

ECOLOGICAL EVALUATION OF
THE POTENTIAL ANTELOPE CREEK RESEARCH NATURAL AREA
WITHIN THE THUNDER BASIN NATIONAL GRASSLAND,
CONVERSE COUNTY, WYOMING

Prepared for
Nebraska National Forest,
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By

George P. Jones

Wyoming Natural Diversity Database
1604 Grand Avenue
Laramie, Wyoming 82070

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TABLE OF CONTENTS

INTRODUCTION. 1
 Land Management Planning.. . . . 1

OBJECTIVES. 1

PRINCIPAL DISTINGUISHING FEATURES.. . . . 2

LOCATION. 2
 Boundary.. . . . 2
 Area.. . . . 3
 Elevation. 3
 Access.. . . . 3
 Ecoregion. 3
 Maps.. . . . 3

VEGETATION. 4
 Description. 4
 Area by Type.. . . . 5

PHYSICAL AND CLIMATIC CONDITIONS. 7
 Physical Setting.. . . . 7
 Geology. 7

DESCRIPTION OF VALUES.. . . . 7
 Vegetation Types.. . . . 7
 Flora. 7
 Threatened, Endangered, and Sensitive Plant Species.. 7
 Plant Species List. 7
 Fauna. 10
 Threatened, Endangered, and Sensitive Vertebrates.. 10
 Lands. 10

SUITABILITY FOR RESEARCH NATURAL AREA SELECTION.. . . . 11
 Quality. 11
 Condition. 11
 Viability. 13
 Defensibility. 13
 Degree to Which the Potential RNA Meets Criteria.. . . . 13

IMPACTS AND POSSIBLE CONFLICTS. 14
 Mineral Resources. 14
 Grazing. 14
 Timber.. 14
 Watershed Values.. 14
 Recreation Values. 14
 Wildlife and Plant Values. 14
 Transportation Values. 15

MANAGEMENT CONCERNS..	15
REFERENCES.	15
Appendix 1. Maps of the potential Antelope Creek Research Natural Area..	18
Appendix 2. Photographs from the potential Antelope Creek Research Natural Area...	20
Appendix 3. Canopy cover of plants in plots and at locations of vegetation descriptions in the potential Antelope Creek Research Natural Area...	21
Appendix 4. Explanations of ranks used by the Wyoming Natural Diversity Database..	33
Appendix 5. Plant community types in the potential Antelope Creek Research Natural Area...	35

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INTRODUCTION

The potential Antelope Creek Research Natural Area (RNA) is located in the Cheyenne River Basin of northeastern Wyoming. The area includes segments of two perennial streams (Antelope Creek and Dry Fork of the Cheyenne River), plains cottonwood woodlands, shrub vegetation of plains silver sagebrush and black greasewood, grasslands of prairie sandreed and needle-and-thread, and wet meadows of leafy bulrush and alkali cordgrass. The potential RNA is in the Thunder Basin National Grassland and is currently used primarily for livestock grazing.

In 1997, 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 Antelope Creek area was done by the Wyoming Natural Diversity Database. This report presents the results of that evaluation.

Land Management Planning

In 1997, an interdisciplinary team from the Thunder Basin National Grassland selected the Antelope Creek 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 an Antelope Creek 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 Antelope Creek RNA are the aquatic ecosystem and the terrestrial ecosystem associated with Antelope Creek and the Dry Fork of the Cheyenne River.

LOCATION

The potential Antelope Creek RNA is located within the Thunder Basin National Grassland in northeastern Wyoming. The approximate center of the potential RNA is at latitude 43°26'42"N and longitude 105°05'08"W.

The potential RNA includes parts of the following sections (all on the 6th Principal Meridian): Township 40 North, Range 68 West, Sections 18, 19, 20; T40N, R69W, Sections 10, 13, 14, 15.

Boundary (See Figure 1).

Two possible boundaries are shown for the potential RNA, both of which outline a large, western (upstream) portion of the area along Antelope Creek upstream from the confluence with the Dry Fork of the Cheyenne River, and a smaller, eastern (downstream) portion at the confluence of the two streams. Both possible boundaries include only National Grassland.

The first boundary (shown as a dashed line on Figure 1) was drawn before the field survey. In the western portion of the potential RNA, it circumscribes a relatively narrow part of the riparian zone along Antelope Creek; and in the eastern portion, it includes the riparian zone and greasewood shrub vegetation on higher terraces.

The second boundary, drawn as a dotted line, is based on information gathered during the field survey, which showed that, in the western portion, the first boundary excluded much of the flood-plain landforms (sensu Driscoll et al. 1984) associated with Antelope Creek. Some of these flood-plain landforms support cottonwood stands and other riparian vegetation, and all are parts of the valley floor within which the creek meanders.

In the eastern portion, and to a much smaller extent in the western portion, the first boundary includes upland areas so far above the stream channel that they will not (in the foreseeable

future) be part of the riparian system. The second boundary excludes those areas.

The second possible boundary, then, is drawn (based on the field survey) to follow more closely the limits of the area through which the streams meander. Hence it approximates the boundary of the riparian ecosystem.

Area

Boundary #1 outlines a potential Antelope Creek RNA of ca. 739 acres (300 ha). The second possible boundary outlines an area of 1102 acres (446 ha).

Elevation

For both possible boundaries, the low elevation of the potential Antelope Creek RNA is ca. 4310 feet (1314 m). Boundary #1 reaches a high point at ca. 4390 feet (1338 m), and boundary #2 at ca. 4420 feet (1347 m).

Access

The potential Antelope Creek RNA may be reached on public roads. From the intersection of Wyoming Highway 59 with Grassland Road 942, ca. 14 miles (23 km) northwest of Bill, Wyoming, travel east on Grassland Road 942 ca. 20 miles (32 km) to the crossing of Antelope Creek, where Grassland Road 942 turns to Grassland Road 949. That is the western end of the western (upstream) portion of the potential RNA, and the entire western portion may be reached from there on foot. The eastern end of the western portion can be reached by traveling east an additional 4 miles (6.4 km) on the Grassland Road 949 to a two-track road leading west from the Grassland Road. The eastern (downstream) portion of the potential RNA may be reached by traveling southeast an additional ca. 1.5 mile (2.4 km) to the intersection with Grassland Road 933, and crossing the stream to the south.

Ecoregion

The potential Antelope Creek RNA lies within the Great Plains-Palouse Dry Steppe Province, Powder River Basin Section, Southern Powder River Basin-Scoria Hills Subsection (331Gf) of the ecoregion classification of Bailey et al. (1994) (Freeouf 1996).

Maps

USDA Forest Service ½ inch = 1 mile scale map of the Thunder Basin National Grassland.

USDI Geological Survey 7.5 minute topographic Quadrangle Maps:
Coalbank Draw, Wyo. and Fiddleback Ranch, Wyo.

VEGETATION

Description

Synonyms for the plant community types are listed in Appendix 5. Data from sample plots and information from vegetation sampling locations are shown in Appendix 3.

The vegetation types in the potential RNA form a mosaic shaped in large part by soil texture and height of the ground surface above the water table. The lowest fluvial surfaces, closest to the channel, support long, narrow stands of the leafy bulrush type, often growing in saturated soils. Stands of this type on slightly higher surfaces often contain groves of cottonwood seedlings and saplings. In a few spots, this leafy bulrush type gives way to meadows of the alkali cordgrass community type growing on slightly higher, drier surfaces. Groves of plains cottonwood saplings and poles (usually of the plains cottonwood/western wheatgrass community type) also occur on the surfaces above the leafy bulrush stands.

Intermediate surfaces support groves of cottonwood poles and trees, with a range in tree size and density and in understory composition. The groves with understories dominated by western wheatgrass, Kentucky bluegrass (an exotic), and green needlegrass, growing on fine-textured soils, belong to the plains cottonwood/western wheatgrass community type. These stands often occur in and along abandoned channels on the higher terraces. Groves with understories of prairie sandreed and needle-and-thread, growing on coarse-textured soils, belong to the plains cottonwood/prairie sandreed community type. Stands intermediate between these two types are common.

The cottonwood woodland in the potential RNA exhibits the structure typical of plains cottonwood stands (Friedman et al. 1997): linear and arcuate groves of trees, parallel to the stream channel, with each grove consisting of trees of nearly uniform size. Groves of cottonwood seedlings, saplings, poles, and trees are all common in the area, indicating that the cottonwood trees are reproducing successfully and the woodland is viable.

The fluvial surfaces at intermediate height above the channel also support stands of the prairie sandreed - needle-and-thread community type and stands of a sparse needle-and-thread community type with little or no prairie sandreed. The prairie

sandreed - needle-and-thread association occurs on sand dunes and higher fluvial surfaces with sandy soils, and is a major type in the potential RNA. Prairie sandreed generally dominates or co-dominates the moderately-dense vegetation, and needle-and-thread is an important species. Exotic brome grasses (especially cheatgrass) contributes substantial cover in most stands. Sandy alluvial bars with a high volume of gravel and rock supports a sparse herbaceous vegetation of needle-and-thread, plains pricklypear, cheatgrass, and other species. This association to which this vegetation belongs is unclear. It is a minor type in the area.

The highest surfaces in the potential RNA support shrublands of the black greasewood/western wheatgrass association and of the basin silver sagebrush/western wheatgrass association. Exotic, annual brome grasses co-dominate or dominate the herbaceous layers in most stands of these types. Stands intermediate between these two types, with shrub layers composed of both black greasewood and basin silver sagebrush, are common. These shrub types merge with the adjacent upland vegetation.

Area by Type

Complexes of community types 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 map with a digital planimeter. (The vegetation map shows complexes because delineating stands of individual community types was impossible.) For each complex, the plant community types that contribute substantial cover are marked by "M" after the type name in Table 2 and Figure 1, and types contributing little cover by "m".

The area of each Kuchler (1966) type was estimated by summing the area of the plant community types belonging to that Kuchler type.

In both tables, estimates are given for the area of the type encompassed by each of the two possible boundaries. See page 2 for a discussion of the boundaries.

Table 1. Areas of Kuchler Types (Kuchler 1966) encompassed by the two possible boundaries of the potential Antelope Creek RNA. Numerators are areas within boundary #1; denominators are areas within boundary #2. "M" denotes a major community type in a complex, and "m" a minor type.

Cover Type	Acres	Hectares
Wheatgrass-needlegrass shrubsteppe (50) (<i>Agropyron-Stipa-Artemisia</i>)	156/230	63/93
Gramma-needlegrass-wheatgrass (57) (<i>Bouteloua-Stipa-Agropyron</i>)	344/560	139/227
Northern floodplain forest (89) (<i>Populus-Salix-Ulmus</i>)	239/312	97/126

Table 2. Areas of complexes of plant community encompassed by the two possible boundaries of the potential Antelope Creek RNA. Numerators are areas within boundary #1; denominators are areas within boundary #2. "M" denotes a major community type in a complex, and "m" a minor type. See Figure 1. See synonyms in Appendix 5.

Complex	Acres	Hectares
Plains cottonwood/western wheatgrass (M) and plains cottonwood/prairie sandreed (M)	239/312	97/126
Black greasewood/western wheatgrass (M) and plains silver sagebrush/western wheatgrass (m)	156/230	63/93
Prairie sandreed - needle-and-thread (M) with needle-and-thread (m), alkali cord- grass (m), and leafy bulrush (m)	344/560	139/227

PHYSICAL AND CLIMATIC CONDITIONS

Physical Setting

The potential Antelope Creek RNA lies within the Cheyenne River Basin in east-central Wyoming. The two portions of the area are centered on valleys of perennial streams (Antelope Creek and the Cheyenne River) flowing primarily eastward through rolling hills of claystone and sandstone. The stream valleys are ca. 0.3 mile (0.5 km) wide and ca. 150 feet (46 m) deep.

Geology

Bedrock in the region of the potential Antelope Creek RNA is claystone and concretionary sandstone of the Paleocene-aged Lebo Member of the Fort Union Formation (Love and Christiansen 1985). Within the potential RNA, the substrate is Quaternary alluvium derived from the surrounding uplands, including outcrops of porcellanite (scoria) several miles upstream (west) of the area. Textures of the alluvium range from clay to sand, and a large proportion of it contains a high volume of sand and gravel.

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.

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 Antelope Creek RNA.

Plant Species List

The following species were identified during field work in the potential Antelope Creek RNA.

Table 3. Vascular Plants of the potential Antelope Creek RNA. Nomenclature for scientific names is based on Dorn (1992). Family acronyms are based on Weber (1982). Family taxonomy follows Dorn (1992). Family acronyms are based on Weber (1982). Non-native species are indicated by "!" before the species name.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Family</u>
TREES		
<i>Populus deltoides</i> var. <i>occidentalis</i>	Plains cottonwood	SAL
SHRUBS & DWARF SHRUBS		
<i>Artemisia cana</i> var. <i>cana</i>	Basin silver sagebrush	AST
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush	AST
<i>Salix exigua</i>	Sandbar willow	SAL
<i>Sarcobatus vermiculatus</i>	Black greasewood	CHN
GRAMINOIDS		
<i>Agrostis stolonifera</i>	Creeping bentgrass (Redtop)	POA
<i>Aristida purpurea</i> var. <i>longiseta</i>	Fendler threeawn	POA
<i>Bouteloua gracilis</i>	Blue grama	POA
<i>Bromus commutatus</i>	Meadow brome	POA
! <i>Bromus inermis</i> var. <i>inermis</i>	Smooth brome	POA
<i>Bromus tectorum</i>	Cheatgrass	POA
<i>Calamovilfa longifolia</i>	Prairie sandreed	POA
<i>Carex filifolia</i>	Threadleaf sedge	CYP
<i>Carex hoodii</i>	Hood's sedge	CYP
<i>Carex praegracilis</i>	Clustered field sedge	POA
<i>Distichlis stricta</i>	Inland saltgrass	POA
<i>Eleocharis palustris</i>	Common spikerush	CYP
! <i>Elymus repens</i>	Quackgrass	POA
<i>Elymus smithii</i>	Western wheatgrass	POA
<i>Elymus trachycaulus</i> var. <i>andinus</i>	Bearded wheatgrass	POA
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>	Slender wheatgrass	POA
<i>Festuca octoflora</i>	Sixweeks fescue	POA
<i>Hordeum jubatum</i>	Foxtail barley	POA
<i>Juncus balticus</i>	Baltic rush	JUN
<i>Koeleria macrantha</i>	Prairie junegrass	POA
<i>Oryzopsis hymenoides</i>	Indian ricegrass	POA
<i>Poa glaucifolia</i> ?	Plains bluegrass	POA
<i>Poa juncifolia</i> var. <i>ampla</i>	Alkali bluegrass	POA
! <i>Poa pratensis</i>	Kentucky bluegrass	POA
<i>Poa secunda</i>	Sandberg bluegrass	POA
<i>Scirpus pungens</i>	Leafy bulrush	CYP
<i>Spartina gracilis</i>	Alkali cordgrass	CYP

<i>Sporbolus cryptandrus</i>	Sand dropseed	POA
<i>Stipa comata</i>	Needle-and-thread	POA
<i>Stipa viridula</i>	Green needlegrass	POA
FORBS		
<i>Abronia fragrans</i>	Snowball sand verbena	NYC
<i>Achillea millefolium</i>	Common yarrow	AST
<i>Ambrosia psilostachya</i>	Cuman ragweed	AST
<i>Arenaria congesta</i>	Ballhead sandwort	CRY
<i>Arenaria hookeri</i>	Hooker's sandwort	CRY
<i>Artemisia frigida</i>	Fringed sagewort	AST
<i>Artemisia ludoviciana</i>	Lousianna sagewort	AST
<i>Artemisia sp.</i>	Sagewort sp.	AST
<i>Asclepias sp.</i>	Milkweed	ASC
<i>Aster falcatus</i>	Cluster aster	AST
<i>Aster sp.</i>	Aster	AST
<i>Astragalus bisulcatus</i>	Two-grooved milkvetch	FAB
<i>Astragalus miser</i>	Weedy milkvetch	FAB
<i>Astragalus sp.</i>	Milkvetch	FAB
! <i>Camelina microcarpa</i>	Littlepod falseflax	BRA
<i>Chenopodium sp</i>	Chenopod	CHN
! <i>Cirsium arvense</i>	Canada thistle	AST
<i>Cirsium undulatum?</i>	Wavyleaf thistle	AST
<i>Cleome sp.</i>	Beeplant	CPP
<i>Collomia linearis</i>	Narrowleaf collomia	PLM
<i>Coryphantha vivipara</i>	Ball cactus	CAC
<i>Cryptantha cinerea</i>	Cryptantha	BOR
<i>Descurainia pinnata</i>	Western tansymustard	BRA
! <i>Descurainia sophia</i>	Herb sophia (flixweed)	BRA
<i>Equisetum laevigatum</i>	Smooth horsetail	EQU
<i>Erigeron sp.</i>	Fleabane	AST
! <i>Filago arvensis</i>	Field cottonrose	AST
<i>Gaura coccinea</i>	Scarlet beeblossom	ONA
<i>Grindelia squarrosa</i>	Curleycup gumweed	AST
<i>Heterotheca villosa</i>	Hairy goldenaster	AST
<i>Hydrophyllacea</i>	Waterleaf	HYD
<i>Ipomopsis pumila</i>	Dwarf gilia	PLM
! <i>Lactuca serriola</i>	Prickly lettuce	AST
<i>Lappula redowskii</i>	Desert stickseed	BOR
<i>Lathyrus sp.</i>	Peavine	FAB
<i>Lepidium densiflorum</i>	Common pepperweed	BRA
<i>Leptodactylon sp.</i>	Pricklygilia	PLM
<i>Lithospermum sp.</i>	Gromwell (stoneseed)	BOR
<i>Lupinus pusillus</i>	Rusty lupine	FAB

Lygodesmia sp.	Skeletonplant	AST
!Medicago lupulina	Black medic	FAB
!Melilotus officinalis	Yellow sweetclover	FAB
Oenothera nuttallii	Nuttall's eveningprimrose	ONA
Opuntia polyacantha	Plains pricklypear	CAC
Orobanche sp.	Broomrape	ORO
Oxytropis sp.	Crazyweed, locoweed	FAB
Penstemon albidus	Beardtongue	SCR
Petalostemon sp.	Prairieclover	FAB
Polygonum aviculare	Prostrate knotweed	PLG
Psoraleidum lanceolatum	Lemon scurfpea	FAB
Psoraleidum tenuiflorum	Slimflower scurfpea	FAB
Ranunculus cymbalaria	Alkali buttercup	RAN
Ratibida columnifera	Prairie coneflower	AST
Rumex venosus	Veiny dock	PLG
Sisymbrium altissimum	Tall tumbledustard	BRA
Sphaeralcea coccinea	Scarlet globemallow	MLV
Stephanomeria sp.	Wirelettuce	AST
! Taraxacum laevigatum	Rock dandelion	AST
! Taraxacum officinale	Common dandelion	AST
Thermopsis rhombifolia	Prairie thermopsis	FAB
Tradescentia occidentalis	Prairie spiderwort	CMM
! Tragopogon dubius	Yellow salsify	AST
Vicia americana	American vetch	FAB
Xanthium strumarium	Common cocklebur	AST
Zigadenus venenosus	Grassy deathcamas	LIL

Fauna

Threatened, Endangered, and Sensitive Vertebrates

One threatened species is known from the potential RNA:

Bald eagle (*Haliaeetus leucocephalus*)

Heritage network rank: G4/S2S3b,S3N

Federal status: USDI Fish and Wildlife Service Threatened, USDA Forest Service Region 2 Sensitive

Comments: Bald eagles use trees in the southeastern part of the upstream (western) portion of the potential RNA (T40N, R69W, Sec 13, SE1/4) as winter roosts, and a historical nest is known from trees in the central part of the upstream portion (T40N, R69W, Sec 10, SE1/4). See Figure 1.

Animal Species List

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

Lands

The potential Antelope Creek RNA includes only national grassland. Adjoining lands are national grassland, private land, and state 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 (USDA Forest Service 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 major ecosystem type within the potential RNA is a perennial stream, Antelope Creek, and the associated mosaic of vegetation types. That mosaic probably represents well the range of vegetation types along perennial plains streams. The plains cottonwood (*Populus deltoides*) woodland is rich mix of even-aged stands of seedlings, saplings, poles, and trees of different size classes, from small to large. Understories in the tree stands vary with substrate, with western wheatgrass (*Pascopyrum smithii*) and Kentucky bluegrass (*Poa pratensis*) on fine-textured alluvium, and prairie sandreed, (*Calamovilfa longifolia*), needle-and-thread (*Stipa comata*), and cheatgrass (*Bromus tectorum*) on sandier alluvium. Cottonwood groves are interspersed with meadows of needle-and-thread grass and prairie sandreed on sandy alluvium, and leafy bulrush (*Scirpus pungens*), prairie cordgrass (*Spartina pectinata*), and western wheatgrass on finer-textured alluvium. Sparsely-vegetated sediment bars are common. Black greasewood/western wheatgrass (*Sarcobatus vermiculatus/Pascopyrum smithii*) shrub stands and silver sagebrush/western wheatgrass (*Artemisia cana ssp. cana/Pascopyrum smithii*) shrub stands are present on higher alluvial terraces.

Condition: the degree to which the potential RNA has been altered from pre-settlement conditions.

-- Exotic Species

The 1997 field survey suggests that exotic plant species are rare in the tree and shrub layers: salt cedar (*Tamarix chinensis*) was observed in six places, as individual shrubs or groups of less than a dozen shrubs. Exotic species are common, however, in the herbaceous understories throughout potential RNA. *Bromus tectorum* is a major species on sandy substrates, and co-dominates some stands. On finer-textured substrates, *Poa pratensis* (Kentucky bluegrass) and *Bromus commutatus* (meadow brome) are present in most stands, and co-dominate or dominate some. Sweetclover (*Melilotus spp.*, especially *M. officinalis*) is

common on a variety of soils types, but contributes substantial cover in a limited number of patches. Canada thistle (*Cirsium arvense*) is present throughout, as scattered patches rarely containing up to ca. 1000 stems and covering up to 1000 square meters. The ubiquity of these exotic species probably is typical of riparian areas in eastern Wyoming (Jones and Walford 1995). Even in the stands with a substantial amount of exotic plants, native species are major components of the vegetation.

-- Structures

The potential RNA contains few structures. Dilapidated building and short length (ca. 30 yards, or 33 meters, long) of woven-wire fence are present on the north side of the creek in the central part. Several feed troughs are scattered throughout, and several barbed-wire livestock fences cross the area.

-- Ecological processes

Flooding is an ecological process crucial to the riparian ecosystem that forms the core of the potential RNA. Antelope Creek is not impounded, although Porcupine Creek, a major tributary, has been dammed several miles (several km) upstream from the potential RNA. The presence of numerous stands of seedlings and saplings indicates that the hydrologic regime is adequate to maintain cottonwood woodlands.

Beaver can exert a significant effect on cottonwood woodlands, and scattered throughout the potential RNA are stumps of cottonwoods cut long ago by beavers. Active beaver dams are present at the upper end of the potential RNA and in the downstream portion at the confluence of Antelope Creek with Dry Fork of the Cheyenne River.

Grazing also can have a substantial effects on the riparian vegetation, by suppressing reproduction of the woody plants. Grazing by large mammals was undoubtedly a major ecological factor influencing the composition of the upland vegetation in the Cheyenne River Basin before settlement by whites, and grazing animals used the riparian zones at least sporadically. 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 before white settlement (Dorn 1986), but probably were much less abundant than were bison (Long 1965) and hence had less influence on the ecosystems. Elk still inhabit parts of the Cheyenne River Basin. Pronghorn were abundant in eastern Wyoming in pre-settlement times (Long 1965) and still are common.

Black-tailed prairie dogs (*Cynomys ludovicianus*) are present on the edges of potential RNA, but not in the riparian zone.

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

The viability of cottonwood woodlands depends on a flood regime that provides sites for tree establishment (Friedman et al. 1997). The presence of numerous stands of cottonwood seedlings and saplings indicates that the flood regime is adequate to assure the viability of the riparian woodland.

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 serious threats to the potential RNA were noted. Livestock grazing, recreational use, and uncontrolled vehicle use that suppress regeneration of the cottonwoods or precipitate a decline in the native herbaceous species are the major potential threats to the terrestrial ecosystems, and they can be minimized through appropriate management. The condition of the aquatic ecosystem in the potential RNA can be altered by sources of pollution upstream from the area, both on Dry Fork of the Cheyenne River and on Antelope Creek.

Regular control efforts may be necessary to prevent salt cedar from becoming a major species in the RNA, and to prevent Russian olive (*Elaeagnus angustifolia*), which is present within a mile downstream of the area, from becoming established.

Degree to Which the Potential RNA Meets Criteria

The potential Antelope Creek RNA contains a high quality example of a plains stream ecosystem. The area is in reasonably good condition: exotic plant species are present, and are a major component of some stands, but this probably is true of all riparian areas on the plains, and exotics are less important in the potential RNA than they are on other plains streams, perhaps in large part because of absence of hay meadows near the creek in the potential RNA. The viability of the ecosystem in the potential RNA appears to be good, although the viability of the cottonwood woodlands depends on actions upstream from the potential RNA that affect the flood regime and water quality. Given the lack of obvious, serious threats, the defensibility of the area appears to be good.

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

The potential RNA contains several abandoned oil wells and drill holes, but field survey revealed no conflicts between mineral exploration or production and RNA designation.

Grazing

The potential RNA is part of livestock grazing allotment #231 and is grazed in the winter. Establishment of a research natural area might conflict with livestock grazing, although large mammal grazing was an important ecological process in the grassland and shrub-steppe ecosystems before white settlement, so grazing *per se* should not be viewed as an unacceptable impact.

Timber

The potential RNA contains only plains cottonwood trees. While this species is being harvested from riparian zones in northwestern Wyoming (Kent Houston, USDA Forest Service, Shoshone National Forest, personal communication), no evidence was observed during field survey of timber harvest in the potential RNA or along other streams in the area.

Watershed Values

The potential Antelope Creek RNA contains reaches of two perennial streams, Antelope Creek and the Cheyenne River, and the lower reaches of a number of first- and second-order tributaries (as measured on 7.5' maps) to those streams. No evidence was observed during field survey to suggest that RNA designation would interfere with watershed values.

Recreation Values

The potential RNA contains no developed recreation areas. The cottonwood woodlands in the area offer attractive camping sites on public land in a region where suitable campsites are limited. With the recent publicity about land exchanges between the USDA Forest Service and private landowners, camping and driving in the potential RNA may increase. Wood-gathering and fires associated with this recreational use may become a threat to the condition of the area.

Wildlife and Plant Values

No evidence was observed during the field survey to suggest that RNA designation would conflict with wildlife or plant values. In fact, designation might benefit the wintering bald eagles that use the cottonwood woodlands in the area.

Transportation Values

The narrower of the two possible boundaries includes no maintained roads, and the wider possible boundary includes only ca. 0.25 mile (0.4 km) of Grassland Road 942. This road appears to have no effect on the values for which the area is being considered as a research natural area, and RNA designation apparently would have no effect on the use or maintenance of the road.

Several two-track roads enter the potential RNA, principally along the north side of Antelope Creek in the western tract. These roads appear to receive little use and may have been developed by the former private landowners to reach livestock feed troughs. Although the potential RNA is now National Grassland, the roads into the area still cross pieces of private land and travel on the roads may continue to be light.

MANAGEMENT CONCERNS

Designation of a research natural area on Antelope Creek apparently would cause no major conflicts with management of resources. Recreational use of the area may increase now that land trades have made it part of the Thunder Basin National Grassland, and wood-gathering, campfires, and vehicle travel may increase to a level that threatens the condition and viability of the ecosystems. Livestock grazing could, hypothetically, suppress recruitment of cottonwoods and increase the weediness of the herbaceous vegetation, but apparently it has not done so in the past and there is no reason to expect that it will in the future. All of these potential threats might be averted with judicious management of the area that allows use of the natural resources and protects the values of a research natural area.

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Appendix 1. Maps of the potential Antelope Creek Research Natural Area.

Figure 1. Contour map showing complexes of plant associations in the potential Antelope Creek RNA. Major associations in each complex are indicated by (M) after the name, and minor associations by (m).

Associations in Complex	Map Symbol
Plains cottonwood/western wheatgrass (M) and Plains cottonwood/prairie sandreed (M)	
Black greasewood/western wheatgrass (M) and plains silver sagebrush/western wheatgrass (m)	
Prairie sandreed - needle-and-thread (M) with needle-and-thread (m), alkali cord- grass (m), and leafy bulrush (m)	
Sample plot	
Vegetation description location	
Bald eagle winter roost	
Historical bald eagle nest	
Reclaimed oil well site	
Grassland Road	
First boundary	
Second boundary	

Appendix 2. Photographs from the potential Antelope Creek
Research Natural Area.

Appendix 3. Canopy cover of plants in plots and at locations of vegetation descriptions in the potential Antelope Creek Research Natural Area.

In all of the tables in this appendix, the cover values for species are midpoints of the following cover classes:

<u>Cover Value</u>	<u>Range of Canopy Cover</u>
1	<1%
3	1% - 5%
10	5% - 15%
20	15% - 25%
30	25% - 35%
40	35% - 45%
50	45% - 55%
60	55% - 65%
70	65% - 75%
80	75% - 85%
90	85% - 95%
97	95% - 100%

The vegetation descriptions are for parts of stands and were not made for formal sample plots. At each location, the species in each stratum of the vegetation are listed approximately in order from those with the most canopy cover to those with the least.

Locations of sample plots and of vegetation descriptions are shown on Figure 2.

Table 3-1. Canopy cover (and height, for trees) of plants in the plains cottonwood sample plots in the potential Antelope Creek RNA. Single numbers in cells are canopy cover values; for trees, numerators are canopy cover values, and denominators are height in meters.

	Plot/Association*				
	13	41	23	21	31
	Popdel/ Callon	Popdel/ Callon	Popdel/ Elysmi	Popdel/ Elysmi	Popdel/ Elysmi
Species					
TREES					
<i>Populus deltoides</i>	30/20	30/15	40/10	50/17	40/20
DWARF SHRUBS					
<i>Chrysothamnus viscidiflorus</i>		1			
GRAMINOIDS					
<i>Bouteloua gracilis</i>					1
! <i>Bromus commutatus</i>	10	1	10	20	1
! <i>Bromus inermis</i>		1	1	1	1
! <i>Bromus tectorum</i>	10	70	3	10	
<i>Calamovilfa longifolia</i>	50	30	10	1	1
<i>Carex filifolia</i>		1			
<i>Carex hoodii</i>					1
<i>Carex praegracilis</i>					1
<i>Eleocharis palustris</i>					1
! <i>Elymus repens</i>					1
<i>Elymus smithii</i>	3	10	20	20	60
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>				3	3
<i>Festuca octoflora</i>	1	1	1		1
<i>Hordeum jubatum</i>					1
<i>Juncus balticus</i>					1
<i>Koeleria macrantha</i>	1	1	1	1	1
<i>Oryzopsis hymenoides</i>	3	1	1		
! <i>Poa pratensis</i>			30	40	30
<i>Poa juncifolia</i> var. <i>ampla</i>		1	1		10
<i>Sporobolus cryptandrus</i>				3	
<i>Stipa comata</i>	20	40	3	10	1
<i>Stipa viridula</i>				10	10
FORBS					
<i>Abronia fragrans</i>		1			
<i>Achillea millefolium</i>				1	
<i>Ambrosia psilostachya</i>	1			1	
<i>Artemisia frigida</i>	1	1	1	1	
<i>Artemisia ludoviciana</i>			1	1	1
<i>Artemisia</i> sp.			1		
<i>Asclepias</i> sp.	1				

Aster falcatus			1	1	
Aster sp.	1				1
Astragalus bisulcatus				1	1
Astragalus miser			1	1	1
Astragalus sp.		1		1	
! Camelina microcarpa	1	1	1	1	1
Chenopodium sp.		1		1	1
Cirsium undulatum?	1		1	1	
Collomia linearis		1		1	
Coryphantha vivipara		1			
Cryptantha cinerea		1		1	
Descurainia pinnata			1	1	
! Descurainia sophia		1			1
Equisetum laevigatum	1	1	10	3	1
Erigeron sp.			1		
Gaura coccinea				1	
Grindelia squarrosa					1
Heterotheca villosa	1				
Ipomopsis pumila	1		1		
! Lactuca serriola?				1	1
Lappula redowskii		1			
Lepidium densiflorum		1	1	1	
Lithospermum sp.		1			
Lupinus pusillus			1		
Lygodesmia sp.	1	1			
! Medicago lupulina				1	1
! Melilotus officinalis	1	1	3	1	3
Oenothera nuttallii		1			
Opuntia polyacantha	1				
Oxytropis sp.	1				
Penstemon albidus	1				
Polygonum aviculare					1
Psoralidium tenuiflorum			20		
Ratibida columnifera			1	1	1
Rumex venosus		1			
Sisymbrium altisissimum	1	1		1	
! Taraxacum laevigatum			1	1	
! Taraxacum officinale					3
Thermopsis rhombifolia			1		1
Tradescentia occidentalis	1	1			
! Tragopogon dubius	1	1	1	1	1
Unknown forbs	1			1	
Vicia americana			1		3
Zigadenus venenosus			1		
GROUND COVER					
Bare ground	3	7	25	4	8
Gravel			1	1	
Rock				1	

Litter	91	88	69	82	86
Wood	3	2	2	4	2
Moss					
Basal vegetation	3	3	3	5	4

Association acronyms:

- Popdel/Callon: *Populus deltoides*/*Calamovilfa longifolia* (Plains cottonwood/prairie sandreed)
- Popdel/Elysmi: *Populus deltoides*/*Elymus smithii* (Plains cottonwood/western wheatgrass)

Notes:

- Plot 13: 50 m x 20 m, in one of several linear stands of trees with long axes parallel to stream channel, on high fluvial terrace. Other areas on this terrace are meadows between the bands of trees, with composition like the understory in this stand. Next lower surface is dry bar (plot 12). Surface soil loamy sand. Photo 97GJ1.3.
 - Plot 41: 25 m x 40 m, in band of trees on ridge ca. 20 m wide and ca. 1 m above adjacent ground surface, parallel to channel. Surface soil sandy loam; plot represents cottonwood stand on sandy substrate.
 - Plot 23: 20 m x 10 m, representing one stand of plains cottonwood saplings. Surface soil sandy clay loam. Pocket gopher digging common. Photo 97GJ1.9. This plot represents sequence of vegetation types: farthest from channel is grove of old trees in shallow, abandoned channel (plot 21); closer to channel on slightly higher surface is dry meadow (plot 22); then this plot on slightly lower surface closer to channel; closest to channel on lowest surface is bulrush vegetation (plot 24).
 - Plot 21: 40 m x 40 m, representing a stand of old trees on a higher surface. Surface soil is sandy clay loam in northwestern corner (old channel, with *Stipa viridula*), loamy sand in rest of plot. Photo 97GJ1.7. This plot represents end of vegetation sequence farthest from channel; closer to channel on higher surface is dry meadow (plot 22); then sapling stand closer to channel on slightly lower surface (plot 23); closest to channel on lowest surface is bulrush vegetation (plot 24).
 - Plot 31: 20 m x 35 m, on higher fluvial terrace. Surface soil clay. Photo 97GJ1.10.
-

Table 3-2. Size-class structure of trees in the plains cottonwood sample plots.

Plot 13; 50 m x 20 m			DBH,	INCHES		
SPECIES	<Breast Height	<5"	<9"	<14"	<21"	<36"
Populus deltoides, live					6	3

Plot 41; 25 m x 40 m			DBH,	INCHES		
SPECIES	<Breast Height	<5"	<9"	<14"	<21"	<36"
Populus deltoides, live				7	9	
Populus deltoides, dead				1	1	

Plot 23; 25 m x 40 m			DBH,	INCHES		
SPECIES	<Breast Height	<5"	<9"	<14"	<21"	<36"
Populus deltoides, live	18	31	7			
Populus deltoides, dead	6	23				

Plot 21; 40m x 40m			DBH,	INCHES			
SPECIES	<Breast Height	<5"	<9"	<14"	<21"	<36"	≥36"
Populus deltoides, live					9	4	1
Populus deltoides, dead						2	

Plot 31; 40m x 40m			DBH,	INCHES			
SPECIES	<Breast Height	<5"	<9"	<14"	<21"	<36"	≥36"
Populus deltoides, live					2	4	1

Table 3-3. Canopy cover of plants in wet meadow and mesic meadow sample plots from the potential Antelope Creek RNA.

Species	Plot/Association*					
	24 Scipun	11 Spagra	12 Callon- Sticom	22 Callon- Sticom	32 Callon- Sticom	14 Callon- Sticom
DWARF SHRUBS						
<i>Populus deltoides</i>	1	1				
<i>Salix exigua</i>	1					
GRAMINOIDS						
<i>Agrostis stolonifera</i>		3				
<i>Aristida purpurea</i> var. <i>longiseta</i>						1
<i>Bouteloua gracilis</i>			1		1	30
! <i>Bromus commutatus</i>		1	1		1	1
! <i>Bromus tectorum</i>			10	40	60	20
<i>Calamovilfa longifolia</i>			1	1	40	40
<i>Carex praeegracilis</i>		3				
<i>Eleocharis palustris</i>	10					
<i>Elymus smithii</i>		30		1	10	3
<i>Elymus trachycaulus</i> var. <i>andinus</i>		3				
<i>Elymus trachycaulus</i> var. <i>trachycaulus</i>	3					
<i>Festuca octoflora</i>				1	3	1
<i>Hordeum jubatum</i>		1				
<i>Juncus balticus</i>	1	1				
<i>Koeleria macrantha</i>					1	
<i>Oryzopsis hymenoides</i>			10	1	1	
<i>Poa glaucifolia?</i>			1			
<i>Poa juncifolia</i> var. <i>ampla</i>		10				
! <i>Poa pratensis</i>		3				
<i>Poa secunda</i>			1			
<i>Scirpus pungens</i>	40	20				
<i>Spartina gracilis</i>	1	50				
<i>Sporobolus cryptandrus</i>			10	1	1	
<i>Stipa comata</i>			10	10	30	10
FORBS						
<i>Ambrosia psilostachya</i>		1			1	
<i>Arenaria congesta</i>			1			
<i>Artemisia frigida</i>			3	1	1	3
<i>Artemisia ludoviciana</i>		1	1		1	
<i>Asclepias</i> sp.				1		
<i>Aster</i> sp.		1				
<i>Astragalus bisulcatus</i>		1				
<i>Astragalus miser</i>			1			
<i>Astragalus</i> sp.					1	

! <i>Camelina microcarpa</i>		1	1			1
<i>Chenopodium</i> sp.		1				
! <i>Cirsium arvense</i>		1				
<i>Cirsium undulatum</i>					1	
<i>Cleome</i> sp.			1			
<i>Cryptantha cinerea</i>				3	1	
<i>Dalea</i> sp.			1			1
<i>Descurainia pinnata</i>		1				1
<i>Equisetum laevigatum</i>	10	30	1		1	
<i>Erigeron</i> sp.						1
! <i>Filago arvensis</i>						3
<i>Gaura coccinea</i>			1		1	1
<i>Heterotheca villosa</i>			10			1
Hydrophyllacea				1		
<i>Ipomopsis pumila</i>			1			
! <i>Lactuca serriola?</i>		1				
<i>Lappula redowskii</i>				1		1
<i>Lathyrus</i> sp.		1				
<i>Lepidium densiflorum</i>			1	1	1	1
<i>Leptodactylon</i> sp.			1			
<i>Lithospermum</i> sp.					1	
<i>Lupinus pusillus</i>			1	1		1
<i>Lygodesmia</i> sp.			1	1		
! <i>Melilotus officinale</i>	1	30	1	1	1	1
<i>Oenothera nuttallii</i>				1		
<i>Opuntia polyacantha</i>			1	1	1	1
<i>Orobanche</i> sp.						1
<i>Psoralidium lanceolatum</i>				20		
<i>Ranunculus cymbalaria</i>	1					
<i>Rumex venenosus</i>				1	1	
<i>Sisymbrium altissimum</i>			1			
<i>Sphaeralcea coccinea</i>				1		1
<i>Stephanomeria</i> sp.						1
<i>Thermopsis rhombifolia</i>						1
<i>Tradescentia occidentalis</i>				1	1	1
! <i>Tragopogon dubius</i>			1	1	1	1
<i>Xanthium strumarium</i>	1	1				
<i>Zigadenus venenosus</i>						1
GROUND COVER						
Bare ground	90	10	66	50	25	51
Gravel			10	7	1	1
Rock			1	1		
Litter	8	87	20	40	65	40
Wood			1		1	1
Moss & lichen						5
Basal vegetation	2	3	2	2	3	2

Association acronyms:

– Scipun: *Scirpus pungens* (Leafy bulrush)

- Spagra: *Spartina gracilis* (alkali cordgrass)
- Callon-Sticom: *Calamovilfa longifolia*-*Stipa comata* (prairie sandreed - needle-and-thread)

Notes:

- Plot 24: 20 m x 4 m, representing vegetation on first and second fluvial surfaces above channel, neither higher than 20 cm above the channel. Lower surface is pure *Scirpus pungens*; higher surface is mix of *Scirpus pungens*, *Eleocharis*, *Equisetum*. Surface soil sandy clay, anaerobic. Photo 97GJ1.6. This plot samples part of sequence of vegetation types and represents vegetation on lowest surface closest to channel; next higher surface farther from channel is *Populus deltoides* sapling stand (plot 23); then, on highest surface, dry meadow between cottonwood groves (plot 22); then, farthest from active channel, grove of old *Populus deltoides* (plot 21).
 - Plot 11: 10 m x 20 m, representing long, narrow stand (ca. 300 m x 20-30 m) on first surface ca. 1 m above channel. Next higher surface is dry cobble and gravel bar (plot 12). Surface sandy clay loam. Photo 97GJ1.1.
 - Plot 12: 10 m x 20 m, on second surface above stream channel. Surface soil is sand. Next lower surface is mesic meadow (plot 11); next higher surface is old plains cottonwood woodland (plot 13). Photo 97GJ1.2.
 - Plot 22: 20 m x 30 m, on higher surface. Surface soil loamy sand. Pocket gopher diggings common. *Calamovilfa* is patchy in this stand; patches up to ca. 400 square meters each cover ca. 10% of the area. Photo 97GJ1.8. Plot samples part of sequence of vegetation types: farthest from channel is band of old *Populus deltoides* growing in shallow (ca. 75 cm deep) abandoned channel (21); this plot is on slightly higher surface and closer to channel than 21; on lower surface closer to channel is *Populus deltoides* sapling stand (plot 23); closest to channel on lowest surface is bulrush stand (plot 24).
 - Plot 32: 20 m x 25 m, representing *Calamovilfa*-*Stipa* vegetation on relatively high, sandy sites in a mosaic with *Populus deltoides*/*Elymus smithii* stands on lower sites with finer-textured soils (represented by plot 31). Surface soil loamy sand. Photos 97GJ1.12, 1.13, 1.14.
 - Plot 14: 15 m x 20 m, representing opening between bands of *Populus* woodland. Surface soil sandy loam. Photo 97GJ1.4.
-

VEGETATION DESCRIPTIONS

LOCATION 1. Mosaic of vegetation types south of channel on inside of meander; NW1/4 Sec 14, T40N, R69W.

-ELEVATION: 4375 feet (1333 meters). -ASPECT: North
-TOPOGRAPHIC POSITION: Fluvial terraces in valley bottom.

1a.

-VEGETATION TYPE: *Populus deltoides*/*Elymus smithii* woodland
-DESCRIPTION: Bands of trees in and on margins of old channels or active overflow channels in surface supporting types 1b and 1c. Most tree bands here are made of saplings (<5" dbh) and poles (5"-9" dbh).

Trees: *Populus deltoides* (\leq 9" dbh)

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs: *Poa pratensis*, *Elymus smithii*, *Bromus commutatus*, *Equisetum laevigatum*

-NOTES:

1b.

-VEGETATION TYPE: *Stipa comata*

-DESCRIPTION: Sparsely-vegetated openings between cottonwood bands

Trees:

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs: *Stipa comata*, *Oryzopsis hymenoides*, *Bromus tectorum*, *Melilotus officinale*. (Dominance varies from place to place)

-NOTES: Sandy soil with high percentage of gravel and rock.

1c.

-VEGETATION TYPE: *Calamovilfa longifolia*-*Stipa comata*

-DESCRIPTION: Openings with denser vegetation than 1b.

Trees:

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs: *Calamovilfa longifolia*, *Stipa comata*, *Bromus commutatus*, *Equisetum laevigatum*.

-NOTES: Soil has much less gravel and rock than at type 1b.

LOCATION 2. Edge of upland south of straight stretch of Antelope Creek; NE1/4 Sec 14, T40N, R69W.

-VEGETATION TYPE: *Sarcobatus vermiculatus/Elymus smithii*
-ELEVATION: 4370 feet (1332 meters). -ASPECT: North
-TOPOGRAPHIC POSITION: Gently-sloping fan or terrace above the fluvial surfaces and 2-3 m above the channel of Antelope Creek
-DESCRIPTION: Open shrubland with a dense herbaceous layer

Trees:

Shrubs: *Sarcobatus vermiculatus*

Dwarf Shrubs:

Graminoids & Forbs: *Elymus smithii*, *Bromus commutatus*,
Bromus tectorum

-NOTES: This type covers much of the upland bordering the riparian zone of Antelope Creek

LOCATION 3. Low hills north of straight stretch of Antelope Creek; SE1/4 Sec 13, T40N, R69W.

-VEGETATION TYPE: *Calamovilfa longifolia-Stipa comata*
-ELEVATION: 4340 feet (1323 meters). -ASPECT: East
-TOPOGRAPHIC POSITION: Dunes and swales.
-DESCRIPTION: Moderately dense herbaceous vegetation

Trees:

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs: Major species are *Calamovilfa longifolia*, *Stipa comata*, *Bromus tectorum*; other species present are *Oryzopsis hymenoides*, *Bouteloua gracilis*, *Elymus smithii*, *Sporobolus cryptandrus*, *Lupinus pusillus*.

-NOTES: Similar to vegetation sampled in plot 32. These dunes apparently formed in sandy alluvium blown out of the channel of Antelope Creek to the west.

LOCATION 4. Fans north of Antelope Creek and south of Grassland Road 949; NE1/4 Sec 13, T40N, R69W.

-VEGETATION TYPE: *Sarcobatus vermiculatus/Elymus smithii*
-ELEVATION: 4350 feet (1326 meters). -ASPECT: South
-TOPOGRAPHIC POSITION: Alluvial and colluvial fans
-DESCRIPTION: Moderately-dense shrub vegetation with dense herbaceous understory.

Trees:

Shrubs: *Sarcobatus vermiculatus*

Dwarf Shrubs:

Graminoids & Forbs: Major species are *Bromus commutatus*, *Bromus tectorum*, *Hordeum pusillum*; secondary species are *Elymus smithii*, *Stipa viridula*, *Poa juncifolia* var. *ampla*.

-NOTES: On clay-rich soils. To south, borders *Calamovilfa longifolia-Stipa comata* vegetation on sand dunes (location 3); to

north, merges with *Sarcobatus vermiculatus* shrubland with considerable cover of *Bouteloua gracilis*.

LOCATION 5. Southeastern corner of eastern portion of potential RNA; SW1/4 Sec 20, T40N, R68W.

-VEGETATION TYPE: *Artemisia cana ssp. cana/Elymus smithii*

-ELEVATION: 4340 feet (1323 meters). -ASPECT: Northwest

-TOPOGRAPHIC POSITION: Valley bottom; flat surface 2-3 m above channel of Dry Fork of Cheyenne River

-DESCRIPTION: Moderately dense shrub layer with dense herbaceous understory

Trees:

Shrubs: *Artemisia cana ssp. cana, Sarcobatus vermiculatus*

Dwarf Shrubs:

Graminoids & Forbs: Major species are *Bromus commutatus, Bromus tectorum, Poa pratensis* (low spots); secondary species are *Elymus smithii, Poa juncifolia* var. *ampla, Bouteloua gracilis*.

-NOTES: Much of the shrub layer is a mixture of the two species, but silver sagebrush forms pure patches and greasewood forms pure patches.

LOCATION 6. Southeastern corner of eastern portion of potential RNA; SW1/4 Sec 20, T40N, R68W.

-VEGETATION TYPE: *Scirpus pungens*

ELEVATION: 4340 feet (1323 meters). -ASPECT: Northwest

-TOPOGRAPHIC POSITION: Low terraces, within 1 m of low-water channel, incised 2-3 m into valley floor

-DESCRIPTION: Dense herbaceous vegetation growing in narrow bands in wet and mesic soils along channel.

Trees:

Shrubs:

Dwarf Shrubs:

Graminoids & Forbs: Major species are *Scirpus pungens, Carex lanuginosa, Hordeum jubatum*; secondary species are *Spartina gracilis, Poa pratensis*

-NOTES: *Populus deltoides* seedlings and saplings are present near the confluence with Antelope Creek.

LOCATION 7. Eastern side of eastern portion of potential RNA;
SW1/4 NW1/4 and NW1/4 SW1/4 Sec 20, T40N, R68W.

-VEGETATION TYPE: *Artemisia cana* ssp. *cana*/*Elymus smithii*

-ELEVATION: 4325 feet (1318 meters). -ASPECT: Northwest

-TOPOGRAPHIC POSITION: Valley floor, on surface 1-2 m above
channel

-DESCRIPTION: Sparse shrub layer above herbaceous layer dominated
by patches of different species.

Trees:

Shrubs: *Artemisia cana* ssp. *cana* (ca. 10% canopy cover)

Dwarf Shrubs:

Graminoids & Forbs: *Bromus tectorum* (dominates over much of
area), *Elymus smithii*, *Bouteloua gracilis*, *Sporobolus*
cryptandrus, *Opuntia polyacantha*, *Distichlis stricta*.

-NOTES: Fallen *Populus deltoides* logs are present; a few decadent
trees grow on north end of flat

Appendix 4. Explanations of ranks used by the Wyoming Natural Diversity Database.

As part of the North American network of natural heritage programs, the Wyoming Natural Diversity Database (WYNDD) uses the natural heritage element ranking system developed by The Nature Conservancy. In this system, each species is assigned a two-part rank that reflects its rarity and security both globally (the G part of the rank) and within a state or province (the S part of the rank). Both the global rank and the state rank can range from 1 (extremely rare or threatened) to 5 (common and secure). Ranks are defined as follows:

Global Ranks

- G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extinction.
- G2: Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals) or because of factors making it very vulnerable to extinction.
- G3: Either very rare and localized throughout its range, or found locally (and perhaps abundantly at some sites) throughout a restricted range, or vulnerable to extinction throughout its range.
- G4: Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.
- G5: Demonstrably secure globally and essentially ineradicable under present conditions.
- T: A "T" following the global rank (G#T#) refers to a rank assigned to a sub-specific taxon. The number following the "G" is the rank of the species, and the number following the "T" is the rank of the sub-specific taxon.
- Q: Taxonomic questions or problems exist about the taxon; more information is needed. A "G#Q" rank implies that the taxonomic distinctiveness of the taxon may be of questionable validity. A "G#T#Q" rank implies that the taxonomic distinctiveness of the sub-specific taxon is of questionable validity.

State Ranks

- SE1: Critically imperiled in the state or province because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factors making it especially vulnerable to extinction.
- R2: Imperiled in the state or province because of rarity (6 to 20 occurrences or few remaining individuals) or because of factors making it very vulnerable to extinction.
- G3: Rare or uncommon in the state (on the order of 21 to 100 occurrences).
- G4: Apparently secure in the state or province, with many occurrences.
- G5: Demonstrably secure in the state or province and essentially ineradicable under present conditions.
- ZU: Possibly imperiled in the state but status is uncertain; more information needed before a numerical rank can be assigned.
- S?: Status uncertain due to lack of information. The "?" is usually combined with any of the numerical ranks, as in "G3?".

Migratory Ranks

- B: A "B" following a rank (e.g., S.B.) indicates that the rank refers to the breeding status of the species within the state. B ranks are usually assigned to birds.
- N: An "N" following a rank (e.g., SON) indicates that the preceding rank refers to the non-breeding status of the species in the state. N ranks are usually assigned to birds.

A state rank of S2BS5N indicates that the species is rare in the state as a breeder, but abundant as a non-breeder.

Appendix 5. Plant community types in the potential Antelope Creek Research Natural Area.

The communities are listed by common name. Citations following the common names refer to these sources:

- Johnston (1987): equivalent plant association from the list for USDA Forest Service Region 2;
- The Nature Conservancy (1997): equivalent plant association from the classification of the network of state Natural Heritage Programs and The Nature Conservancy;
- Thilenius et al. (1995): equivalent vegetation type from this study of the Cheyenne River Basin;
- Federal Geographic Data Committee (1997): type in the hierarchy of the National Vegetation Classification Standard to which the association belongs;
- Kuchler (1966): Kuchler vegetation type to which the association belongs.

Plains cottonwood/western wheatgrass

- Johnston (1987): Unknown
- The Nature Conservancy (1997): *Populus deltoides*/*Pascopyrum smithii* woodland
- Thilenius et al. (1995): *Populus sargentii*/*Symphoricarpos occidentalis* deciduous forest
- Federal Geographic Data Committee (1997): II.B.2.N.b.; temporarily-flooded, cold-deciduous, open tree canopy, natural/semi-natural woodland
- Kuchler (1966): Northern floodplain forest (*Populus-Salix-Ulmus*)

Plains cottonwood/prairie sandreed

- Johnston (1987): Unknown
- The Nature Conservancy (1997): *Populus deltoides*/*Calamovilfa longifolia* woodland
- Thilenius et al. (1995): *Populus sargentii*/*Symphoricarpos occidentalis* deciduous forest
- Federal Geographic Data Committee (1997): II.B.2.N.b.; temporarily-flooded, cold-deciduous, open tree canopy, natural/semi-natural woodland
- Kuchler (1966): Northern floodplain forest (*Populus-Salix-Ulmus*)

Basin silver sagebrush/western wheatgrass

- Johnston (1987): *Artemisia cana*/*Elytrigia smithii* plant association
- The Nature Conservancy (1997): *Artemisia cana* ssp. *cana*/*Pascopyrum smithii* sparse shrubland
- Thilenius et al. (1995): *Artemisia cana*/*Agropyron smithii* type (from preliminary classification)

-- Federal Geographic Data Committee (1997): V.A.7.N.g.; medium tall, temperate or subpolar, natural/semi-natural grassland with a sparse, cold-deciduous shrub layer.
-- Kuchler (1966): Wheatgrass-needlegrass shrubsteppe (Agropyron-Stipa-Artemisia)

Black greasewood/western wheatgrass

-- Johnston (1987): Sarcobatus vermiculatus-Artemisia tridentata/Elytrigia smithii plant association
-- The Nature Conservancy (1997): Sarcobatus vermiculatus/Pascopyrum smithii sparse shrubland
-- Thilenius et al. (1995): Sarcobatus vermiculatus/Agropyron smithii-Bouteloua gracilis shrub-steppe
-- Federal Geographic Data Committee (1997): V.A.7.N.g.; medium tall, temperate or subpolar, natural/semi-natural grassland with a sparse, cold-deciduous shrub layer.
-- Kuchler (1966): Wheatgrass-needlegrass shrubsteppe (Agropyron-Stipa-Artemisia)

Leafy bulrush

-- Johnston (1987): Unknown
-- The Nature Conservancy (1997): Scirpus pungens herbaceous vegetation
-- Thilenius et al. (1995): Unknown
-- Federal Geographic Data Committee (1997): V.A.5.N.m.; saturated, temperate or subpolar, natural/semi-natural grassland
-- Kuchler (1966): Wheatgrass-needlegrass shrubsteppe (Agropyron-Stipa-Artemisia)?

Alkali cordgrass

-- Johnston (1987): None?
-- The Nature Conservancy (1997): Spartina gracilis herbaceous vegetation
-- Thilenius et al. (1995): Unknown
-- Federal Geographic Data Committee (1997): V.A.5.N.k.; seasonally flooded, temperate or subpolar, natural/semi-natural grassland
-- Kuchler (1966): Wheatgrass-needlegrass shrubsteppe (Agropyron-Stipa-Artemisia)?

Needle-and-thread

-- Johnston (1987): Calamovilfa longifolia/Stipa comata plant association?
-- The Nature Conservancy (1997): Calamovilfa longifolia-Stipa comata herbaceous vegetation?
-- Thilenius et al. (1995): Calamovilfa longifolia-Stipa comata preliminary type
-- Federal Geographic Data Committee (1997): V.A.5.N.d.; medium-tall, bunch, temperate or subpolar, natural/semi-natural grassland
-- Kuchler (1966): Grama-needlegrass-wheatgrass (Bouteloua-Stipa-Agropyron)

Prairie sandreed - needle-and-thread

-- Johnston (1987): Calamovilfa longifolia/Stipa comata plant association

-- The Nature Conservancy (1997): Calamovilfa longifolia-Stipa comata herbaceous vegetation

-- Thilenius et al. (1995): Calamovilfa longifolia-Stipa comata preliminary type

-- Federal Geographic Data Committee (1997): V.A.5.N.a.; tall, sod, temperate or subpolar, natural/semi-natural grassland

-- Kuchler (1966): Grama-needlegrass-wheatgrass (Bouteloua-Stipa-Agropyron)?