to assist Complex staff on fire suppression incidents on Service lands, and also allow Complex staff and resources to assist with wildfire incidents on private lands covered under the agreement. Mutual aid resources responding from rural fire departments to Service fires will not be required to meet Service fire qualification standards, but must meet the standards set by their own department. Mutual aid resources will report to the IC (in person or by radio) to receive suppression assignments and will be the first priority for demobilization from the fire once controlled. Frequently, individuals arrive at a fire to assist but are not members of a fire department or qualified for any type of fire suppression duties.

These individuals are not to be used as firefighters, but can provide logistical support under certain circumstances. A copy of all current mutual aid agreements for the Complex can be found in Appendix Q.

4. Escaped Fires/Extended Attack

The IC or Project Leader/Refuge Manager will notify the Zone FMO whenever it appears a fire will escape initial attack efforts, escape Service lands, or when fire complexity will exceed the existing capabilities of the staff. The Zone FMO will be responsible for coordinating extended attack actions including:

- * Completion of a **Wildland Fire Situation Analysis** (WFSA) for the Project Leader.
- * Assignment or ordering of appropriate resources including coordination with NDC.
- * Drafting the **Delegation of Authority** if needed.

Appendix X contains the Complex **Pre-Attack Plan** including copies of the Delegation of Authority document to be used by the Project Leader or designee to delegate authority to the IC for control of the incident, and a copy of the WFSA to be used in the event of an escaped fire situation.

I. Mop up Standards and Emergency Stabilization and Rehabilitation

The IC will be responsible for mop-up and mitigation of suppression actions taken on Refuge fires. The mop-up standards established in the Fireline Handbook will be followed. Refuge fires will be patrolled or monitored until declared out.

Prior to releasing all firefighters from a wildland fire the following actions will be taken:

- G All trash will be removed.
- G Firelines will be refilled and waterbars added if needed.
- G Hazardous trees and snags cut and the stumps cut flush.
- G Disked firelines should be compacted as soon as possible to preserve the living root stock of natives grasses.
- G Overturned sod resulting from plowing must be rolled back with a grader or by hand and compacted to preserve native grass root stock.

Other emergency stabilization and emergency rehabilitation measures may be taken in accordance with Chapter 5 of the Fire Management Handbook. Briefly:

- G **Emergency stabilization** is the use of appropriate emergency stabilization techniques in order to protect public safety and stabilize and prevent further degradation of cultural and natural resources in the perimeter of the burned area and downstream impact areas from erosion and invasion of undesirable species. The Incident Commander may initiate Emergency Stabilization actions before the fire is demobilized, as delegated by the Agency Administrator, but completing emergency stabilization activities may be

completed after the fire is declared out.

- G **Rehabilitation** is the use of appropriate rehabilitation techniques to improve natural resources as stipulated in approved refuge management plans and the repair or replacement of minor facilities damaged by the fire. Total "rehabilitation" of a burned area is not within the scope of the Emergency Rehabilitation funding. Emergency Rehabilitation funding can be use to begin the rehabilitation process if other funding is committed to continue the rehabilitation throughout the life of the project (beyond the initial 3 years of Emergency Rehabilitation funding). Major facilities are repaired or replaced through supplemental appropriations of other funding.
- G Because of the emergency nature of the fire event, the emergency stabilization section of the Emergency Stabilization and Rehabilitation Plan (ESR Plan) must be developed expeditiously and is frequently developed by a local unit or designated burned area ESR team. The rehabilitation section of the ESR Plan is not considered an emergency, and is developed as other refuge land use plans. The refuge manager is responsible for preparing all ESR Plans. In order to be funded, ESR Plans must meet resource management objectives and be approved by the Project Leader and the Regional Director.

J. Records and Reports

The IC will complete all situation reports as soon as practical. The IC will complete DI-1202 fire reports within 3 days and will ensure that all expenses and/or items lost on the fire are reported, that the timekeeper is advised of all fire time and premium pay to be charged to the fire, and that expended supplies are replaced. The dispatcher will assist with report compilation and entering the reports into the FMIS Fire Occurrence System.

IX. PRESCRIBED FIRE MANAGEMENT

The Complex has been using prescribed fire as a management tool since the early 1970's. From 1985 to 1998, a total of 114 prescribed burns were accomplished treating 16,243 acres. Much of this has been accomplished since the Complex received fire staffing in 1995. These totals represent only 21% of the Complex's 76,000 acres within habitat types with historical fire frequency of 3-20 years. Average burn size was 142 acres during this period.

In the late 1980's and early 1990's, refuge management realized the need to increase prescribed burning as a habitat management tool. Prior to the mid-1990's, resource shortages hampered the Complex's ability to meet this need. In the past three years the Complex has gone from no fire staff to a permanent staff of three and a seasonal staff of six. Initial years have been taken up with expansion of the program on all fronts, with significant increases seen in planning, preparation, training and burn implementation. We anticipate a continued increase in the use prescribed fire within the Complex in the future, with a goal of burning a minimum of 5,000 acres on the Complex yearly.

New prescribed fire funding authority (9263 account code) will also help to increase the level of prescribed fire on the Complex. This funding is anticipated to continue in the coming years. The new FireBase budget allocation program recognizes prescribed fire as an integral part of Service fire management programs, something the former FirePro system did not. With FireBase, refuges will have the ability to form prescribed fire districts to supply fire management resources for prescribed fire implementation on stations that in the past had never received any assistance.

Currently the Complex has created a prescribed fire district that includes the Upper Souris NWR and Audubon NWR Complex. Prescribed fire resources are stationed at the JCS Complex with the understanding that these resources are to be used to assist both Upper Souris and Audubon in prescribed fire programmatic implementation. Since 1996 this system has been developing, with Complex resources assisting with all burns conducted on Upper Souris NWR and roughly 60% of burns conducted on Audubon NWR Complex during this period.

Prescribed fire resources, as well as wildland fire resources are looked upon as regional and national resources, thus Complex fire staff and equipment often assist other fire programs as needed. When the need arrives and we are able to fill requests for assistance, we will send resources to other Service units in this and other Regions to provide aid for other prescribed fire programs. Complex management realizes this is the structure of the Service fire management program, and is aware that the current prescribed fire district is in place and we have a commitment to providing assistance when requested if possible. We expect an expansion of this process in the coming years as prescribed burn programs increase on all District units.

The Complex breaks prescribed fire into two distinct management purposes: 1)Resource management or habitat improvement burning, and 2)Burning for hazard fuels reduction.

A. Resource Management Prescribed Fire

The goal of resource management prescribed fire is to restore, create, and maintain a healthy diversity of plant communities in order to restore and perpetuate native species of flora and fauna. The use of prescribed fire for resource management on the Complex has gone through the NEPA process and is specifically addressed in the Environmental Assessment completed for managing upland habitats on the Complex approved in 1994. Meeting Complex prescribed fire program goals would include the following activities:

1. Restoration and propagation of native prairie grass and forb species
2. Reduction and control of non native grasses, especially Kentucky bluegrass, quackgrass and smooth brome
3. Control of woody species invasion of grasslands and wetlands including aspen, mixed hardwoods, Russian olive, willow, snowberry and other assorted shrub types
4. Assistance in controlling noxious weeds, particularly leafy spurge and Canada thistle
5. Control of dense cattail and bullrush growth in shallow wetlands
6. Maintenance and rejuvenate of quality nesting cover for waterfowl
7. Assisting in preparation of seedbeds for native grass and DNC plantings
8. Assistance in preparing areas of the refuge currently in cropland for annual re-seeding
9. Removal of unwanted slash piles from mechanical removal of shelter belts and other tree plantings on recently acquired lands
10. Removal of decadent hay, straw and flax bales on Complex lands previously under haying permits

Achieving many of the Complex goals may require repeated prescribed burns over a 10-20 year period with a 3-5 year burn frequency. In aspen parkland, periodic treatments repeated over 20 to 30+ years may be required to achieve desires goals.

Resource Management Prescribed Fire Objectives:

1. Treat 5,000 or more acres including 15 to 30 prescribed burn units per year on the Complex to accomplish resource management goals (assuming current level of funding).
2. Assist with burning of 1,500 to 2,000 or more acres per year within the JCS prescribed fire District (includes Upper Souris and Audubon).

Increases in the above totals are possible only with an increase in funding and fire staffing. At the current level of funding the prescribed fire program cannot meet this need. Additions to the Complex's permanent fire staffing, specifically a Prescribed Fire Specialist, additional career-seasonal fire staff and an Engineering Equipment Operator, new equipment purchases including reliable mowers and additional ATV's, and additional seasonal fire staff during the spring and fall months would provide the resources to increase the prescribed burn program to the level needed to reach Complex goals and objectives. These needs are outlined in Tables 17, 18 and 19. It is important to

note that two of the fire funded FTE's on the complex are Zone positions, and have limited time available to support Complex operations.

Complex management will utilize natural ignitions to the extent possible to assist with reaching resource management goals. A large portion of the Complex is currently covered under approved prescribed burn plans, and much of the Complex has been identified as within prescribed fire zones. Complex management will utilize the appropriate management response when dealing with naturally ignited wildfires. This may include indirect attack by burning out from established prescribed burn unit boundaries or other means provided the area of the fire is within an identified prescribed burn unit, the unit has an approved prescribed burn plan, current conditions fall within the prescription range for the burn plan, and safety of Complex resources and the public is not compromised. During periods when fuels are green and/or fire behavior is low, using natural ignitions for resource management goals should not be difficult.

B. Hazard Fuels Reduction Prescribed Fire

The goal of the Complex hazard fuel reduction program is to use prescribed fire within or near Complex development zones, historic high fire occurrence zones, areas with particularly difficult suppression characteristics, wildfire sensitive resources, and specific WPA and Refuge boundary areas to reduce the risk from wildfire damage and increase the safety and efficiency of wildfire control efforts.

WPA and Refuge boundary zone burn units are selected based on values at risk on adjacent lands, probability for escape from Service land, and fuels. Fuels in hazard fuel sites have 6-10 inches or more of accumulated grass litter (fuel models 1 and 3), high densities of shrubs (fuel models 5 and 6), or extreme fuel loadings of 100 and 1000 hour fuels due to wind damage, over maturity or prior wildfire damage (fuel models 9 and 10). These factors can cause complex control problems during suppression actions. High litter loadings allow wildfires to carry even during full green-up conditions. To the greatest extent possible, hazard fuel burns will only be used when they can compliment resource management objectives.

1. Hazard Fuels Prescribed Fire Objectives:

- * Reduce dead grass fuel loadings by 75% or better
- * Reduce woody shrub component by 50% or more
- * Reduce quantities of 100 and 1000 hour fuels by 50% or more

2. Hazard Fuel Prescribed Fire Strategies:

- * Treat 1,000 to 2,000 acres per year
- * Burn units once every 3-8 years depending on fuel accumulations and resource management considerations

C. Planning

The Project Leader, Refuge Manager and staff Biologist are responsible for developing resource management objectives for individual units and determining unit priorities. The station

FMO, Zone FMO and Regional fire staff will provide technical assistance in the use of prescribed fire as a management tool. Individual site specific burn plans will document objectives and the plan of action for achieving them. Burn plans can be written by any staff member, but must go through a review process specified by the RFMC.

All burn plans will address contingency planning for all prescribed burns. General contingency planning elements are listed in the following paragraph. More specific information regarding contingency planning may be included for a particular prescribed burn if the need exists.

A contingency section will be included in all prescribed burn plans and shall address the following essential elements:

- G Trigger points that are clearly defined.
- G Instructions for reporting an escaped fire or slope-over.
- G Who has the authority to activate the contingency plan.
- G The initial actions to be taken to suppress the wildland fire (Included in this section will be the organizational structure, strategies, tactics, additional resources, health and safety concerns).
- G Who is to be notified when the contingency actions are implemented.
- G The location of values or resources requiring protection and established priority for providing protection.
- G Containment opportunities outside of the burn unit .

Escaped fire contingency lines are natural or human made barriers to fire spread; such as water, roads, fields and heavily grazed pastures, that may be used as indirect holding lines in the event of an escape. Any residences or other private property within these identified lines will receive priority protection.

Determining when to implement the contingency plan or declare a prescribed fire a wildfire will vary with every situation. Therefore, clearly defined trigger points that indicate when the contingency plan will be implemented and under what circumstances the prescribed fire will be declared a wildfire will be identified in each prescribed burn plan. The following are examples of trigger points that may be used:

- G When three or more slope-overs occur within a 30 minute period or when an escape exceeds the ability of the holding forces to suppress it in a timely manner.
- G When private property, cultural resources, structures and other resource values are threatened.
- G When the fire behavior predictions exceed the prescription parameters (MANDATORY).

Potential burn units will be selected yearly through meetings between the Project Leader, Refuge Manager, FMO and Biologist. A review of the previous year's prescribed fire accomplishments, failures, and monitoring results will also take place at this time. Burn plan review and approval requirements vary according to complexity level. There are three recognized complexity

levels based upon the prescribed burn complexity guide and worksheet. Low complexity burns are those burns with a total complexity score of between zero and 115. Moderate or "normal" complexity burns are those whose scores range from 116 to 280, and high complexity burns range in score from 281 to 450.

Low and normal complexity burn plans must be reviewed by the Zone FMO, burn boss and Refuge Manager/District Manager or Project Leader, with final approval granted by the Refuge Manager/District Manager or Project Leader. High complexity burns must be reviewed by the Zone FMO, burn boss, Refuge manager/District Manager or Project Leader, and RFMC or Regional Prescribed Fire Specialist, with final approval granted by the Project Leader.

Complex fire and maintenance staff will be responsible for preparing all fire equipment used for prescribed burning prior to May 1, and will also insure that weekly checks and daily checks prior to burns are completed.

Prescribed burn units may require pre-burn preparation including mowlines, disc lines, blacklining, drum chopper work, chainsaw preparation or other preparation methods as stated in the individual burn plan. Some units may also require advanced public relations work prior to burn initiation. All burn unit preparation as outlined in the individual burn plan will be completed prior to implementation.

The normal prescribed fire season begins approximately April 1 depending upon weather factors, and continues until late fall. Some units may not be burned between June 15 and July 15 in order to avoid burning waterfowl nests and to correspond with haying limitations placed on local ranchers with refuge hay permits. Burn timing depends on unit objectives, staffing, weather and other factors. Burning may occur during the winter months depending upon snow conditions and objectives. Winter burns are generally for cattail control in wetlands and for burning blacklines to be used as control lines for future burn units.

Each prescribed burn unit requires an open burning permit from the State of North Dakota Department of Environmental Health. Procedures for obtaining permits can be found in Appendix K.

Impacts of Drought and Regional and National Preparedness

- G Periods of drought can greatly impact fire behavior and resistance to suppression. For that reason the Rangeland Fire Danger Index, Palmer Drought Index, and the Keetch-Byram Drought Index will be monitored at a minimum on a weekly basis throughout the year. All are available on the Internet at <http://ndc.fws.gov>.

- G Large scale fire suppression activities occurring in various parts of the country can have an impact on local fire management activities. For example, resources may be limited to implement prescribed fire activities because the closest available resources may be assigned to fire suppression duties or Refuge personnel may be involved as well. Regional drought conditions may also tie-up local resources that would normally be able to assist with Refuge fire management activities. It may be necessary to go out of

Region to get the resources needed to staff the Refuge engine during periods of extreme drought or high fire danger.

- G The Refuge is in the Northern Rockies Area. During National and Regional Planning Levels IV and V, it is necessary to receive approval from the Regional Fire Management Officer and the concurrence of the Northern Rockies Area Coordination Group to conduct prescribed burns during PL IV and the National Coordination Group during PL V.
- G When the North Dakota Rangeland Fire Danger Index is in the Extreme category, verbal permission must be obtained from the State Forest Service, Fire Marshal's Office or local rural fire protection district chief.

Under ideal conditions and with sufficient staff, multiple units may be burned at the same time within the Complex. The maximum number of simultaneous burns may be regulated by the cumulative impacts of smoke on sensitive targets. The Complex FMO or other qualified Prescribed Fire Manager will be available to coordinate the management of simultaneous burns. Sufficient suppression forces must be available for each burn in the event of an escape.

With the increase in education and the realization by many cooperators that fire is a necessary part of the North Dakota native grasslands, it is likely that in the near future Complex fire staff may assist other local state and federal agencies or private landowners in conducting prescribed burning operations on private lands. The issue of burning on private lands is currently being addressed at the Regional level. Appendix Z contains the draft Region 6 policy for private lands burning. Once the final policy is approved and distributed to the field, this draft will be replaced with the final copy. Service prescribed fire funds can not be used for burning on private lands.

The North Dakota Fire Council (NDFC) is in the process of completing a statewide fire agreement that will cover all local, State and Federal fire management agencies in North Dakota. This agreement will address prescribed fire and establish methods for agencies to assist each other including cost reimbursement procedures. Once this agreement is in place, cross agency prescribed fire assistance will be much easier.

Until a statewide agreement is completed, a specific cooperative agreement or memorandum of understanding must be completed to allow JCS resources to assist with prescribed fire projects on non-Federal lands.

D. Training

The Complex will meet policy requirements of the Service prescribed fire qualification system. The Project Leader will be responsible for ensuring Complex personnel maintain qualifications necessary to implement the fire program. Minimum staffing requirement to support the Complex's prescribed fire program are listed in Table 18. Training will be obtained for Complex personnel in the area of fire effects and monitoring in

prairie ecosystems as the need arises in order to implement emerging Service ecosystem management strategies.

E. Complexity

The FireBase Complexity Analysis Guide and corresponding worksheets have been incorporated into the Region 6 prescribed burn plan format. Each individual burn unit will have a complexity analysis completed for it and attached as an element of the prescribed fire plan prior to the review and approval process. Plans submitted without this element will be returned unapproved by the Zone FMO.

Most burns on the Complex fall within the low and normal complexity categories as determined by the FireBase Complexity Analysis, requiring an RXB2 or RXB3 to manage. We anticipate very few burns being conducted on the Complex that would fall within the "High" complexity category requiring an RXB1. The average number of personnel required to conduct a burn on the Complex is 6-8, but some units may require 15 or more as specified in the individual burn plan.

F. Monitoring and Evaluation

Current monitoring and evaluation of prescribed burns is often limited due to funding and staffing limitations. Burn prescriptions and timing are normally based on past research (Higgins, Smith, Kruse, Kirsch, and others), thus detailed individual unit monitoring, especially on grassland units, is often not necessary.

Vegetation transects were established on 1/3 to 1/2 of refuge grasslands in 1995 and 1996. Additional transects were completed on smaller portions of grasslands between 1997 and 1999. Grassland physical structure, plant communities, and fuel loads are the main variables measured within these transects. Transects are monitored in the year prior to a planned burn, and again in the year after the burn for first order fire effects information. Many of the established first order fire effects transects have been incorporated into long term monitoring studies as well.

Pre burn evaluations within other grasslands is often limited to photo points, general photos or walk through transects. Burn day evaluations document temperature, relative humidity, windspeed, fine fuel moisture, rate of spread, flame length, smoke dispersal, % litter reduction, and % scorch of woody species. Post burn evaluations within these units are limited to photo points or general burn photos, and qualitative estimates of shrubs, noxious weed abundance and cover, and native species response.

Fire monitoring protocols for the Region have been established, as have monitoring protocols to be used within the Complex. Fire managers have the ability to use the protocol they feel is most applicable for their unit. The Complex has adopted the protocol developed by Grant, Madden and Murphy at J. Clark Salyer and Des Lacs Refuges in North Dakota. Plant species composition, % cover, and changes in stand structure will be monitored to determine burn response and long-term (multiple treatment) vegetation responses. Copies of the Region 6

monitoring guide and the Grant/Madden/Murphy monitoring technique are located in Appendix AA.

Complex staff have spent considerable time and effort to establish clear goals and objectives for managing habitats within the Complex. Prescribed fire is identified as an integral tool needed to meet these objectives. Although we already have a fundamental understanding of fire ecology in northern grasslands, site specific monitoring and evaluation of prescribed burns is essential in understanding fire as a tool to manipulate vegetation and landscapes. Refuge managers must be able to determine if 1) the prescribed fire program, and 2) individual fire treatments are meeting stated objectives. Information garnered from monitoring programs will be used to modify stated objectives, or the strategies used to meet those objectives. A sound monitoring approach will also allow managers to justify these objectives and strategies to potential critics both within and outside the Service.

The process of defining the needs and providing direction for station monitoring and fire research programs is listed below along with a short discussion of actions taken.

Prescribed Fire Monitoring and Evaluation Processes:

1. Conduct extensive background research to access available knowledge pertaining to fire ecology and fire effects within the various fuel models, plant and animal species and habitat types found on the Complex. It is the opinion of JCS staff that much of what a normal monitoring and evaluation program would show in this area has already been tested and documented within habitats of the northern Great Plains. Therefore, ongoing monitoring and evaluation should concentrate on examining aspects of fire ecology and fire effects for which little or no available information exists. Because of the diversity of habitats within the Complex, the sampling of plant communities and animal/habitat associations are yielding models that will help predict the outcome of habitat manipulations, and also prioritize where treatments should occur.
2. Utilize all available sources of information to establish an accurate picture of natural historic fire regimes for the Complex. Establish Complex prescribed fire programs based upon this knowledge to the extent possible.
3. Explore historic documentation to understand the natural occurring flora and fauna of the area prior to European settlement. Contrast vegetation changes since presettlement times and document factors implicated in these changes.
4. Combine the available knowledge concerning fire effects and fire ecology, historic fire regime and historic plant and animal species composition to determine the additional monitoring and evaluation needs for the Complex.
5. Develop management plans to outline the implementation of monitoring programs within the Complex.
6. Develop proposals and request funding for the various (level of intensity) monitoring programs from available sources.

7. Conduct funded monitoring and research, basing future management decisions on program results. Utilize program results to question additional fire ecology issues and prioritize fire treatments and schedules, alone or in combination with other treatments (e.g., grazing, haying, mechanical, etc.).

Extensive work has been accomplished in the process of developing and implementing a monitoring and fire research program at JCS. Ongoing and completed projects are described below.

Literature Review.

Refuge staff have conducted extensive searches of available databases to obtain as much available information relating to specific fire effects, fire ecology, historic fire regimes and pre-European habitat conditions.

Numerous fire databases have also been tapped including the Fire Effects Information System. Information requests have been made to university libraries and Federal and Canadian government sources as well. Much of the most current information dealing with fire effects in aspen forest and aspen parklands has been obtained from the Canadian Forest Service.

The Complex Biologist and Assistant Biologist spent a week in Washington DC in 1997 researching information in the Smithsonian Museum archives to obtain all available historic information on pre-settlement habitat conditions in this area. This included notes from expeditions of the 18th and 19th century, the public land survey records, and international boundary and railroad surveys that passed through the area.

The Complex was also fortunate to have had a biologist on staff from the mid 1930's through 1968. Numerous baseline habitat and animal investigations were completed during this period. A series of aerial photos have been acquired from the late 1930's to present, clearly showing vegetational changes occurring over this 60 year period.

From this review process, we can document dramatic changes in habitats within the Complex. The absence of fire and a period of long-term rest particularly during the 1960'-80's are strongly implicated in massive increases in woody plants (i.e., aspen, willow, choke-cherry, and western snowberry) and cool-season exotic plants (i.e., leafy spurge, Kentucky bluegrass, and smooth brome) into native grasslands.

GIS Database.

In 1995 work began on establishing baseline data for creating a GIS database for the Complex. GIS computer equipment and software was purchased in 1995 and 1996. In 1997 and 1998, the process of acquiring existing digitizing data within the refuge (USGS Topographic maps, refuge roads, section lines from the public land survey, and hypso-contour maps) was completed by contract. 8"/mile black-and-white aerial photographs were scanned and geo-rectified for the southern most portion of the refuge. This work will form

the basis of a vegetative cover layer, and is in the process of being digitized and attributed (in house) with a planned completion date of 2000. Digital soils data are not currently available and will have to be digitized or contracted out in Fiscal year 2000. The remainder of the refuge and selected WPA's will have 8"/mile aerial photographs scanned and georectified in the future. Three members of the JCS staff attended a training course on Arc-View programming in December of 1997 to facilitate this process. This GIS database will form the foundation of future fire monitoring, documentation, and planning on a landscape scale, and will greatly expedite the overall monitoring process.

Bird use of an aspen parkland landscape.

Woody plants continue to replace refuge grasslands. A wide range of habitats exist within the complex, ranging from large contiguous aspen forests at one end of the spectrum to large intact grasslands with little or no woody plant invasion on the other end. In between is a mix of woodlands and grasslands, where woodland blocks become smaller and more isolated the further they are from larger aspen forest. Within this matrix we sampled avian communities to determine what species are associated with these diverse habitats.

Initiated in 1995-96, this project determined that a mix of small forest patches within a grassland matrix appears detrimental to both forest and grassland bird species that depend on large blocks of habitat, many of which have shown steep population declines during the past 50 years. The continued degradation of grasslands by woody plant invasion will continue to displace grassland bird species of management concern (e.g., Baird's sparrow, Sprague's pipit, grasshopper sparrow, chestnut-collared longspur). From this work, we have developed two land management objectives: 1) stop further woody plant invasions into remaining refuge grasslands, and 2) eliminate woody plants and reclaim grassland habitat where possible. We have identified prescribed fire as the most practical tool to meet these objectives.

Effects of woody plant invasion on grassland bird nest/fledging success.

While the above project looked at avian occurrence within refuge habitats, it did not address avian productivity within this woodland/grassland matrix. In 1997 we initiated a two year project to test the effect that woody plants have on nesting grassland birds. The few previous studies conducted suggest that grassland birds have higher predation and nest parasitism rates when nesting closer to woody vegetation. In 1997, we located 350 grassland bird nests and followed their fates through hatching and fledging of young. For ducks and shorebirds, skunk predation was high. Passerine fledging rates were higher than for ducks and shorebirds, and small mammals (ground squirrels and mice) appeared to be the principal nest predators. Only one nest was parasitized by brown-headed cowbirds. We have not analyzed the data yet to test the effect of woody plants on nest/fledging success. 1999 will be the final year of the

project. Our results will be used to further set habitat management priorities and set objectives for the area.

Fire effects and fire behavior in aspen-parkland.

This is an ongoing monitoring program designed to give managers a better understanding of both fire effects and fire behavior related to prescribed burning of aspen parkland. Although some information exists on fire effects in aspen, little recorded data is available concerning these effects and fire behavior potential in dry sandy soils typical of aspen parkland in the Sandhills Management Unit.

Strong discrepancies have been noted by Complex staff between effects and behavior found in available scientific literature and those experienced since 1992 on actual prescribed fire treatments in this area. In order to better understand and manage this unit, additional information is necessary.

Monitoring involves measuring the physical and community structure of aspen plots prior to burning. This includes measure of fuel loads, indexes of ground, shrub, and overstory plants, etc. Burn intensity is measured by heat sensitive markers distributed throughout the unit prior to the burn that record maximum temperature at each specific location. Postburn responses are then correlated to burn day conditions and measures of preburn vegetation. Because burn plots are permanent, multi-year and multi-burn effects can be tracked.

Aspen stands receiving moderate to high intensity prescribed fire treatments in the spring and fall of the year may take up to 3 years to fully show fire effects on overstory plants. This is due to the fact that aspen stands often stem from a single underground root system, spreading by cloning rhizomes. Destruction of the outer cambium layer by heat girdling destroys the phloem, blocking the above ground portions of the clone (stems and leaves) from re-supplying the root storage system with nutrients garnered by photosynthesis. The inner xylem layer is not harmed by fire, thus the root system is able to continue supplying the trees with sufficient water and nutrients to survive. It may take three or more years to exhaust the stored nutrients in the root system. Because aspen suckers prodigiously, multiple burns repeated over decades will be needed to reduce or eliminate many clones.

Due to the atypical dry sandy soil conditions in which these aspen stands are growing, fire behavior characteristics have proven to be quite different than those encountered elsewhere in North America. These factors have caused control problems on both wildland fire and prescribed fire occurrences in the past. The more we understand about how this fuel model reacts to fire, the better we will be able to safely and efficiently manage it.

Effects of prescribed fire regimes on grassland passerine and small mammal populations.

Little work has been done to test the effect of fire on

grassland bird and small mammal populations; and the work to date has primarily focused on species occurrence or abundance in grasslands in years following a fire treatment. Almost no data exist on the effects of fire on altering grassland bird nest/fledging success. Long-term absence of fire in northern grasslands often result in the loss of endemic grassland bird species due to increases in woody plants, exotic plants, and residual vegetation over time. In addition, nest/fledging success of these species may be altered following burns, because burning may affect associated populations of nest predators, nest parasites, or resource competitors. In 1998 we began a five year project to test these effects. We will examine how bird and small mammal communities change in the years following a fire, and also how grassland bird productivity is affected by changes in vegetation structure and small mammal. This information is expected to provide predictions about the use of fire as a tool in mixed-grass prairie grasslands of North Dakota.

As we learn more and the prescribed fire program grows on the Complex, we will undoubtedly have additional questions that will need to be answered by monitoring and research.

G. Prescribed Fire Impacts

Environmental impacts of the prescribed fire program are discussed in previous sections of this Fire Management Plan. An Environmental Assessment addressing prescribed fire is included in the plan and can be found in Appendix B.

Social and economic impacts are discussed in this section. The Complex covers a five county area and does not contain any of the state's larger metropolitan areas. There are numerous small towns and communities within the Complex, but none with populations over 10,000. The main industry in the area is agriculture, and the majority of other industry is agriculture related.

The overall social and economic environment can be affected by how the habitats on the Complex are managed. Often the effect is local, but when all Complex land units are combined, the effect is more widespread. Habitat management is often accomplished by authorizing local farmers to hay or graze on WMD and Refuge units. This is viewed as positive both socially and economically. Local farmers and ranchers prefer to hay or graze lands on the Complex rather than seeing them "go up in smoke".

The majority of neighbors accept the fact that the Federal government owns land for waterfowl production, and most have a general appreciation for the value of wildlife. However, these neighbors expect the land to be managed for wildlife and not ignored. If Complex lands are ignored, allowing the habitat condition to decline in quality and noxious weeds to increase, opinions quickly become negative. If the land is managed for the best interest of wildlife and habitat conditions are maintained, these opinions become positive and wildlife benefits both on and off Service managed lands. Prescribed fire is one of the tools necessary to manage Complex lands.

The majority of recreational uses on the Complex are centered

around hunting and bird watching. Many of the Complex lands offer some of the best waterfowl hunting and birding in the nation. Hunters and birders come from all over the United States to visit the area, and the Complex is currently listed as one of the 50 best birding areas in North America. Annual visitation is estimated at 100,000 per year. Occasionally hunters and birders may comment negatively when they see black, burned areas, but in general most of these people understand the need to utilize fire on the Complex after a short discussion with refuge staff. Negative impacts to the local economy could result if habitat becomes less productive and wildlife populations decrease. The number of hunters and birders traveling to the area could decrease, depriving the local economy of recreation dollars. As shown in this plan, increased use of prescribed fire will increase wildlife populations, thus providing an economic benefit to the area.

Escaped prescribed fires pose a threat to adjacent life and property, but proper planning and prescriptions, qualified personnel, and contingency planning can mitigate this threat. Temporary air quality impacts from smoke may occur, but are generally mitigated by the fuel type (light flashy fuels), small burn unit size, and adherence to prescription parameters.

Negative public opinion for the prescribed fire program will be addressed through proactive public information and education efforts. Depicting the positive effects of prescribed burning should have a limiting effect on negative opinions. See **Section XIII** for specific actions.

H. Reporting and Documentation

Individual prescribed burn plans, DI-1202 fire reports, and fire behavior and effects monitoring data sheets will be the primary documents used to record prescribed fire information. Burn plans document state air quality requirements, personnel, costs, fire behavior, weather, and burn critique information. DI-1202 forms will be completed and entered directly into the FMIS fire occurrence system within 3 days of the fire being declared out.

X. AIR QUALITY

See previous **Section III. M.**

XI. FIRE RESEARCH AND MONITORING

The Complex will continue to encourage fire related research projects on Service lands where research operations will not conflict with unit management objectives. Current fire research is discussed in previous sections of this plan, see **Section IX, part F.**

XII. PUBLIC SAFETY

Firefighter and public safety will always take precedence over property and resource protection during any fire management activity. Firefighter safety is covered throughout this plan. This section will deal with public safety.

Fire fronts in grass fuels are fast moving and dangerous. Entrapment is a threat to sports people and visitors who may be in the area, especially on the south end of the JCS NWR. Neighbors who initiate their own suppression actions lack proper training, equipment, and communications and may be at risk. The Complex staff will attempt to keep the fire scene (wildfire and prescribed fire) clear of people except for Service firefighters and cooperating volunteer fire departments. Burn areas are closed to the public during prescribed fires.

Smoke from a wildfire or prescribed burn could impair visibility on roads and become a hazard. During wildfires the IC is responsible for contacting local law enforcement agency to manage traffic hazards from smoke. Smoke from prescribed fires is part of the burn prescription and is the responsibility of the burn boss. Actions to manage smoke include: use of road guards and pilot car, signing, altering ignition techniques and sequence, halting ignition, road closures, requesting traffic control assistance from the county Sheriff or State Police, or suppressing the fire.

Wildfires which might escape from Service lands and spread to inhabited private property are also a concern. The IC is responsible for warning and evacuating the public from potentially dangerous wildfires. Additionally the Complex will continue, where practical, to use prescribed fire to manage hazard fuels in high risk areas.

XIII. PUBLIC INFORMATION AND EDUCATION

Informing the public is an important part of all aspects of a wildland fire management program including preparedness, suppression, prevention, and prescribed fire, and is also part of the FWS mission. During wildfires the IC is responsible for providing fire information to the press and the public. The IC may delegate this task as needed, or the Complex may pursue training a fire information officer to perform these duties if deemed necessary in the future.

Informing the public is a vital element of the prescribed fire program. The following actions will be used to promote the prescribed fire program to the public:

- press releases
- attendance at local volunteer fire department meetings
- including the prescribed fire message in Complex interpretive publications and materials
- personal contact with bystanders during prescribed burns
- following prescribed burn plans and preventing escapes
- developing a quantitative fire effects monitoring program and sharing results with the public

Each prescribed burn plan approved for the Complex contains a section on public and media contacts. Prior to conducting any Complex burn, local RFD's, County Sheriff offices, and any local resident within a mile of the burn unit is contacted and informed of the burn project. Informational articles are submitted to local newspapers yearly prior to the start of the prescribed burn season. Articles and interviews are also pursued during the wildfire season and typically address current fire danger, or contain positive information concerning Complex staff assisting on interagency fire assignments out of the area. These types of articles promote pride in the Complex fire management program within the local community, especially since the backbone of our firefighting staff were born and raised in the area.

Fire prevention articles and interpretive tours to school groups are also utilized, and interpretive bulletin boards concerning fire management operations are periodically installed at Complex information kiosks. Fire management staff have developed a positive relationship with area Rural Volunteer fire departments by conducting basic S-130/S-190 fire training for these departments during the winter months when most RFD personnel are able to attend. In early 1999 Complex fire staff instructed 18 members of local RFD's in basic wildfire suppression operations. Nearly all of these individuals took and passed the physical fitness tests for wildfire suppression and/or prescribed burning in the spring of 1999, and several of these individuals have since been hired as emergency firefighters in support of the Complex prescribed fire program.

XIV. ARCHAEOLOGICAL/CULTURAL/HISTORICAL RESOURCES

Fire management activities within the Complex will be implemented in accordance with the regulations and directions governing the protection of cultural resources as outlined in Departmental Manual Part 519 (519M), Code of Federal Regulations (36 CFR 800), the Archeological Resources Protection Act of 1979, and the Archeology and Historic Preservation Act of 1974. All fire management activities will be in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

Cultural resources are scattered throughout the Complex as the area was heavily used by Native Americans. Historical records indicate that the last inhabitants of the area before European settlement were the southern Assiniboine tribes (Denig 1961) who now reside in Canada. Many "tipi ring" sites are known to exist on Refuge lands where Native Americans occupied the area either in permanent or transient camps. These locations are well documented and area burn plans address measures required to secure them from potential fire damage.

An archaeological inventory of the Souris River floodplain was completed in 1989 as part of the Souris Basin Flood Control Project. North Dakota site files do not record any cultural resource sites within the floodplain boundaries. No historic or prehistoric resources have been documented within the WMD. This area encompasses over 29,000 acres of grasslands and has the possibility of containing cultural resources.

Currently wildfires are suppressed. However, historical evidence demonstrates that natural and artificial fires were regular events in the mixed grass prairie. In recent years, fire suppression has resulted in a steady buildup of grassland and riparian fuel loads, colonization of disturbed soils by invading plant species, and natural vegetative growth, increasing the chances of an uncontrolled wildfire that could potentially endanger the Refuge's cultural resources as well as surrounding private property. Although over 20 years of fire ecology research allows ecologists to predict impacts on biotic communities, the possible impacts of prescribed burning (and wildfires) on archeological resources are not well known.

Heat from grassland fires rarely penetrates more than a centimeter into the soil. Impacts of grassland fires on artifacts and other materials in subsurface settings will be negligible even if they are buried only a centimeter or less below the ground surface (Wright and Bailey, Vogl). Knudsen (Fire in Ecosystem Mgmt. 1996) states that architectural surfaces can be damaged at temperatures above 300 degrees centigrade, lithics (stone tools) above 500 degrees C, Ceramics (pottery) above 600 degrees C, and bone above 400 degrees C.

Research conducted by Saylor, Seabloom, and Ahler at Knife River Indian Villages National Historic Site in North Dakota indicated that fire related impacts to buried artifacts are negligible, but effects on surface-exposed artifacts may be significant depending on fire conditions, artifact type, and size (Seabloom et al 1991). Potential damage may include scorching,

fracturing, charring, and spalling. Secondary impacts are created by erosion and vandalism. The severity of fire related effects can be controlled and diminished to some degree by controlling the fireline intensity at the time of the burn. The conclusions drawn by the Knife River studies have received criticism by fire management professionals due to the incredibly high temperatures and long fire durations indicated during the study burn. These temperatures and durations far exceed anything normally seen in this fuel type (fuel model 1), and are greatly outside the parameters displayed by the BEHAVE fire behavior prediction runs for similar conditions.

Given the historic frequency of fire in this ecosystem, which has been established at anywhere from 3 to 10 years (Davis & Mulch 1996, Pyne 1982 & 1996), any surface and subsurface artifacts would likely have undergone a minimum of at least 6-10 fire disturbances since Europeans arrived in the second half of the 19th century. Based upon this fire frequency research, prior to European settlement, this area received an average of 10 to 30 fire disturbances per century. It is logical to imply that most potential fire damage to ancient Native American artifacts existing on Complex lands may have occurred well before the area came under Service management.

Impacts to archeological resources by fire activities vary. The four basic sources of damage are (1) fire intensity, (2) duration of heat, (3) heat penetration into soil, and (4) suppression actions. Of the four, the most significant threat is from equipment during line construction for prescribed fires or wildfire holding actions (Anderson 1983).

Fireline construction that causes soil disturbance including heavy equipment use and handline construction can damage artifactual remains by displacement, subsurface exposure or by covering sites with above normal fuel loadings (jack piles) which can obscure artifacts and also build up fuels that can create abnormally high heat levels on subsequent fires. Concentration of people on sites during suppression activities can cause increase artifact poaching or soil compaction (fire camps etc.). Mop-up damage can occur from digging up burning roots or hydraulic mining with water, rehabilitation techniques such as waterbarring, berm leveling, and reseeding can also cause damage. Even retardant use can cause damage to artifacts by exposure, corrosion, or direct force (standing structures) (Knudsen, 1996).

Fortunately, typical suppression tactics in this fuel type consist of direct attack with engines or indirect attack by backing off the main fire and utilizing a burn out operation off a natural or human made barrier (lake, river, road). Although the practice of initial attack fireline construction by discing is commonplace on state and private lands around the refuge, it is an extremely uncommon practice on Complex lands, and would only be used as a last ditch method to protect human life or property.

A high percentage of Complex lands were at one time in cultivation. On these areas, damage to above ground artifacts can be assumed to be of minimal importance from current fire operations based upon damage that likely has already occurred from the previous land use.

The following actions will be taken to protect archeological and cultural resources: on the Complex:

- ! Files and records of cultural resources should be consulted by the staff when planning prescribed burns, developing pre-attack plans, and performing other preparedness actions. The potential for adverse impacts to cultural resources will be evaluated prior to prescribed burning and in the selection of fire suppression strategies during wildfires.
- ! The Regional Archeologist will be contacted during the development phase of the burn plan writing process when cultural resources are suspected or known to exist in the project area.
- ! The North Dakota State Historic Preservation Officer (SHPO) will be contacted by the Regional Archeologist when it is known a planned management action may impact archeological or cultural resources. The SHPO has 30-days to respond. The Refuge will follow any programmatic archeological/cultural resources management plan that may be implemented in the future.
- ! Low impact wildfire suppression tactics (cold-trailing, use of foam/wet-water/water, use of natural and manmade barriers, change in vegetation, mowing, etc.) will be used to the fullest extent possible. Line construction for prescribed fire activities will follow the same principle. Maps indicating the known location of significant cultural resources will be consulted prior to laying out burn units, and whenever possible, before constructing fireline to halt the spread of a wildfire.
- ! Prescriptions for management ignited prescribed fires will take into account the presence of known cultural sites. Cooler fires with short residence time will be used in areas containing known cultural sites, whenever possible.
- ! Known surface sites will be marked, protected, and excluded from the burn, if possible. Foam will not be used in areas known to harbor surface artifacts.
- ! The use of mechanize equipment within the refuge must be approved by the Refuge Manager on a fire by fire basis, and the use of these resources will be considered in the approval process for any planned management actions. When the use of heavy equipment is authorized, its use will be monitored.
- ! The location of sites discovered as the result of fire management activities will be reported by the ROS to the Regional Archeologist.
- ! Rehabilitation plans will address cultural resources and will be reviewed by the Regional Archeologist.

XV. FIRE CRITIQUES AND PLAN REVIEW

This Fire Management Plan will be reviewed annually (no later than November 30) to ensure the fire program advances and evolves with the Service and the mission of the Complex.

Wildfires will be critiqued by the IC. The RFMC will conduct formal fire critiques in the event of:

- significant injury/accident
- significant property or resource damage
- significant safety concerns are raised
- an extended attack is necessary

Prescribed fires will be critiqued by the burn boss and documented in the burn plan. The RFMC will conduct a formal critique in the event of:

- significant injury/accident
- an escape prescribed fire occurs
- significant safety concerns are voiced
- smoke management problems occur

Approximately once every four years a formal fire management review will be conducted on the Complex. This review will typically be conducted by the Zone FMO, RFMC and Regional Prescribed Fire Specialist and will follow the current format as outlined by the Regional Fire Office.

XVI. CONSULTATION AND COORDINATION

All fire management program activities will be implemented in cooperation and coordination with the State of North Dakota, North Dakota Department of Environmental Health, and rural fire protection districts. Other agencies and organizations will be consulted with as needed.

General program consultation and coordination will be sought from the North Dakota Zone FMO, the Regional Fire Management Coordinator, Regional Prescribed Fire Specialist, Service staff located at the National Interagency Fire Center (NIFC) in Boise, Idaho, cooperating agencies within the North Dakota Fire Council, North Dakota Interagency Dispatch staff, and fire managers and fire ecologists/biologists throughout the northern great plains.