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ECOLOGICAL EVALUATION OF THE POTENTIAL CEDAR KNOLL RESEARCH NATURAL AREA WITHIN THE THUNDER BASIN NATIONAL GRASSLAND, WESTON COUNTY, WYOMING

Prepared for
Nebraska National Forest,
USDA Forest Service

By

George P. Jones

Wyoming Natural Diversity Database
The Nature Conservancy
1604 Grand Avenue
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INTRODUCTION

The potential Cedar Knoll Research Natural Area (RNA) is located in the Cheyenne River Basin of northeastern Wyoming. The area includes rolling hills and broad draws with grassland vegetation, and ponderosa pine woodlands on outcrops of resistant shales and sandstones. The potential RNA is in the Thunder Basin National Grassland and is currently used primarily for livestock grazing.

In 1996, The Nature Conservancy entered a contract with the USDA Forest Service, Nebraska National Forest, to prepare ecological evaluations of areas in the Thunder Basin National Grassland and other national grasslands for use by the Forest Service in examining the suitability of the areas as research natural areas. The evaluation of the Cedar Knoll area was done by the Wyoming Natural Diversity Database. This report presents the results of that evaluation.

Land Management Planning

In 1996, an interdisciplinary team from the Thunder Basin National Grassland selected the Cedar Knoll area as a potential RNA for possible analysis during revision of the Land and Resource Management Plan. This ecological evaluation is intended to aid the Forest Service staff in that analysis.

OBJECTIVES

One of the primary objectives of research natural areas is to "...preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geologic and similar natural situations..." (Forest Service Manual 4063.02).

The objectives of a Cedar Knoll RNA would be to 1) maintain a reference area for (a) monitoring effects of resource management techniques and practices applied to similar ecosystems, (b) comparing results from manipulative research, and (c) determining range of natural variability; 2) protect elements of biological diversity; 3) provide a site for non-manipulative scientific research; and 4) provide on-site and extension educational opportunities.

PRINCIPAL DISTINGUISHING FEATURES

The principal distinguishing features of the potential Cedar Knoll RNA are rolling hills and broad, shallow valleys with grassland of the western wheatgrass/green needlegrass association; stands of prairie cordgrass in and along the channels of ephemeral streams; and ponderosa pine/sun sedge woodlands on outcrops of resistant shale and sandstone bedrock.

LOCATION

The potential Cedar Knoll RNA is located within the Thunder Basin National Grassland of northeastern Wyoming (Figure 1), at the northern edge of the Cheyenne River Basin. The approximate center of the potential RNA is at latitude 47°07'45"N and longitude 104°30'00"W.

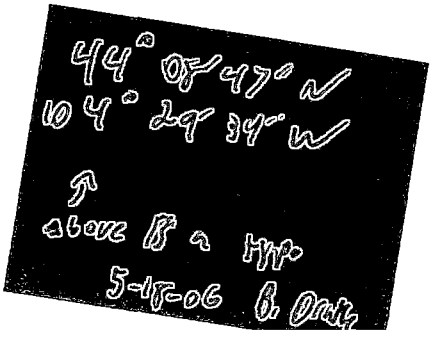
The potential RNA includes all or parts of the following sections: Township 48 North, Range 64 West (6th Principal Meridian), Sections 13, 14, 23, 24, 25, and 26.

Boundary (See Figure 2).

The proposed boundary of the potential RNA follows pasture boundaries and a road. Starting at the southwestern corner of the potential RNA, at a point on National Grassland Road 913 in the NE1/4 NW1/4 Sec 26 (T48N, R64W), the boundary runs north ca. 1.6 mile (2.6 km) and northeast ca. 1.2 mile (1.9 km) along Road 913 to a point in the SW1/4 NW1/4 Sec 13 (T48N, R64W) on the west side of Cedar Knoll; thence northeast ca. 0.4 mile (0.6 km) across Cedar Knoll to a pasture fence in the SE1/4 NW1/4 Sec 13; thence southeast ca. 0.7 mile (1.1 km) along the pasture fence to a point in the SW1/4 SE1/4 Sec 13; thence south ca. 1 mile (1.6 km) along the pasture fence to a point in the NW1/4 SE1/4 Sec 24 (T48N, R64W); thence west ca. 0.5 mile (0.8 km) along the pasture fence to a point in the SW1/4 SW1/4 Sec 24; thence southwest ca. 0.5 mile (0.8 km) along the pasture fence to a point on the East Fork of Iron Creek in the NW1/4 NW1/4 Sec 25 (T48N, R64W); thence northwest ca. 0.1 mile (0.16 km) along the pasture fence to a point in the NE1/4 NE1/4 Sec 26; thence south ca. 0.1 mile (0.16 km) along the pasture fence; thence west ca. 0.6 mile (1 km) to the starting point.

Area

The total area of the potential Cedar Knoll RNA is ca. 1488 acres (602 ha).



Elevation

The elevation of the potential Cedar Knoll RNA ranges from ca. 4390 feet (1338 m) on the southern boundary to 4749 feet (1447 m) on Cedar Knoll at the northern end.

Access

The potential Cedar Knoll RNA may be reached on public roads. From the intersection of Wyoming Highway 116 with National Grassland Road 913 ca. 10 miles (16 km) north and east of Upton, Wyoming, travel south on Road 913 ca. 2 miles (3.2 km) to the western side of Cedar Knoll and the northern edge of the potential RNA. Road 913 runs ca. 1.2 mile (1.9 km) along the area's northern boundary and ca. 1.6 mile (2.6 km) along the western boundary and provides ready access to the area.

Ecoregion

The potential Cedar Knoll RNA lies within the Great Plains-Palouse Dry Steppe Province, Northwestern Great Plains Section, Pierre Shale Scablands Subsection (331Fb) of the ecoregion classification of Bailey et al. (1994) (Freeouf 1996).

Maps

USDA Forest Service 1/2 inch = 1 mile scale map of the Thunder Basin National Grassland.

USDI Geological Survey 7.5 minute topographic Quadrangle Maps: Sheldon Creek, Wyo.; Clay Spur, Wyo.; Upton East, Wyo.; and Arrowhead Reservoir, Wyo.

AREA BY COVER TYPES

The Vegetation

The potential Cedar Knoll RNA contains the following plant associations from Johnston (1987). Synonyms are shown in Appendix 4. Descriptions from specific locations are given in Appendix 2.

Upland vegetation

Two plant associations form the upland vegetation of the potential RNA. Stands of the ponderosa pine/sun sedge association grow on sandstone and resistant shale outcrops in the southwestern third of the area and along the northeastern boundary. Ponderosa pine forms a patchy tree layer with canopy cover averaging 25% to 30%. The trees are typically 8 inches to 12 inches (20 cm to 30 cm) dbh and 30 feet to 50 feet (10 m to 15 m) tall. Rocky Mountain juniper forms a patchy subcanopy 8 feet

to 10 feet (2.5 m to 3 m) tall with overall cover of 25%. Patches of pine saplings are common. In the stands in the southwestern part of the area, the main understory species are sun sedge and western wheatgrass, and small amounts of big bluegrass, Kentucky bluegrass, big bluestem, bentgrass, western yarrow, and exotic brome grass (Japanese brome or corn brome) are present. The understories in the northeastern part of the area consist of sun sedge and western wheatgrass (the most common species), with patches of little bluestem and prairie muhly on rocky hillsides, and patches of exotic sweetclover in openings.

The western wheatgrass/green needlegrass vegetation grows on slopes and ridgetops and in draws throughout the area. Western wheatgrass generally contributes more cover than any other species, and green needlegrass is present in substantial amounts (and often contributes nearly as much cover as does the wheatgrass); sun sedge, blue grama, prairie muhly, and prairie junegrass often are present and may contribute substantial cover. Exotic species have swamped much of this vegetation type and now codominate (with western wheatgrass) or dominate the vegetation: annual brome (probably Bromus japonicus) and sweetclover (Melilotus sp.) on slopes and in swales, and Kentucky bluegrass (Poa pratensis) in draws. Wyoming big sagebrush often is present but contributes > 10% cover only in small patches in draws.

Riparian vegetation

Prairie cordgrass strongly dominates the vegetation in bands to ca. 30 feet (9 m) wide in channels of the larger ephemeral streams. This vegetation of the prairie cordgrass association merges into the western wheatgrass/green needlegrass association on the lower stream terraces next to the channel. Small areas of the inland saltgrass/western wheatgrass association, dominated by those two species and containing big bluegrass and exotic sweetclover, occur on higher terraces of some streams. A stand of the hardstem bulrush/sedge association was noted in a stream channel downstream from one of the dams in the area.

Area by Type

Complexes of communities were mapped on a 1:24,000-scale topographic map using aerial photos and field reconnaissance, and the area of each complex in the potential RNA was estimated from the maps. The vegetation maps show complexes because delineating stands of individual communities was impossible. The plant community types from Johnston (1987) listed in Table 2 are cross-referenced to plant community types from Thilenius et al. (1995) and The Nature Conservancy (1997) in Appendix 4. The relative importance of each plant association within each complex is indicated in the legend for Figure 3 (M = major association, m = minor association).

Table 1. Areas of Kuchler Types (Kuchler 1966) in the potential Cedar Knoll RNA. See Figure 2.

Cover Type	Acres	Hectares
Black Hills pine forest (16) (Pinus)	529	214
Wheatgrass-needlegrass (59) (Agropyron-Stipa)	959	388

Table 2. Areas of plant associations (Johnston 1987) in the potential Cedar Knoll RNA. See Figure 3. See synonyms in Appendix 4.

Plant association	Acres	Hectares
Ponderosa pine/Sun sedge	529	214
Western wheatgrass/Green needlegrass	905	366
Inland saltgrass/Western wheatgrass	4	2
Prairie cordgrass	45	18
Hardstem bulrush/Sedge	4	2

PHYSICAL AND CLIMATIC CONDITIONS

Physical Setting

The potential Cedar Knoll RNA is located in the northern Cheyenne River Basin, on the broad divide between that basin to the southeast and the Belle Fourche River Basin to the northwest. The area includes the headwaters of the drainage of East Iron Creek, an ephemeral stream that flows south out of the area. Slopes in the potential RNA face south, east, and west. The terrain in the central and southern parts of the area consists of gently-rolling hills with broad draws $\leq$ 10 feet (3 m) deep. In the northwestern part of the potential RNA, on the Cheyenne River-Belle Fourche River divide, the hills are steeper and the draws ca. 50 feet (15 m) deep. The northeastern part of the area includes a low, southwest-facing escarpment topped by a flat plateau.

DESCRIPTION OF VALUES

Vegetation Types

See Table 1 for a list of the Kuchler (1964) vegetation types present in the area and the estimated acreage of each, and Table 2 for a list of the plant associations present and the estimated acreage of each.

Flora

Threatened, Endangered, and Sensitive Plant Species

No federally listed Threatened or Endangered plant species, or species on the USDA Forest Service Region Two Sensitive Species List (Estill 1993) are known from the potential Cedar Knoll RNA. The following species of conservation interest, which has no federal status, may occur in the area.

Aristida oligantha (Prairie three-awn grass)
Heritage Rank: G5/S1. (Heritage ranks are explained in Appendix 3.)
Federal Status: None
Geographic Range: Atlantic Seaboard west to the Great Plains; Oregon, California, Arizona (Hitchcock 1950).
Habitat: Dry, sparsely vegetated grasslands and woodlands.
Comments: This annual grass (occurrence #001) is known from a site ca. 4.5 miles (7 km) southwest of the potential RNA, on sparsely-vegetated shale. Suitable habitat occurs in the potential RNA and the species may also grow there.

Plant Species List

The following species were identified during field work in the potential Cedar Knoll RNA.

Table 3. Vascular Plants of the potential Cedar Knoll RNA. Nomenclature for scientific names is based on Dorn (1992). Family acronyms are based on Weber (1982). Family taxonomy follows Dorn (1992).

Scientific Name	Common Name	Family
	TREES	
Juniperus scopulorum	Rocky Mountain juniper	PIN
Pinus ponderosa	Ponderosa pine	PIN

Table 3 (continued). Vascular Plants of the potential Cedar Knoll RNA.

Scientific Name	Common Name	Family
	SHRUBS & DWARF SHRUBS	
Artemisia tridentata var. wyomingensis	Wyoming big sagebrush	AST
	GRAMINOIDS	
Agrostis stolonifera	Redtop	POA
Andropogon gerardii	Big bluestem	POA
Andropogon scoparius	Little bluestem	POA
Aristida purpurea var. fendleriana	Purple three-awn	POA
Beckmannia syzigachne	American sloughgrass	POA
Bouteloua curtipendula	Sideoats grama	POA
Bouteloua gracilis	Boue grama	POA
Bromus japonicus	Japanese brome	POA
Bromus tectorum	Cheatgrass	POA
Buchloe dactyloides	Buffalo grass	POA
Calamovilifa longifolia	Prairie sandreed	POA
Carex pensylvanica	Sun sedge	CYP
Elymus smithii	Western wheatgrass	POA
Elymus spicatus	Bluebunch wheatgrass	POA
Koeleria macrantha	Prairie junegrass	POA
Muhlenbergia richardsonis	Mat muhley	POA
Oryzopsis micrantha	Small-flowered ricegrass	POA
Poa compressa	Canada bluegrass	POA
Poa pratensis	Kentucky bluegrass	POA
Poa secunda	Sandberg bluegrass	POA
Stipa viridula	Green needlegrass	POA
	FORBS	
Achillea millefolium	Common yarrow	AST
Alyssum alyssoides?	Pale alyssum	BRA
Antennaria microphylla	Small-leaved pussytoes	AST
Artemisia frigida	Fringed sagewort	AST
Aster falcatus	Creeping white aster	AST
Cerastium arvense	Field chickweed	CRY
Cirsium arvense	Canada thistle	AST
Cirsium pulcherrimum	Pretty thistle	AST

Table 3 (continued). Vascular Plants of the potential Cedar Knoll RNA.

Scientific Name	Common Name	Family
Collomia linearis	Narrowleaf collomia	PLM
Comandra umbellata	Bastard toadflax	SAN
Geum triflorum	Prairie smoke	ROS
Gutierrezia sarothrae	Broom snakeweed	AST
Linum lewisii	Blue flax	LIN
Melilotus officinalis	Yellow sweetclover	FAB
Opuntia polyacantha	Plains pricklypear	CAC
Oxalis dillenii	Dillen's oxalis	OXA
Pediomelum argophyllum	Silver scurfpea	FAB
Plantago patagonica	Indian wheat	PTG
Ratibida columnifera	Plains coneflower	AST
Sphaeralcea coccinea	Scarlet globemallow	MLV
Yucca glauca	Soapwell, yucca	AGA
	FERN ALLIES	
Selaginella densa	Compact spike-moss	SEL

Fauna

Threatened, Endangered, and Sensitive Vertebrates

A bald eagle winter roost is known from the northern boundary of the potential RNA, in the SW1/4 NW1/4 Section 3.

Animal Species List

The field work in the potential Cedar Knoll RNA did not include identification of the animal species present.

Geology

Bedrock in the potential RNA is Cretaceous-age sedimentary rock. The soft, fissile shale, of the Skull Creek Formation underlies most of the area, and the sandstone of the Inyan Kara Group crops out in the northeastern part of the potential RNA (Love and Christiansen 1985).

Lands

The potential Cedar Knoll RNA is national grassland. Adjoining lands are a mix of national grassland and private land.

SUITABILITY FOR RESEARCH NATURAL AREA SELECTION

An area is suitable for designation as a research natural area according to how well it meets four criteria: quality, condition, viability, and defensibility (Andrews 1993). Each criterion is briefly defined below, and the information collected during field work that is pertinent to each criterion is described.

Quality: the degree to which the potential RNA represents the range in variability within the ecosystem types that it contains.

The western wheatgrass/green needlegrass association grows on a variety of slopes and aspects and exhibits a broad range in the amount of the dominant species and the identity of the associated species present; hence the potential RNA apparently represents this type as it occurs in the region. The ponderosa pine/sun sedge association also grows on a variety of sites and exhibits a range in structure of the tree layer and composition of the understory. The ubiquity of clumps of pine saplings in the woodland suggests that the tree overstories will become more dense over time, perhaps as a result of fire suppression. Assuming that this is true of ponderosa pine woodlands throughout the region, then the stands in the potential RNA adequately represent the type as it occurs in the region.

The stands of the prairie cordgrass association cover only a small part of the potential RNA, which is typical of this type in northeastern Wyoming (Jones and Walford 1995), and the potential RNA is a good representative of this type as well. Given the small size of the inland saltgrass/western wheatgrass association, and the wide distribution of this type in the region (Jones and Walford 1995), the potential RNA should not be considered a good representative of the type. The degree to which the potential RNA represents the hardstem bulrush/sedge association, which also occupies a very small area, is difficult to judge.

Condition: the degree to which the potential RNA has been altered from presettlement conditions.

The potential RNA has been altered from its presettlement condition by the introduction of exotic species, the presence of structures such as roads and reservoirs, and changes in the ecological processes that shaped the area's ecosystems. These causes of change are interrelated and a complete discussion is impossible; the information here is largely restricted to observations made during field survey.

-- Exotic species

Three exotic plant species are major parts of the vegetation in the potential RNA. An annual or biennial brome grass, Japanese brome (Bromus japonicus) or corn brome (B. squarrosus), is widespread in the western wheatgrass/green needlegrass vegetation, and patches up to several hundred square meters in area dominated by this species (often to the virtual exclusion of other plants) are common. Kentucky bluegrass also is widespread in the western wheatgrass/green needlegrass association, and this species codominates much of the type with western wheatgrass in the draws. Sweetclover (probably yellow sweetclover, Melilotus officinalis) is the third widespread species, growing in the western wheatgrass/green needlegrass vegetation and in the ponderosa pine/sun sedge woodland in the northeastern part of the area. Although sweetclover does not dominate the vegetation to the degree that the exotic grasses do, it contributes substantial cover to patches of several hundred square meters throughout the potential RNA.

Smaller amounts of two other exotic plants were noted during the 1996 field work as well. Canada thistle (Cirsium arvense) was found growing in a patch covering ca. 300 square yards (250 square meters) and containing ca. 200 stems below one of the reservoirs. This species probably is also present elsewhere in the riparian zone. Alyssum (probably Alyssum alyssoides), an annual forb, was observed in the stands of the western wheatgrass/green needlegrass vegetation on rocky soils.

-- Structures (Figure 3)

Six dams and reservoirs have been constructed in the draws of the potential RNA. Two-track roads run along ridges through the western half and the southeastern part of the area. Barbed-wire fences run along the eastern and southern boundaries and part of the northern boundary. A dilapidated cabin covering several hundred square feet, and a smaller outbuilding, are located next to the dam near the southern boundary of the area.

The structures with the greatest effect on the area probably are the reservoirs, which create small wetlands in otherwise-ephemeral watercourses, and concentrate livestock.

During 1996 field work, 10 to 20 stumps from cut ponderosa pines and Rocky Mountain junipers were noted in one ponderosa pine woodland in the west-central part of the potential RNA. These stumps were from poles of a size suitable for fence posts.

-- Ecological processes

Grazing by large mammals was undoubtedly a major ecological factor influencing the composition of the vegetation in the

Cheyenne River Basin before white settlement. Bison abounded in eastern Wyoming (Dorn 1986, Long 1965), but free-ranging bison were gone from the area by the latter 19th century. Elk were present in the Cheyenne River Basin (Dorn 1986) and the nearby Black Hills (Long 1965) before white settlement, but probably were much less abundant on the plains than were bison (Long 1965) and hence had less influence on the ecosystems. Elk now inhabit parts of the Cheyenne River Basin and the Black Hills, but they probably are less common in the plains to the southwest of the potential RNA than they were during presettlement times. Pronghorn were abundant in eastern Wyoming in presettlement times (Long 1965) and still are common.

Domestic livestock graze the potential RNA now and may influence the composition of the vegetation, but the extent to which domestic livestock have replaced bison and elk as an ecological factor is unclear. Small areas with obvious signs of concentrated livestock use were noted during the 1996 field work only around reservoirs.

Black-tailed prairie dogs (Cynomys ludovicianus) exert a strong influence on the species composition and the processes in grassland ecosystems in the Great Plains (Coppock et al. 1983). The species occurs throughout eastern Wyoming (Clark and Stromberg 1987). The gently-rolling grasslands in the potential Cedar Knoll RNA appear to provide suitable habitat for this species, so prairie dogs probably used the area at least intermittently before settlement.

Outbreaks of grasshoppers are a disturbance known to have large effects on the grasslands of the Great Plains (Knight 1994, Chapter 5). Although no information was encountered regarding grasshoppers in the potential Cedar Knoll RNA or the immediate area, grasshopper outbreaks are known from northeastern Wyoming (Allred 1941) and undoubtedly affected the potential RNA. The effects that grasshopper control programs have had on the potential RNA are unknown.

No signs of fire were noted in the potential RNA during 1996 field work, and the degree to which fire suppression (the general policy in the region) has affected the ecosystems of the potential Cedar Knoll RNA is unclear. Information about fire in the region, however, is relevant. Fires are known to have burned in the Cheyenne River Basin before white settlement (Dorn 1986), and although fire suppression is the general policy in the region, wildfires still burn in the Basin. Hansen and Hoffman (1988) suggest that fire suppression is allowing ponderosa pine/sun sedge woodlands to replace little bluestem grassland on buttes and hills in southeastern Montana, and that may be true of the stands of ponderosa pine/sun sedge woodland with little bluestem in the understory on the rocky sites in the northeastern part of the potential RNA. The potential RNA lies within ca. 10

miles (16 km) of the western flank of the Black Hills, and the expansion of ponderosa pine woodland, and the increase in tree density in existing woodlands, due to fire suppression in the Hills is well documented (Knight 1995, Chapter 16).

Viability: the prospect for long-term maintenance of the ecosystem types in the area and the survival of their constituent species.

No immediate threats to the maintenance of the ecosystems or the survival of the constituent species in the potential RNA were noted during field work. Long-term maintenance of the ecosystems in a condition similar to presettlement condition will require that the ecological processes that shaped those ecosystems continue to exert an influence. Of those processes, the ones that managers are most likely to control are grazing by large mammals, burrowing and grazing by prairie dogs, and fire. The size of the potential RNA will complicate management of these processes: the area is too small to support populations of pronghorn, elk, and mule deer (and their predators), which will use the potential RNA as part of a larger range. Similarly, when considered as livestock range, the potential RNA must be viewed as part of a larger area.

The potential RNA may be large enough to support a black-tailed prairie dog town entirely within its boundary, should a town become established, although the prairie dogs likely would move onto lands outside the potential RNA. The proximity of private land to the potential RNA would complicate management for prairie dogs. Allowing outbreaks of grasshoppers to exert an influence on the ecosystems of the potential RNA will also be a problem for managers: the area is too small to contain this ecological process, and allowing grasshoppers to affect a larger area may be impracticable.

The density of pine saplings in the ponderosa pine woodlands, and indeed the presence of the woodlands in parts of the area, may be due to fire suppression. As is true in most ponderosa pine woodlands, which developed with frequent low-intensity ground fires (Knight 1995, Chapter 16), prescribed fire will be necessary to maintain quasi-natural conditions. Fire may also be necessary to maintain the desired condition of the grassland vegetation. Managers may be able to delineate burn units entirely within the potential RNA, but the area's topography may make it difficult to prevent fires near the potential RNA's northeastern boundary from spreading to adjacent lands. The presence of the annual brome grasses and yellow sweetclover will complicate the use of fire as a tool to maintain the ecosystems in the potential RNA, because these species may increase or decrease in abundance, depending on the season of burning (The Nature Conservancy 1987, 1989). Consequently, while fire may be necessary to maintain the ponderosa pine woodlands,

it may also constitute a threat to the viability of the western wheatgrass/green needlegrass grassland by promoting the increase of exotic plants.

Defensibility: the extent to which the area can be protected from extrinsic, anthropogenic factors that might worsen the condition of the area or threaten the viability of the ecosystems present.

No immediate threats to the ecosystems in the potential RNA were obvious during the 1996 field work. Public roads provide ready access to the area, and the gentle topography permits four-wheel-drive vehicles to travel inside it. Hence damaging vehicle use is a possibility, particularly during hunting seasons in the fall. No evidence was observed of damage from vehicles, though. The unfenced western boundary will allow ready access by livestock using the pasture that includes the potential RNA.

Degree to Which the Potential RNA Meets Criteria

The potential Cedar Knoll RNA represents the western wheatgrass/green needlegrass plant association, and probably the ponderosa pine/sun sedge association and the prairie cordgrass association, as they occur in the region. The condition of the grassland ecosystem in the potential RNA has been compromised, however, by exotic brome grass and Kentucky bluegrass, which contribute substantial cover to the grassland and codominate or dominate patches. The alteration of the major ecological processes that once affected the ecosystems in the region -- fire; grazing by large mammals, prairie dogs, and insects; and mammal burrowing -- certainly has had some effect on the condition of the potential RNA, but that effect is largely unknown.

The degree to which the dense stands of exotic grasses threaten the viability of the western wheatgrass/green needlegrass vegetation, by suppressing reproduction of the native plants, is unclear. The viability of all of the types in the potential RNA will require that livestock continue to be managed to prevent repeated, excessive grazing; that wildlife (including prairie dogs) are allowed to use the area; and that a prescribed fire program can be implemented. The size of the area will pose a problem for managers in implementing these ecological processes.

Although the gentle topography in the area, the accessibility via public roads, and the unfenced western boundary all combine to make defensibility of the area difficult, it contains few obvious attractions (other than big game habitat) to most potential users. Hence defensibility may not be a concern.

IMPACTS AND POSSIBLE CONFLICTS

This section is limited to the conflicts obvious from field survey and from conversations with USDA Forest Service staff.

Mineral Resources

Field work in 1996 revealed no impacts from mineral resources or potential conflicts between mineral resources and RNA management.

Grazing

The potential Cedar Knoll RNA is part of allotment #356 and is used for season-long grazing with deferred rotation. Establishment of a research natural area might conflict with current livestock management, although large mammal grazing was an important ecological process in the grassland ecosystem before white settlement, so grazing *per se* should not be viewed as an unacceptable impact.

Timber

The stands of ponderosa pine in the potential RNA appear to have no commercial value. In 1996, 10 to 20 stumps from cut ponderosa pines and Rocky Mountain junipers were noted in one ponderosa pine woodland in the west-central part of the potential RNA. These stumps were from poles of a size suitable for fence posts. The stumps were not fresh, and the poles apparently were cut at least several years before.

Watershed Values

The potential RNA contains the upper part of the basin of East Iron Creek, a southward-flowing, ephemeral stream. Five reservoirs, each covering $\leq$ 1 acre (0.4 ha) have been constructed on branches of the creek. Establishment of a research natural area might conflict with the use of equipment needed to maintain the dams on these reservoirs.

Recreation Values

The potential RNA contains no developed recreation areas. Recreational use apparently is limited to fall hunting, and establishment of an RNA would have no obvious effect on recreational use other than restriction on excessive vehicle use.

Wildlife and Plant Values

Management of the area as a research natural area apparently would not conflict with the wildlife or plant values therein.

Transportation Values

The potential RNA contains no designated national grassland roads or trails, but a number of two-track roads in the potential RNA are shown on the National Grassland map.

MANAGEMENT CONCERNS

Establishment of a Cedar Knoll RNA might require a change in the current grazing management, and might require limitations on vehicle traffic within the area during hunting seasons. Management to restore or maintain ecological processes in an RNA this small and in this location would probably involve management of adjoining national grassland and state land.

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