RARE PLANT INVENTORY AND PLANT COMMUNITY DESCRIPTIONS OF THE SWEET GRASS HILLS PROPOSED AREA OF CRITICAL ENVIRONMENTAL CONCERN (PACEC), TOOLE AND LIBERTY COUNTIES, MONTANA

Prepared for:

United States Department of Interior
Bureau of Land Management
812 14th Street North
P.O. Box 2865
Great Falls, Montana 59401

Prepared by:

Western Technology and Engineering, Inc.
P.O. Box 6045
Helena, Montana 59604

In Cooperation With:

Montana Natural Heritage Program
Montana State Library Building
1515 East 6th Avenue
Helena, Montana 59620

ORDER NO. MT950 - PH9 - 366

December, 1989

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1.0 INTRODUCTION

The Sweet Grass Hills proposed Area of Critical Environmental Concern (PACEC) comprises about 3,220 hectares of Bureau of Land Management surface in Toole and Liberty counties of north-central Montana (Figure 1). The Hills are the smallest and, in many respects, the most isolated of the intrusive "island" mountain ranges of the northern Great Plains (Thompson and Kuijt 1976a). High peaks rise abruptly from the surrounding prairie, supporting montane to subalpine plant communities. Elevations within the PACEC range from about 1340 m to over 2100 m on top of West Butte. The geographic position, rugged topography and elevational range support a diversity of plant communities more closely related to the Rocky Mountains than the Northern Great Plains. The presence of both floras results in a unique assemblage of plant communities.

The purpose of this inventory was to assess the status of any rare plants potentially occurring within the PACEC. Secondary objectives were to generate a comprehensive species list and briefly describe the major plant communities of the PACEC.

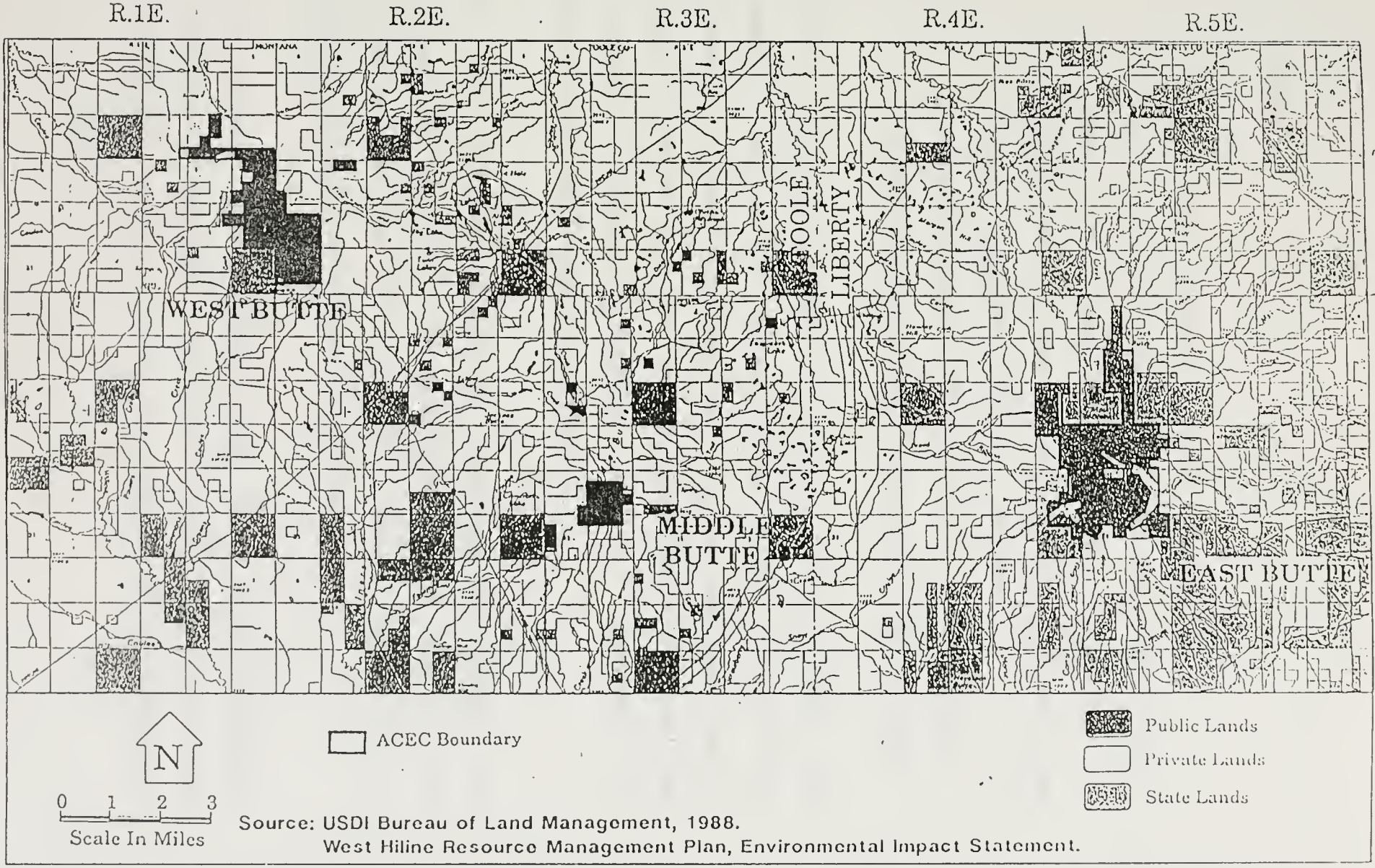

FIGURE 1 Sweet Grass Hills Emphasis Area - Surface Ownership Map

2.0 METHODS

Tasks completed prior to the field inventory included:

1. Search of Montana Natural Heritage Program data base to determine rare plants previously identified in the area.
2. Review of local and regional literature regarding rare plants and plant communities pertinent to the area.
3. Obtain USGS topographic maps and outline PACEC boundaries.
4. Contact landowners and obtain access across private lands.

Field work was conducted June 13-14, 1989 and July 18-21, 1989. The range of vegetation types on West, East and Middle (Gold) Buttes was surveyed by pedestrian reconnaissance. Species lists were made at selected locations; taxa not readily identified in the field were collected and pressed for verification in the office. Photographs were taken of representative plant communities.

The site previously recorded for Ranunculus cardiophyllus Hook. (Thompson and Kuijt 1976b) was intensively surveyed, although it is located outside the PACEC boundary. Likely habitats for R. cardiophyllus within the PACEC were also inventoried.

Plant specimens were identified in the office using a stereozoom dissecting microscope. Taxonomic manuals used for plant identification included Hitchcock and Cronquist (1973), Hitchcock et

al. (1955-69), Dorn (1984), Great Plains Flora Association (1986) and Sooggan (1978).

3.0 RESULTS

3.1 RARE PLANT EVALUATION

Lesica et al. (1984) list 34 vascular plant species of limited distribution in the north-central region of Montana. Of those listed, only one, heart-leaved buttercup (Ranunculus cardiophyllus) was listed by Thompson and Kuijt (1976b) as occurring in the Sweet Grass Hills. Because of the relative paucity of botanical information for the Hills, all species not readily identified in the field were collected to evaluate other potentially rare taxa, and to obtain as complete a species list as possible. Three species have been identified as meriting additional investigation: heart-leaved buttercup, springbeauty (Claytonia lanceolata Pursh var. flava (A. Nels.) C.L. Hitchc.) and twiggy halimolobos (Halimolobos virgata) (Nutt.) Schulz.

3.1.1 Ranunculus cardiophyllus (Heart-leaved buttercup)

Ranunculus cardiophyllus has been recorded from only six locations in Montana: four stations in Glacier County, one in Sweetgrass County, and one in Toole County (Montana Natural Heritage Program database, Helena.) The location in Toole County is from the West Butte in the Sweet Grass Hills, and was collected by Miller and Hassinger (4828) on West Butte on June 30, 1975. The collection site was described as a "flat, exposed, meadowy area near Fred and George Creek" (University of Lethbridge herbarium label).

Hitchcock and Cronquist (1973) list heart-leaved buttercup as occurring in mountain meadows from British Columbia to Alberta and Saskatchewan, sporadically south to northeast Washington, and in Wyoming, Utah, New Mexico and Arizona. The eastern limit of the species in the U.S. is apparently the Dakotas, where it is found infrequently in wet meadows and along streams in the Black Hills of South Dakota (Van Bruggen 1976; Dorn 1977) and in McKenzie County, North Dakota (Great Plains Flora Association 1986). The taxon is apparently poorly understood (Welsh et al. 1987) and is similar to R. inamoenus Greene and R. pedatifidus Smith. It is considered by Scoggan (1978) to be a variety of R. pedatifidus. Heart-leaved buttercup has been reported for both the Saskatchewan and Alberta portions of the Cypress Hills, approximately 112 km northeast of the Sweet Grass Hills (Breitung 1954; de Vries and Bird 1968). To the northwest, Kuijt (1982) lists the species as occurring on rather dry grassy meadows at low elevations in Waterton Lakes National Park.

Moss (1959) lists heart-leaved buttercup as common in moist prairie and mountain meadows of Alberta, while Looman and Best (1979) report the species as uncommon in western parklands of the Canadian prairie provinces. In the Cypress Hills, it is common in grasslands of the plateau (Breitung 1954).

Habitat affinity for heart-leaved buttercup changes from north to south. In the north it is characterized as occurring primarily in mountain meadows at low to mid-elevations (Hitchcock and Cronquist

1973, Kuijt 1982, Weber 1976, Van Bruggen 1976, Harrington 1964 and Dorn 1988). In Arizona, however, it is found in pine forests from 7,000 to 9,500 feet (Kearney and Peebles 1960).

West Butte was revisited in an attempt to relocate heart-leaved buttercup. Several Ranunculus specimens were collected, but R. cardiophyllus was not found. Given the imprecise location reported on the herbarium label from the previous collection, a general site traverse was conducted in suitable habitats in and near the PACEC.

The veracity of the previous collection is not questioned; failure to relocate the population may indicate that it is very small, or that it has been extirpated. Also, the previous collection may have been made on private land outside the Sweet Grass Hills PACEC.

3.1.2 Claytonia lanceolata variety (Springbeauty)

Springbeauty (Claytonia lanceolata var. flava) is listed as critically imperiled in Montana because of extreme rarity; it is designated "C2" by the U.S. Fish and Wildlife Service (current information indicates that proposing to list as endangered or threatened is possibly appropriate but substantial biological information is not on file to support an immediate ruling); and as sensitive by the U.S. Forest Service (Shelly 1989). Claytonia lanceolata is common in the Hills and several specimens were collected. Specimens collected have white flowers and narrow leaves, and may represent either variety multiscapa or a white form of variety flava (Shelly pers. comm.). Systematic

studies of these taxa, by J.S. Shelly and P. Lesica, are not yet completed, and a positive identification cannot be made at this time. Upon completion of these studies, the Montana Natural Heritage Program will update the Bureau of Land Management as to the identification of these plants. The taxon is common on East and West Buttes in grassland habitats, and no immediate threats are apparent.

3.1.3 Halimolobos virgata (?) (Twiggy halimolobos)

Plant specimens tentatively identified as twiggy halimolobos (Halimolobos virgata) were collected near a rock outcrop on foothills north of Mount Brown in the East Butte area. The specimens depart from the published species descriptions, in having pubescent siliques and shorter petals. Specimens are being sent to the New York Botanic Garden for verification. Shelly (pers. comm., December, 1989) also collected specimens tentatively identified as Halimolobos from the Bull River in northwestern Montana. If correctly identified, these collections represent new state records for Montana. Twiggy halimolobos is previously documented from open prairies to lower mountains, from Yukon to Alberta and Saskatchewan, south to eastern Idaho, Wyoming, Utah and Colorado (Hitchcock and Cronquist 1973).

3.2 SPECIES LIST

Thompson and Kuijt (1976b) prepared a comprehensive species list for the Sweet Grass Hills during their investigations in 1972-1975.

Hagener (1972) and Hagener and Hagener (1977) list common plants of north-central Montana.

Appendix A lists plant species encountered during the 1989 rare plant inventory. Appendix A also lists additional species recorded for the Sweet Grass Hills area by Thompson and Kuijt (1976b), but which were not observed in the rare plant inventory conducted by WESTECH.

A total of 339 species were recorded, of which 71 were graminoids, 228 were forbs, 27 were low shrubs and subshrubs and 13 were trees and tall shrubs. Some of the taxa listed by Thompson and Kuijt (1976b) may not occur within the PACEC boundaries surveyed by WESTECH; however they are at least proximal and are included in Appendix A since many of these species are expected to occur in the PACEC.

Although very few rare plant species have been listed for the Sweet Grass Hills and vicinity (Lesica et al. 1984), a number of taxa are of phytogeographical interest due to island biogeography considerations. Some species within the PACEC which may represent range extensions of subalpine/alpine taxa are included in Table 1. Thompson and Kuijt (1976a) listed cordilleran species of phytogeographic interest in the Sweet Grass Hills.

Table 1. Subalpine and alpine plant taxa which may represent range extensions in the Sweet Grass Hills PACEC (see Appendix A).

Graminoids	Forbs
Agrostis thurberiana*	Arenaria rubella
Carex albonigra*	Castilleja rhexifolia
Carex phaeocephala*	Epilobium alpinum
Luzula spicata	Erigeron simplex*
Poa alpina*	Hedysarum alpinum
Poa rupicola	Rumex acetosa
Phleum alpinum	Sibbaldia procumbens

Trees

Abies lasiocarpa
Pinus albicaulis

* identified by Thompson and Kuijt (1976a) in the Sweet Grass Hills, but not observed during the 1989 WESTECH inventory of the PACEC.

3.3 VEGETATION TYPE DESCRIPTIONS

3.3.1 Literature Review

Vegetation communities of the Sweet Grass Hills have been mapped and described in very general terms during several statewide efforts. Ross and Hunter (1976) utilized the USDA Soil Conservation Service range site methodology to map climax vegetation of Montana based on soils and climate. In the Sweet Grass Hills, upper elevation sites were mapped as a forest-grassland complex in the 15 to 19-inch precipitation zone on shallow to moderately deep soils with a frigid temperature regime. Species occurring on forested sites include Douglas-fir, snowberry, spirea, Oregon grape and Idaho fescue. Grassland species listed were Idaho fescue, bluebunch wheatgrass, Columbia needlegrass, lupine and arrowleaf balsamroot. Foothills surrounding the forest grassland complex were mapped as a silty range site, also in the 15 to 19-inch precipitation zone. Dominant species listed for this mapping unit include rough fescue, Idaho fescue and bluebunch wheatgrass. The prairie surrounding the Sweet Grass Hills was mapped as a silty-clayey range site complex in the 10 to 14-inch precipitation zone of the Western Glaciated Plains Geographical Area. This range site occurs across much of north-central Montana, from west of Shelby to near Havre. Dominant species on silty sites include needle-and-thread, western and thickspike wheatgrass, green needlegrass, bluebunch wheatgrass, prairie junegrass, blue grama and several forbs. Similar species composition is listed for the clayey range site, although relative abundance would be expected to differ from silty sites.

Payne (1973) mapped and described rangeland sites of Montana. Upper elevation forested sites in the Sweet Grass Hills were mapped as lodgepole pine/Douglas-fir forest. Foothills and grassy meadows were mapped as a Foothills Grassland type. Principal forage species listed include fescues, wheatgrasses and needle-and-thread. The distinguishing feature of this type is the mixture of montane and plains species. Vegetation of the plains surrounding the Sweet Grass Hills is described as Northern Grassland, including blue grama, western wheatgrass, needle-and-thread and dryland sedges (threadleaf and needleleaf).

Pfister et al. (1977) have developed a comprehensive classification of Montana's forest habitat types; however, their study did not include stands from isolated, non-U.S. Forest Service-managed mountain ranges in central and eastern Montana. Mueggler and Stewart (1980) have classified grass and shrub communities of the western one-third of Montana. The Sweet Grass Hills were not included in this classification, although some similarities with their descriptions are apparent. Hansen et al. (1988) described riparian dominance types of Montana. Their compilation may be applicable to some riparian types in the Sweet Grass Hills; however, no sampling or literature pertaining to the Hills was used in the classification.

Qualitative, site-specific descriptions of major vegetation communities of the Sweet Grass Hills are presented by Thompson and Kuijt (1976a).

They divided plant communities elevationally into two groups: plains communities occurring primarily below 1400 m, and montane communities primarily above 1400 m. Figure 2 profiles vegetation communities across the montane region of East Butte.

PLAINS COMMUNITIES

Agricultural land. Most of the flat, arid prairie surrounding the Hills has been altered by agriculture. Little native prairie, probably formerly dominated by western wheatgrass, needle-and-thread and blue grama, now remains.

Foothills prairie. The higher grasslands surrounding the Hills (about 1100 to 1500 m) are similar to the foothills prairie described by Kuchler (1964), normally supporting stands dominated by wheatgrasses, fescues and needle-and-thread.

Riparian shrubbery. Edges of intermittent prairie streams are lined with shrub communities generally dominated by serviceberry, hawthorn and chokecherry. Scattered stands of boxelder are present along some drainage bottoms.

Riparian forest. A deciduous forest association dominated by black cottonwood and plains cottonwood extends into the montane region of the Hills, reaching elevations up to 1500 m along Breed

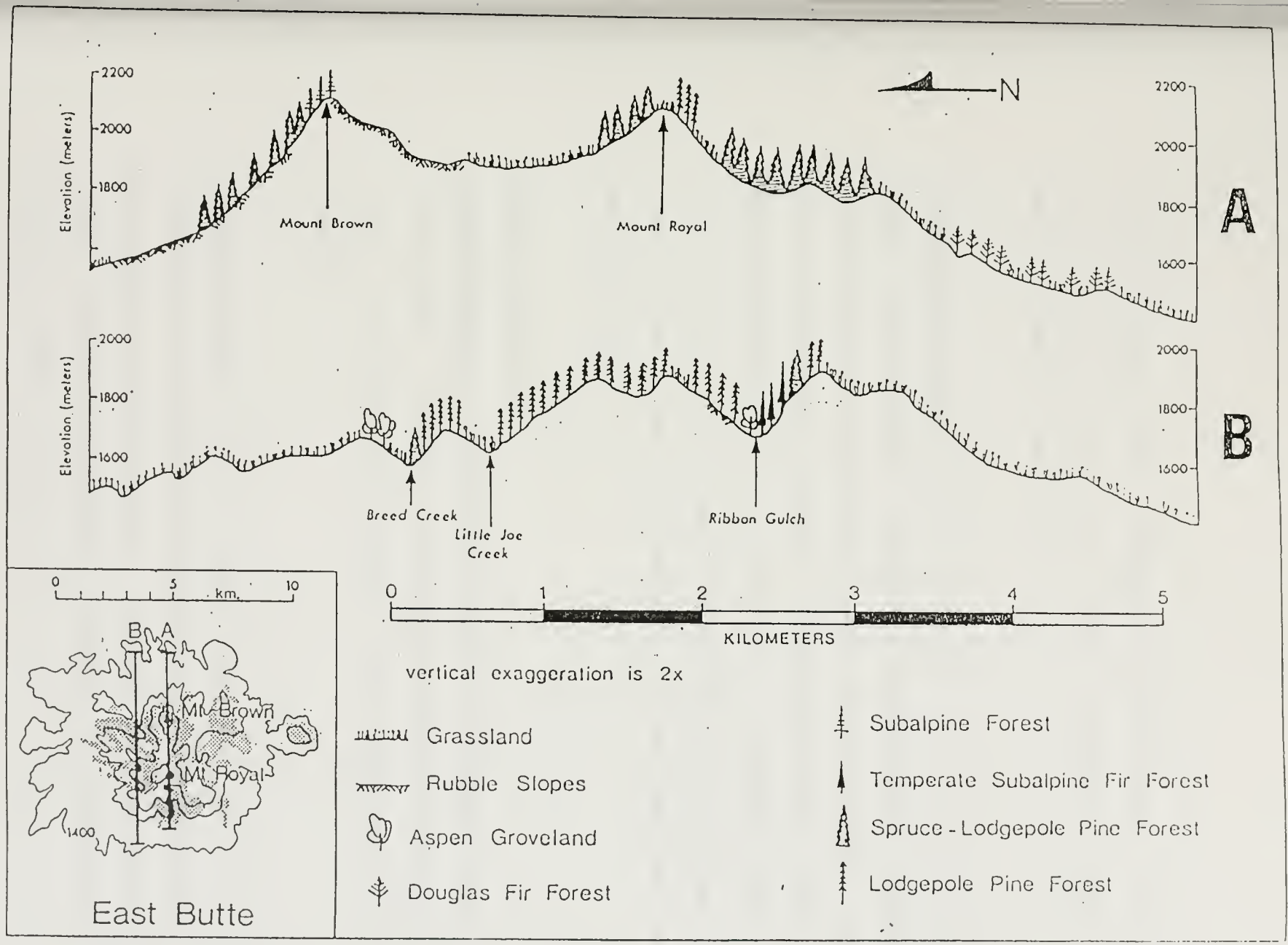

FIGURE 2 Vegetation profiles along two north-south transects through the montane regions of East Butte.

Source: Thompson and Kuijt (1976a)

Creek and Simmons Creek. Understory consists largely of dense shrubbery including Rocky Mountain maple, serviceberry, dogwood, hawthorn, chokecherry and willows.

Potholes and reservoirs. Small glacial kettles, from a few square meters to several hectares, are found as high as 1300 m and are abundant north and west of East Butte. Ponds are shallow, and most are usually dry by late July. Some support cattail, rushes, bulrushes and sedges. Since no natural lakes or marshes are found within the Hills proper, natural wetland communities similar to marshes of the Cypress Hills (Breitung 1954) are absent from the Sweet Grass Hills.

MONTANE COMMUNITIES

Montane grassland. Dry south-facing slopes and foothills between 1500 and 2000 m, and many non-forested portions of north-facing slopes, are dominated by rough fescue, Idaho fescue and shrubby cinquefoil.

Subalpine grassland. Small grassland areas above timberline on the summits of Mount Royal and West Butte appear distinct from the lower-elevation montane grassland, and somewhat resemble alpine tundra. Caespitose vegetation is dominated by stunted rough fescue and shrubby cinquefoil, with American bistort a major

component. A more moist grassland found on the steep, shady north face of Mount Royal is dominated by sedge species.

Douglas-fir forest. Douglas-fir forest comprises the lowest coniferous forest of the Hills. Ponderosa pine, more common in other isolated mountain ranges, is absent; apparently, base elevations of the Hills are above the cold limits of ponderosa pine. The understory of Douglas-fir forest is the most developed of all coniferous forests found in the Hills. Shrubs are abundant, including serviceberry, Oregon grape, prince's pine, common juniper, russet buffaloberry and white spirea. Conspicuous forbs include bluntleaf sandwort, orange arnica, clematis, spotted coralroot, Virginia strawberry, northern bedstraw, Richardson's geranium, stonecrop, starry Solomon's seal and meadowrue. A drier Douglas-fir savannah occurs on some south slopes, while Douglas-fir and limber pine are found on the rocky, lower south slope of West Butte.

Limber pine woodland. Limber pine occurs along forest edges throughout the montane region, forming pure stands on dry ridges east of Mount Brown.

Lodgepole pine forest. Dense, even-aged stands of lodgepole pine occur on steeper, north-facing slopes from 1500 to 2100 m. The understory is sparse and includes heart-leaved arnica, twinflower, white spirea, sidebells pyrola, one-flowered wintergreen, green

wintergreen, dwarf huckleberry, blue huckleberry, myrtle huckleberry and grouse whortleberry.

Spruce-lodgepole pine forest. This type is found on north-facing slopes and along streams from 1600 to 2100 m on East Butte only. Lodgepole pine and spruce dominate a sparse understory similar in composition to the lodgepole pine forest.

Temperate subalpine fir forest. Subalpine fir and spruce dominate steep, shady north-facing slopes from 1650 to 1800 m above Ribbon Gulch (west side of East Butte). This unusually low-elevation occurrence of subalpine fir may be due to cold air drainage down the canyon. Scattered lodgepole pine and Douglas-fir are found in the type. The understory includes Rocky Mountain maple, harebell, fireweed, twinflower, one-flowered wintergreen, russet buffaloberry and grouse whortleberry.

Subalpine forest. Whitebark pine is a major component of forests near the summits of Mount Brown and Mount Royal. Lodgepole pine, limber pine, spruce, and, on the north face of Mount Brown, subalpine fir also occur. These stands are apparently above the cold limits of Douglas-fir. Whitebark pine and lodgepole pine dominate forest stands at timberline on the summit of West Butte. On West Butte, subalpine fir is found only on the dry, rocky ridge south of the summit, where its stunted, wind-blown form resembles

krummholz. Understory plants are virtually absent from most subalpine forest stands.

Aspen groveland. Groves of aspen surrounded by grassland are found up to 1800 m. These stands support a dense understory of herbaceous and shrubby species, and are similar to the aspen groveland described by Lynch (1955) on the east slope of the Rockies.

Aspen woodland. Clones of aspen occur within the Douglas-fir forest at elevations between about 1400 and 1600 m. These stands have understories similar to the Douglas-fir forest and probably represent a fire-caused seral stage.

Mountain ravines. In the higher montane regions, between 1500 and 2000 m, major streams flow through steep rocky ravines. These ravines are generally bordered by coniferous forest and support stands of aspen and Rocky Mountain maple.

Rubble slopes. Higher montane steep slopes with loose, lichen-covered rocks (1 to 4-dm diameter) are sparsely vegetated, occasionally supporting clumps of spruce or lodgepole pine. Other species found on these rubble slopes include sulfur buckwheat, kinikinnick, matted saxifrage and raspberry.

Several vegetation inventories of other isolated mountain ranges in Montana and Canada may be pertinent to the Sweet Grass Hills. The flora of the Cypress Hills has been described by Breitung (1954), deVries and Bird (1968) and Newsome and Dix (1968). Forest habitat types of the Bear's Paw Mountains have been classified by Roberts and Sibbernsen (1979a) and Roberts (1980). Forest habitat types of the Little Rocky Mountains have also been classified by Roberts and Sibbernsen (1979b) and Roberts (1980). Culwell et al. (1989) have described vegetation types of a portion of the Little Rocky Mountains.

Forest habitat types of the Blackfeet Indian Reservation have been classified by Cooper (1981), and Lynch (1955) has inventoried aspen groveland in Glacier County, Montana.

Table 2 lists habitat types and community types reported in pertinent vegetation inventories.

3.3.2 Habitat/Community Types of the Sweet Grass Hills

A preliminary assessment of habitat/community types of the PACEC is possible utilizing general descriptions provided by Thompson and Kuijt (1976a), qualitative notes from the rare plant inventory, and extrapolation of reports from adjacent, isolated mountain ranges. This assessment of types must be considered speculative given the lack of quantitative ecological data. Photographs of representative vegetation types are presented in Appendix B.

Table 2. Habitat or community types identified in or peripheral to the Sweet Grass Hills.

Habitat/community type[1]	STUDY AREA[2]				
	Sweet Grass Hills	Cypress Hills	Bear's Paw Mountains	Little Rocky Mountains	Blackfeet Indian Res.
GRASSLAND					
Foothills Prairie	X	X			
Wheatgrass/fescue/needle-and-thread c.t.	X				
Thickspike wheatgrass/needle-and-thread c.t.		X			
Montane Grassland	X	X		X	
Bluebunch wheatgrass/native bluegrass h.t.				X	
Idaho fescue/bluebunch wheatgrass h.t.				X	
Rough fescue/Idaho fescue h.t.	X	X		X	
Subalpine Grassland	X				
Rough fescue/shrubby cinquefoil/bistort c.t.	X				
Sedge meadow	X				
SHRUBLAND (upland)					
Shrubby cinquefoil/rough fescue h.t.		X			
CONIFEROUS FOREST					
Limber Pine Series	X				X
Limber pine/juniper h.t.					X
Douglas-fir Series	X		X	X	X
Douglas-fir/western snowberry h.t.			X	X	
Douglas-fir/common snowberry h.t.					X
Douglas-fir/serviceberry h.t.			X		
Douglas-fir/kinikinnick h.t.				X	
Douglas-fir/Oregon grape h.t.				X	
Douglas-fir/Canada violet h.t.			X		
Douglas-fir/twinflower h.t.			X	X	
Douglas-fir/bunchberry dogwood h.t.			X		

Table 2. (continued)

Habitat/community type[1]	STUDY AREA[2] Sweet Grass Hills	Cypress Hills	Bear's Paw Mountains	Little Rocky Mountains	Blackfeet Indian Res.
Lodgepole Pine Series	X	X		X	
Lodgepole pine/scree c.t.				X	
Lodgepole pine/mixed shrub c.t.				X	
Lodgepole pine/common juniper c.t.				X	
Lodgepole pine/twinflower c.t.				X	
Spruce Series[3]	X	X	X		X
Spruce/common juniper h.t.			X		
Spruce/twinflower h.t.			X		
Spruce/horsetail h.t.					X
Subalpine Fir Series	X		X		X[4]
Subalpine fir/common juniper h.t.			X		
Subalpine fir/twinflower h.t.			X		
Whitebark Pine Series	X				
DECIDUOUS FOREST					
Aspen Series	X	X		X	X
Aspen/common snowberry c.t.					X
Aspen/pinegrass c.t.					X
Aspen/black cottonwood/Osmorhiza c.t.					X
Aspen/paper birch c.t.				X	
RIPARIAN/WETLAND TYPES					
Aspen Series	X	X		X	X
Potholes/reservoirs	X				
Ravines	X				
TALUS/SCREE					
Rubble slopes	X			X	
Forested scree	X			X	

Table 2. (continued)

[1] h.t. = habitat type
c.t. = community type
Ponderosa pine types identified in peripheral studies are not listed since this species is not represented in the Sweet Grass Hills.

[2] Sources by study area are:
Sweet Grass Hills - Thompson and Kuijt (1976a)
Cypress Hills - Breitung (1954), Newsome and Dix (1968)
Bear's Paw Mountains - Roberts and Sibbernsen (1979a), Roberts (1980)
Little Rocky Mountains - Roberts and Sibbernsen (1979b), Roberts (1980), Culwell et al. (1989)
Blackfeet Indian Reservation - Cooper (1981)

[3] Spruce in the Cypress Hills was identified as Picea glauca; spruce in the Sweet Grass Hills is a hybrid, Picea glauca x engelmannii (Thompson and Kuijt (1976a)).

[3] Cooper (1981) lists 16 habitat types in the subalpine fir series; given the limited distribution of subalpine fir in the Sweet Grass Hills, it is likely that only one or two habitat types are present.

GRASSLAND TYPES

Prairie grassland. Several types potentially occur in the prairie surrounding the Sweet Grass Hills; however, the PACEC is primarily above elevations characteristic of Northern Great Plains prairie associations. Absence of fescue species differentiates the prairie grassland from foothills, montane and subalpine grasslands. Dominant species include wheatgrasses (primarily western in association with thickspike and bluebunch), needlegrasses (primarily needle-and-thread with some green needlegrass), blue grama and dryland sedges (threadleaf and needleleaf).

Foothills grassland. This type is dominant in the Buttes immediately above prairie grassland. Fescues dominate most stands. Table 3 presents qualitative data on composition of three vicinity stands sampled by Ross et al. (1973) in their assessment of near-pristine sites in Montana. Each site is clearly dominated by rough fescue. Idaho fescue is present in each stand, but composition is low. Perennial forbs contribute 4 to 10 percent composition by weight. The foothills grassland most closely fits the rough fescue/Idaho fescue habitat type of Mueggler and Stewart (1980). It differs in the Hills by a paucity of Idaho fescue and perennial forbs, and a very high composition of rough fescue. Table 4 presents a comparison of ungrazed and grazed stands at the Gold Butte Cemetery (Ross et al. 1973). Needle-and-thread, not recorded in the ungrazed stand, increased

Table 3. Percent composition (by weight) of three near-pristine sites in foothills grassland of the Sweet Grass Hills (Ross et al. (1973)).

Species	Gold Butte Cemetery	Thompson Ranch SE of Whitlash	Oswood Ranch SE of Whitlash
Rough fescue	80	92	93
Idaho fescue	T	2	1
Western & Thickspike wheatgrass	5	T	
Green needlegrass	5	1	
Cusick bluegrass	T		
Threadleaf sedge	T	T	1
Perennial forbs	10	5	4
Annuals and biennials	T	T	T
Prairie rose			1

Table 4. Percent composition (by weight) of ungrazed and grazed foothills prairie in the Sweet Grass Hills (Gold Butte Cemetery) (Ross et al. (1973)).

Species	Ungrazed	Grazed
Rough rescue	80	5
Idaho fescue	T	
Western wheatgrass	5	5
Green needlegrass	5	
Threadleaf sedge	T	5
Needle-and-thread		50
Prairie junegrass		15
Cusick bluegrass	T	
Perennial forbs	10	15
Annuals	T	3
Broom snakeweed		2

to 50 percent composition (by weight) with grazing. Rough fescue decreased dramatically with grazing from 80 to 5 percent composition, indicating a grazing-induced seral community dominated by needle-and-thread. This grazing response also indicates a substantial deviation from Mueggler and Stewart's (1980) rough fescue/Idaho fescue habitat type, since their paired stands for the type do not show needle-and-thread as a primary increaser.

Grassland similar to the rough fescue/bluebunch wheatgrass habitat type was observed on slightly drier sites.

It is likely that additional investigations will delineate several associations for foothills grassland, reflecting the range of site differences within this zone.

Montane grassland. As in the foothills grassland zone, rough fescue is the dominant species over most of the montane grassland. Potential habitat types within this zone include:

Rough fescue/Idaho fescue
Rough fescue/bluebunch wheatgrass
Idaho fescue/bluebunch wheatgrass

These types were identified by Culwell et al. (1989) in the montane zone of the Little Rocky Mountains. Qualitative

observations indicate compositional differences from Mueggler and Stewart's (1980) types. The rough fescue/bluebunch wheatgrass and Idaho fescue/bluebunch wheatgrass types are much more limited than the rough fescue/Idaho fescue type in the Sweet Grass Hills.

Subalpine grassland. The subalpine grassland is limited to relatively small areas above timberline on the summits of Mount Royal and West Butte. Rough fescue is dominant in some stands, but community stature and associated species composition indicate dissimilarities with montane grassland. Two tentative types based on Thompson and Kuijt's (1976a) description are rough fescue/shrubby cinquefoil and sedge meadow. Idaho fescue and shrubby cinquefoil are dominant on the top of Mt. Royal, suggesting a third type (possibly a seral phase of the rough fescue type). Herbaceous species indicative of the subalpine zone are listed in Table 1.

UPLAND SHRUB

Shrubby cinquefoil grassland. Relative cover of shrubby cinquefoil in some areas warrants separation from grassland types. Rough fescue, usually the dominant grass, identifies the shrubby cinquefoil/rough fescue habitat type of Mueggler and Stewart (1980). Idaho fescue is dominant in other stands, implying a shrubby cinquefoil/Idaho fescue type. Since shrubby cinquefoil generally increases with grazing, additional investigations would be required to determine whether the type is

climax or a grazing-induced seral community in the Sweet Grass Hills.

Western snowberry/rose. Swales, upland drainages and other snow accumulation areas support a low shrub type dominated by western snowberry and rose. Understory species are similar to the adjacent grasslands with higher abundance of mesic-site species. Kentucky bluegrass has generally invaded these stands.

CONIFEROUS FOREST AND SAVANNAH TYPES

Limber pine series. Limber pine is present as a codominant or subdominant in the Douglas-fir series, and forms pure stands on dry ridges east of Mt. Brown. Limber pine stands are frequently open, appearing as a woodland or savannah. Idaho fescue is the dominant understory species, implying the limber pine/Idaho fescue type of Pfister et al. (1977).

Douglas-fir series. Douglas-fir occurs as dense forests on north-facing aspects at lower elevations and as a savannah on drier south-facing slopes. It is a seral component of higher elevation forest in the spruce or subalpine fir series. Thompson and Kuijt (1976a) describe the understory as the most well-developed of coniferous types in the Hills. Douglas-fir types described for the Bear's Paw Mountains and Little Rocky Mountains that may be present in the Sweet Grass Hills include Douglas-fir/western

snowberry, Douglas-fir/serviceberry, Douglas-fir/kinikinnick, Douglas-fir/Oregon grape, Douglas-fir/Canada violet, Douglas-fir/twinflower and Douglas-fir/bunchberry dogwood.

Lodgepole pine series. Lodgepole is extensive at mid to upper elevations on cool, mesic slopes. It is likely seral, related to fire history. Succession may be very slow, however, reflecting possible soil loss following extensive burns. Understory is depauperate, making classification difficult. Types that may be present include lodgepole pine/twinflower, lodgepole pine/mixed shrub, lodgepole pine/huckleberry species, and lodgpole pine/common juniper.

Spruce series. Spruce is found on East Butte (Figure 2) at mid to upper elevations. Potential types include spruce/twinflower, spruce/common juniper and perhaps spruce/matted clematis on limestone substrates.

Subalpine fir series. Subalpine fir/common juniper and subalpine fir/twinflower are found in the Bear's Paw Mountains (Roberts, 1980), and may be present in the Sweet Grass Hills. Other possible subalpine fir types include subalpine fir/grouse whortleberry and subalpine fir-whitebark pine at the highest elevations.

DECIDUOUS FOREST

Aspen series. Aspen occurs as groves surrounded by grassland, and as woodland in coniferous forest. Understory is dense and diverse. Possible types include aspen/sweetroot in the groves and aspen/twinflower or aspen/western snowberry in the coniferous forest.

SCREE/TALUS/ROCK OUTCROP

Most rocky slopes are poorly vegetated and can be designated technically as scree, talus or rock outcrop. Scattered trees occur on some rocky slopes and may be designated as limber pine/scree, spruce/scree or lodgepole pine/scree, depending on tree species dominance.

4.0 MANAGEMENT RECOMMENDATIONS

Rare plants

Field investigations should be continued to determine the status of heart-leaved buttercup in the Sweet Grass Hills. Bureau of Land Management or contract botanists should periodically conduct botanical investigations during spring or early summer to determine if heart-leaved buttercup is present in the PACEC. Investigations should be conducted prior to any changes in land management policies that might affect the taxon. If no threats are posed to suitable habitat, the priority for additional investigations is considered low. Because access is limited, and the Hills are rugged, a detailed field inventory to document the status of heart-leaved buttercup will require a substantial field effort. The status of springbeauty and twiggy halimolobos should be determined following verification of the voucher specimens.

Habitat type descriptions

Habitat types of the Sweet Grass Hills have not been quantitatively described. Previous investigations by Thompson and Kuijt (1976a) have been qualitative. Although plant communities in the Hills resemble some habitat types described for Montana by Pfister et al. (1977) and Mueggler and Stewart (1980), neither study specifically addressed or sampled types within the Hills. Some similarities are apparent with other prairie mountain ranges in north-central Montana; however, each range contains unique types. A detailed quantitative evaluation of

habitat types of the Hills would allow comparison with other isolated mountain ranges (e.g. Bears Paw Mountains and Little Rocky Mountains), and identify unique types that may merit protection or special management.

Vegetation mapping

Vegetation mapping was beyond the scope of the rare plant inventory. Mapping of general vegetation types identified by Thompson and Kuijt (1976) could be accomplished using aerial photographs and field verification. Preparation of a habitat type map would be of more value to land management decisions.

Noxious weeds

Three state-listed noxious weeds were encountered on the PACEC during the rare plant inventory: leafy spurge (Euphorbia esula), spotted knapweed (Centaurea maculosa), and Canada thistle (Cirsium arvense). Identified populations included:

Leafy Spurge - two locations on West Butte: one in the bottom of Pratt Canyon bordering coniferous forest (10m by 10m) and one along a mining road on the west side of West Butte (1m x 5m);

Spotted knapweed - A sizeable population on the edge of the quarry on the east side of East Butte - isolated plants were pulled;

Canada thistle - A small population in a drainage north of Mount Brown in a moderately to heavily grazed pasture.

Recommendations for noxious weed control include:

1) Conduct additional surveys to identify populations of noxious weeds.

2) Monitor known populations.

3) Selectively spray the quarry area for spotted knapweed.

4) Mechanically control isolated populations of spotted knapweed by hand pulling.

5) Consider spot spraying of Canada thistle and/or modifications to the grazing plan.

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APPENDIX A. Vascular plant species by class, Sweet Grass Hills, Toole County and Liberty County, Montana, 1989.

Binomial	Code	Common Name
NATIVE PERENNIAL GRAMINOIDS		
Agropyron caninum	Agr can	Slender wheatgrass
Agropyron dasystachyum	Agr das	Thickspike wheatgrass
Agropyron spicatum	Agr spi	Bluebunch wheatgrass
Agrostis scabra	Agr sca	Rough bentgrass
Agrostis thurberiana*	Agr thu	Thurber bentgrass
Alopecurus aequalis	Alo aeq	Shortawn foxtail
Bouteloua gracilis	Bou gra	Blue grama
Bromus carinatus	Bro car	California brome
Bromus ciliatus*	Bro cil	Fringed brome
Calamagrostis canadensis	Cal can	Bluejoint reedgrass
Calamagrostis purpurascens	Cal pur	Purple reedgrass
Calamagrostis rubescens	Cal rub	Pinegrass
Carex albonigra*	Car alb	Black-and-white sceled sedge
Carex aquatilis*	Car aqu	Water sedge
Carex athrostachya	Car ath	Slenderbeaked sedge
Carex atrata*	Cer atr	Blackened sedge
Carex aurea	Car aur	Golden sedge
Carex capillaris	Car cap	Hair sedge
Carex eleocharis*	Car ele	Needleleaf sedge
Carex filifolia	Car fil	Threadleaf sedge
Carex hoodii	Car hoo	Hood's sedge
Carex hystricina (?)*	Car hys	Porcupine sedge
Carex microptera	Car mic	Smallwing sedge
Carex nebrascensis	Car neb	Nebraska sedge
Carex obtusata	Car obt	Blunt sedge
Carex parryana*	Car par	Parry sedge
Carex pensylvanica	Car pen	Sun sedge
Carex petasata	Car pet	Liddon sedge
Carex phaeocephala*	Cer pha	Dunhead sedge
Carex raynoldsii	Car ray	Raynold's sedge
Carex rossii	Car ros	Ross' sedge
Carex siccata	Car sic	Silvertop sedge
Carex sprengelii	Car spr	Sprengel's sedge
Carex xerantica	Car xer	Dryland sedge
Catabrosa aquatica	Cat aqu	Brookgrass
Danthonia californica	Dan cal	California oatgrass
Danthonia intermedia	Dan int	Timber oatgrass
Deschampsia cespitosa	Des ces	Tufted hairgrass
Festuca idahoensis	Fes ida	Idaho fescue
Festuca ovina	Fes ovi	Sheep fescue
Festuca scabrella	Fes sca	Rough fescue
Helictotrichon hookeri	Hel hoo	Spike-oat
Hordeum brachyantherum	Hor bra	Meadow barley
Hordeum jubatum	Hor jub	Foxtail barley
Juncus balticus	Jun bal	Wire rush
Juncus ensifolius	Jun ens	Dagger-leaf rush
Juncus nevadensis	Jun nev	Sierra rush
Juncus tenuis	Jun ten	Slender rush
Koeleria cristata	Koe cri	Prairie junegrass
Luzula spicata	Luz spi	Spiked woodrush
Phleum alpinum	Phl alp	Alpine timothy
Poa alpina*	Poa alp	Alpine bluegrass
Poa compressa	Poa com	Canada bluegrass
Poa cusickii	Poa cus	Cusick bluegrass
Poa fendleriana	Poa fen	Mutton-grass
Poa interior	Poa int	Inland bluegrass
Poa juncifolia	Poa jun	Big bluegrass
Poa nervosa	Poa ner	Wheeler's bluegrass

Binomial	Code	Common Name
Poa rupicola	Poa rup	Timberline bluegrass
Poa sandbergii*	Poa san	Native bluegrass
Stipa comata	Sti com	Needle-and-thread
Stipa occidentalis	Sti occ	Columbia needlegrass
Stipa viridula	Sti vir	Green needlegrass
Trisetum canescens*	Tri can	Tall trisetum
INTRODUCED PERENNIAL GRASSES		
Agropyron repens	Agr rep	Quackgrass
Bromus inermis	Bro ine	Smooth brome
Festuca pratensis*	Fes pra	Meadow fescue
Phleum pratense	Phl pra	Common timothy
Poa palustris	Poa pal	Fowl bluegrass
Poa pratensis	Poa pra	Kentucky bluegrass
INTRODUCED ANNUAL GRASSES		
Bromus tectorum	Bro tec	Cheatgrass
NATIVE PERENNIAL FORBS		
Achillea millefolium	Ach mil	Common yarrow
Actaea rubra	Act rub	Red baneberry
Agoseris glauca	Ago gla	Pale agoseris
Allium cernuum	All cer	Nodding onion
Allium textile	All tex	Textile onion
Anemone multifida	Ane mul	Ball anemone
Anemone patens	Ane pat	Pasqueflower
Angelica arguta	Ang arg	Sharptooth angelica
Antennaria anaphaloides	Ant ana	Tall pussytoes
Antennaria microphylla	Ant mic	Rose pussytoes
Antennaria neglecta	Ant neg	Field pussytoes
Antennaria parvifolia	Ant par	Small-leaf pussytoes
Antennaria racemosa	Ant rac	Raceme pussytoes
Antennaria umbrinella	Ant umb	Umber pussytoes
Arabis lemmonii	Ara lem	Lemmon's rockcress
Arabis nuttallii	Ara nut	Nuttall rockcress
Arceuthobium americanum	Arc ame	American dwarf mistletoe
Arenaria congesta	Are con	Ballhead sandwort
Arenaria lateriflora*	Are lat	Bluntleaf sandwort
Arenaria rubella	Are rub	Reddish sandwort
Arnica cordifolia	Arn cor	Heartleaf arnica
Arnica fulgens	Arn ful	Orange arnica
Arnica sororia*	Arn sor	Twin arnica
Artemisia campestris	Art cam	Field sagewort
Artemisia longifolia*	Art lon	Long-leaved sagewort
Artemisia ludoviciana	Art lud	Cudweed sagewort
Aster falcatus	Ast fal	Creeping white prairie aster
Aster foliaceus	Ast fol	Leafybract aster
Aster occidentalis	Ast occ	Western mountain aster
Aster pansus	Ast pan	Tufted white prairie aster
Astragalus aboriginum*	Ast abo	Indian milkvetch
Astragalus adsurgens	Ast ads	Prairie milkvetch
Astragalus agrestis	Ast agr	Purple milkvetch
Astragalus drummondii	Ast dru	Drummond milkvetch
Astragalus vexilliflexus	Ast vex	Bent-flowered milkvetch
Balsamorhiza sagittata*	Bal sag	Arrowleaf balsamroot
Besseya wyomingensis	Bes wyo	Kittentail
Callitriche verna	Cal ver	Spring water-starwort
Calypso bulbosa	Cal bul	Fairy-slipper.
Campanula parryi (?)*	Cam par	Parry's harebell
Campanula rotundifolia	Cam rot	Roundleaf harebell
Castilleja lutescens	Cas lut	Yellow paintbrush
Castilleja rhexifolia (x miniata?)	Cas rhe	Rhexia-leaved paintbrush

Binomial	Code	Common Name
Cerastium arvense	Cer arv	Field chickweed
Chamaerhodos erecta	Cha ere	Chamaerhodos
Cicuta douglasii*	Cic dou	Western water-hemlock
Cirsium undulatum	Cir und	Wavyleaf thistle
Claytonia lanceolata var. (?)	Cla lan	Springbeauty
Clematis columbiana*	Cle col	Rock clematis
Clematis tenuiloba	Cle ten	Matted purple clematis
Comandra umbellata	Com umb	Pale bastard toadflax
Conimitella williamsii	Con wil	Conimitella
Corallorhiza maculata*	Cor mac	Spotted coral-root
Corallorhiza trifida	Cor tri	Early coral-root
Corydalis aurea	Cor aur	Golden corydalis
Crepis runcinata	Cre run	Dandelion hawksbeard
Cryptantha celosioides	Cry cel	Miner's candle
Cystopteris fragilis	Cys fra	Brittle bladderfern
Delphinium bicolor	Del bic	Low larkspur
Disporum trachycarpum	Dis tra	Rough-fruited fairy-bells
Dodecatheon conjugens	Dod con	Shooting star
Dodecatheon pulchellum*	Dod pul	Few-flowered shooting star
Draba aurea*	Dra aur	Golden draba
Draba oligosperma*	Dra oli	Few-seeded draba
Epilobium alpinum	Epi alp	Alpine willow-herb
Epilobium angustifolium	Epi ang	Fireweed
Equisetum arvense	Equ arv	Common horsetail
Equisetum laevigatum	Equ lae	Smooth scouring-rush
Erigeron acris*	Eri acr	Bitter fleabane
Erigeron caespitosus	Eri cae	Tufted fleabane
Erigeron compositus	Eri com	Fernleaf fleabane
Erigeron corymbosus	Eri cor	Purple daisy fleabane
Erigeron glabellus*	Eri gla	Smooth daisy
Erigeron pumilus*	Eri pum	Shaggy fleabane
Erigeron simplex*	Eri sim	Alpine daisy
Erigeron speciosus	Eri spe	Showy fleabane
Eriogonum flavum	Eri fla	Yellow buckwheat
Eriogonum umbellatum	Eri umb	Sulfur buckwheat
Erysimum inconspicuum	Ery inc	Small wallflower
Fragaria virginiana	Fra vir	Virginia strawberry
Fritillaria pudica	Fri pud	Yellowbells
Gaillardia aristata	Gai ari	Common gaillardia
Galium boreale	Gal bor	Northern bedstraw
Gaura coccinea	Gau coc	Scarlet gaura
Gentiana amarella*	Gen ama	Northern gentian
Geranium richardsonii	Ger ric	Richardson geranium
Geranium viscosissimum	Ger vis	Sticky geranium
Geum aleppicum	Geu ale	Yellow avens
Geum triflorum	Geu tri	Prairiesmoke
Habenaria hyperborea	Hab hyp	Green bog-orchid
Hedysarum alpinum	Hed alp	American sweetvetch
Hedysarum sulphurescens	Hed sul	Yellow sweetvetch
Helianthus rigidus	Hel rig	Stiff sunflower
Heracleum lanatum	Her lan	Cow parsnip
Heterotheca villosa	Het vil	Hairy golden aster
Heuchera parvifolia	Heu par	Littleleaf alumroot
Hieracium umbellatum*	Hie umb	Narrow-leaved hawkweed
Hymenoxys acaulis*	Hym aca	Stemless hymenoxys
Lathyrus ochroleucus	Lat och	Cream peavine
Lesquerella alpina	Les alp	Alpine bladderpod
Linum perenne	Lin per	Blue flax
Lithophragma parviflora	Lit par	Smallflower woodlandstar
Lithospermum ruderale	Lit rud	Western gromwell
Lomatium cous	Lom cou	Cous biscuit-root
Lomatium dissectum	Lom dis	Fern-leaved lomatium
Lomatium macrocarpum	Lom mac	Large-fruited lomatium
Lomatium triternatum	Lom tri	Nineleaf lomatium
Lupinus argenteus	Lup arg	Silvery lupine

Binomial	Code	Common Name
Lupinus lepidus	Lup lep	Prairie lupine
Lychnis drummondii	Lyc dru	Drummond campion
Mertensia viridis*	Mer vir	Green bluebells
Monarda fistulosa	Mon fis	Horsemint
Musineon divaricatum	Mus div	Leafy musineon
Oenothera cespitosa	Oen ces	Tufted evening primrose
Orobanche fasciculata	Oro fas	Clustered broomrape
Osmorhiza depauperata*	Osm dep	Blunt-fruited sweet-root
Oxytropis lagopus (?)*	Oxy lag	Haresfoot loco
Oxytropis sericea	Oxy ser	White point loco
Oxytropis splendens	Oxy spl	Showy crazyweed
Parnassia palustris	Par pal	Northern grass-of-parnassus
Penstemon confertus	Pen con	Yellow penstemon
Penstemon nitidus	Pen nit	Waxleaf penstemon
Penstemon procerus	Pen pro	Littleleaf penstemon
Perideridia gairdneri	Per gai	Yampa
Phacelia sericea*	Pha ser	Silky phacelia
Phlox alyssifolia	Phl aly	Alyssum-leaved phlox
Phlox hoodii	Phl hoo	Hood's phlox
Polemonium pulcherrimum	Pol pul	Showy polemonium
Polemonium viscosum	Pol vis	Sticky polemonium
Polygonum bistortoides	Pol bis	American bistort
Potentilla anserina*	Pot ans	Common silverweed
Potentilla arguta	Pot arg	Tall cinquefoil
Potentilla diversifolia	Pot div	Diverse-leaved cinquefoil
Potentilla glandulosa	Pot gla	Glandular cinquefoil
Potentilla gracilis	Pot gra	Northwest cinquefoil
Potentilla hippiana	Pot hip	Horse cinquefoil
Potentilla pensylvanica	Pot pen	Prairie cinquefoil
Pyrola asarifolia*	Pry asa	Common pink wintergreen
Pyrola secunda	Pyr sec	Sidebells pyrola
Pyrola uniflora*	Pyr uni	Woodnymph
Pyrola virens	Pyr vir	Green-flowered wintergreen
Ranunculus acris	Ran acr	Meadow buttercup
Ranunculus aquatilis	Ran aqu	Watercrowfoot buttercup
Ranunculus cardiophyllus*	Ran car	Heart-leaved buttercup
Ranunculus glaberrimus	Ran gla	Sagebrush buttercup
Ranunculus uncinatus	Ran unc	Little buttercup
Rumex salicifolius	Rum sal	Willowleaved dock
Saxifraga bronchialis	Sax bro	Matted saxifrage
Saxifraga cernua*	Sax cer	Nodding saxifrage
Saxifraga occidentalis	Sax occ	Western saxfrage
Sedum lanceolatum	Sed lan	Lanceleaf stonecrop
Selaginella densa	Sel den	Compact clubmoss
Senecio canus	Sen can	Woolly groundsel
Senecio integerrimus	Sen int	Lambstongue groundsel
Senecio streptanthifolius	Sen str	Rocky Mountain butterweed
Sibbaldia procumbens	Sib pro	Creeping sibbaldia
Silene parryi*	Sil par	Parry's silene
Sisyrinchium angustifolium	Sis ang	Blue-eyed grass
Smilacina racemosa	Smi rac	Feather solomon's seal
Smilacina stellata*	Smi ste	Starry false solomon's seal
Solidago gigantea*	Sol gig	Smooth goldenrod
Solidago missouriensis	Sol mis	Missouri goldenrod
Solidago multiradiata*	Sol mul	Northern goldenrod
Solidago nemoralis*	Sol nem	Field goldenrod
Solidago rigida	Sol rig	Stiff goldenrod
Solidago spathulata*	Sol spa	Dune goldenrod
Stellaria longifolia*	Ste lon	Long-leaved starwort
Thalictrum spp.	Tha spp.	Meadowrue
Thermopsis rhombifolia	The rho	Round-leaved thermopsis
Townsendia parryi	Tow par	Parry's townsendia
Urtica dioica	Urt dio	Stinging nettle
Veronica americana	Ver ame	American speedwell

Binomial	Code	Common Name
Vicia americana	Vic ame	American vetch
Viola adunca	Vio adu	Western violet
Viola canadensis	Vio can	Canada violet
Viola nuttallii	Vio nut	Nuttall violet
Woodsia oregana	Woo ore	Woodsia
Zigadenus elegans	Zig ele	Glaucous zigadenus
Zigadenus venenosus	Zig ven	Meadow death camas
Zizia aptera*	Ziz apt	Heart-leaved Alexanders
INTRODUCED PERENNIAL FORBS		
Centaurea maculosa	Cen mac	Spotted knapweed
Cirsium arvense	Cir arv	Canada thistle
Euphorbia esula	Eup esu	Leafy spurge
Rumex acetosa	Rum ace	Garden sorrel
Rumex acetosella	Rum ace	Sheep sorrel
Taraxacum officinale	Tar off	Common dandelion
Trifolium repens	Tri rep	White clover
NATIVE ANNUAL/BIENNIAL FORBS		
Androsace septentrionalis	And sep	Northern rockjasmine
Arabis divaricarpa	Ara div	Spreading-pod rockcress
Arabis glabra	Ara gla	Tower mustard
Arabis hirsuta	Ara hir	Hairy rockcress
Arabis holboellii	Ara hol	Holboell's rockcress
Barbarea orthoceras	Bar ort	American wintercress
Chenopodium leptophyllum	Che lep	Narrow goosefoot
Collinsia parviflora	Col par	Blue-eyed Mary
Collomia linearis	Col lin	Narrow-leaved collomia
Descurainia pinnata	Des pin	Pinnate tansymustard
Descurainia richardsonii	Des ric	Mountain tansymustard
Ellisia nyctelea	Ell nyc	Nyctelea
Epilobium paniculatum*	Epi pan	Autumn willow herb
Erigeron strigosus*	Eri str	Daisy fleabane
Grindelia squarrosa	Gri squ	Curlcup gumweed
Hackelia deflexa	Hac def	Nodding stickseed
Halimolobos virgata	Hal vir	Twiggy halimolobos
Lepidium densiflorum	Lep den	Prairie pepperweed
Mimulus guttatus	Mim gut	Common monkey flower
Monolepis nuttalliana	Mon nut	Patata
Oenothera villosa	Oen vil	Rydberg's evening primrose
Orthocarpus luteus	Ort lut	Yellow owlclover
Phacelia linearis	Pha lin	Linearleaf phacelia
Plagiobothrys scouleri	Pla sco	Scouler's plagiobothrys
Polygonum douglasii	Pol dou	Douglas knotweed
Potentilla rivalis*	Pot riv	Brook cinquefoil
Ranunculus abortivus	Ran abo	Smallflower buttercup
Ranunculus sceleratus	Ran sce	Celery-leaved buttercup
Veronica peregrina	Ver per	Purslane speedwell
INTRODUCED ANNUAL/BIENNIAL FORBS		
Alyssum alyssoides	Aly aly	Pale alyssum
Berteroa incana	Ber inc	Berteroa
Camelina microcarpa	Cam mic	Littlepod falseflax
Capsella bursa-pastoris	Cap bur	Shepherd's-purse
Chenopodium album	Che alb	Lambsquarter goosefoot
Cirsium vulgare	Cir vul	Bull thistle
Draba nemorosa	Dra nem	Woods draba
Erysimum cheiranthoides*	Ery che	Treacle mustard
Melilotus officinalis	Mel off	Yellow sweetclover
Sisymbrium altissimum	Sis alt	Tumblemustard
Thlaspi arvense	Thl arv	Fanweed
Tragopogon dubius	Tra dub	Common salsify

Binomial	Code	Common Name
SUBSHRUBS		
Arctostaphylos uva-ursi	Arc uva	Kinikinnick
Artemisia frigida	Art fri	Fringed sagewort
Berberis repens*	Ber rep	Creeping Oregon-grape
Chimaphila umbellata*	Chi umb	Prince's pine
Cornus canadensis*	Cor can	Bunchberry dogwood
Linnaea borealis	Lin bor	Western twinflower
LOW SHRUBS		
Amelanchier alnifolia	Ame aln	Western serviceberry
Ceanothus velutinus*	Cea vel	Snowbrush ceanothus
Cornus stolonifera*	Cor sto	Red osier dogwood
Juniperus communis	Jun com	Common juniper
Juniperus horizontalis	Jun hor	Creeping juniper
Juniperus scopulorum*	Jun sco	Rocky Mountain juniper
Potentilla fruticosa	Pot fru	Shrubby cinquefoil
Prunus virginiana	Pru vir	Common chokecherry
Ribes setosum	Rib set	Redshoot gooseberry
Rosa acicularis (?)	Ros aci	Prickly rose
Rosa arkansana	Ros ark	Prairie rose
Rosa woodsii	Ros woo	Wood's rose
Rubus idaeus	Rub ida	Red raspberry
Shepherdia canadensis	She can	Canada buffaloberry
Spiraea betulifolia	Spi bet	White spirea
Symphoricarpos albus*	Sym alb	Common snowberry
Symphoricarpos occidentalis	Sym occ	Western snowberry
Vaccinium caespitosum	Vac cae	Dwarf huckleberry
Vaccinium membranaceum*	Vac mem	Thinleaf huckleberry
Vaccinium myrtillus*	Vac myr	Dwarf bilberry
Vaccinium scoparium*	Vac sco	Grouse whortleberry
TREES AND TALL SHRUBS		
Abies lasiocarpa	Abi las	Subalpine fir
Acer glabrum	Ace gla	Rocky Mountain maple
Acer negundo*	Ace neg	Box-elder
Crataegus douglasii*	Cra dou	Black hawthorn
Picea engelmannii x glauca	Pic eng	Engelmann spruce x White spruce
Pinus albicaulis	Pin alb	Whitebark pine
Pinus contorta	Pin con	Lodgepole pine
Pinus flexilis	Pin fle	Limber pine
Populus tremuloides	Pop tre	Quaking aspen
Populus trichocarpa	Pop tri	Black cottonwood
Pseudotsuga menziesii	Pse men	Douglas-fir
Salix bebbiana	Sal beb	Bebb willow
Salix exigua	Sal exi	Slender willow

Scientific nomenclature follows Hitchcock and Cronquist (1973) and Hitchcock et al. (1955-1969). Common names were mostly taken from these sources.

*Taxa listed by Thompson and Kuijt (1976b) for the Sweet Grass Hills, but which were not observed during 1989 WESTECH surveys; although some of these species are located on lands outside the PACEC, many are expected to occur within the PACEC.

APPENDIX B. PHOTOGRAPHS

Photo No.	Location	Community Type
EAST BUTTE		
1	Looking W toward Middle and West Buttes	Coniferous forest
2	S side Mt. Brown	Scree/talus
3	Top of Mt. Royal looking SW	Subalpine grassland
4	N side Mt. Brown	Foothills grassland
5	Little Joe Creek (Mt. Royal on left)	Montane grassland with lupine and shrubby cinquefoil
6	Looking down Little Joe Creek to Breed Creek	Shrubby cinquefoil grassland
7	NW BLM boundary (Mt. Brown on left)	Foothills grassland
MIDDLE BUTTE		
8	NW end Middle Butte	Scree/talus, Forested scree/talus, Foothills grassland
9	E side of West Butte from Middle Butte	Foothills grassland
10	N side Middle Butte	Open coniferous forest
11	Looking N from Middle Butte	Foothills grassland with shrubby cinquefoil
WEST BUTTE		
12	SW end of West Butte looking N from Coal Mine road	Scree/talus, Forested scree/talus, Rock outcrop, Foothills grassland
13	Looking N to head of Fred and George Creek	Montane grassland, Coniferous forest
14	W side of West Butte	Mosaic of types
15	Looking SW at Kicking Horse Canyon	Montane grassland, Coniferous forest
16	Saddle on W side West Butte	Montane grassland, Shrubby cinquefoil

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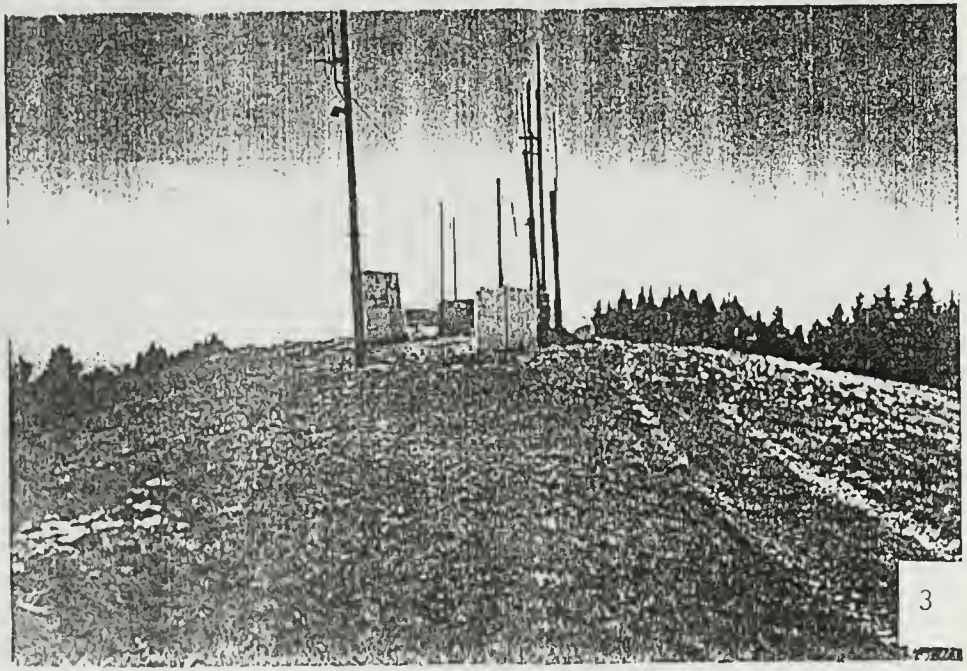

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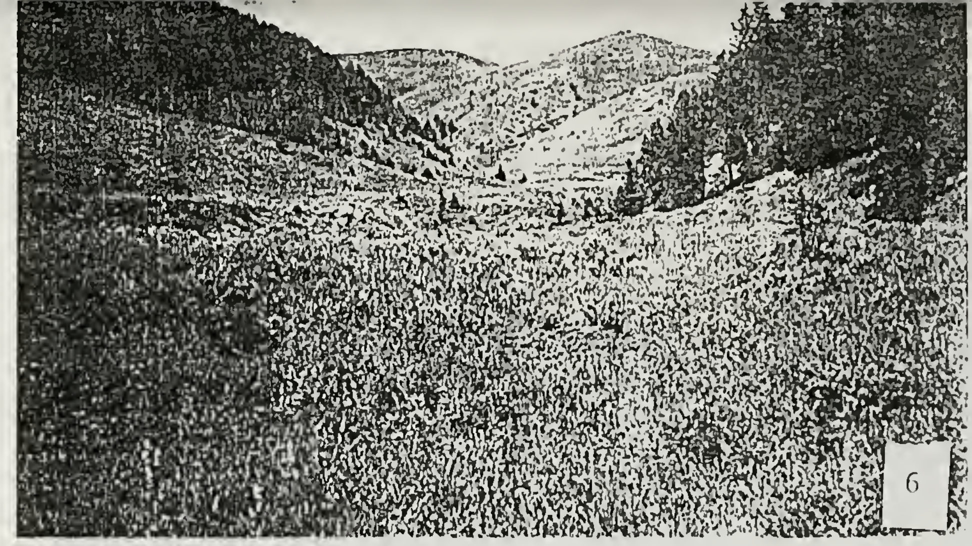
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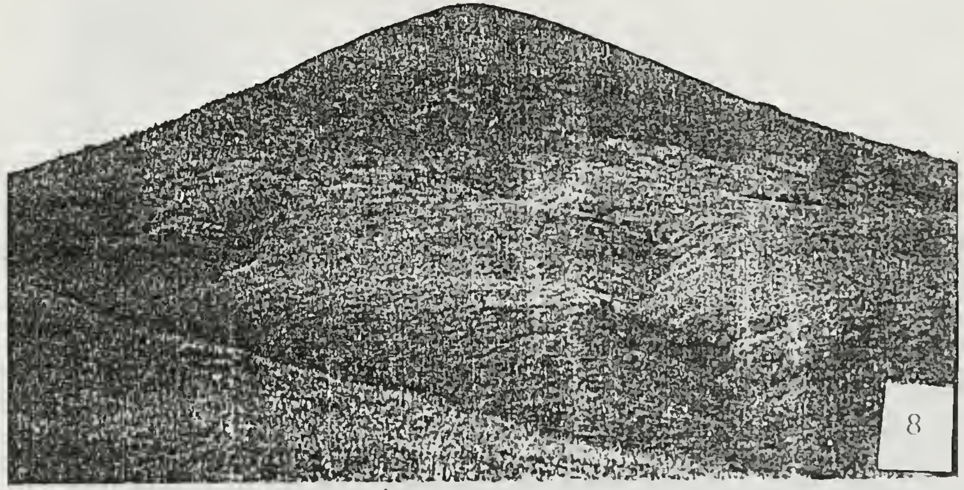
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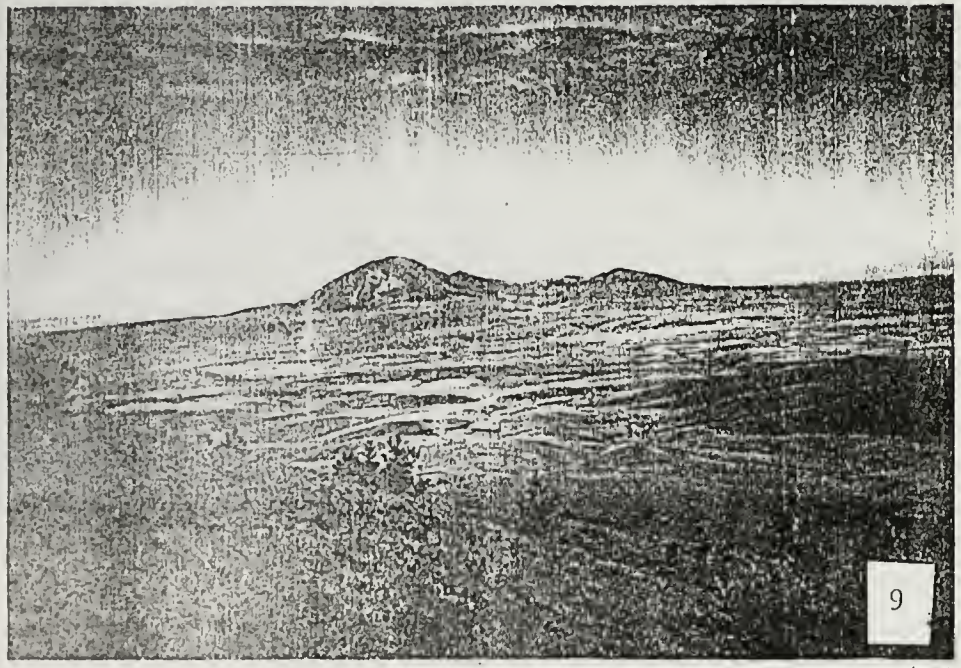
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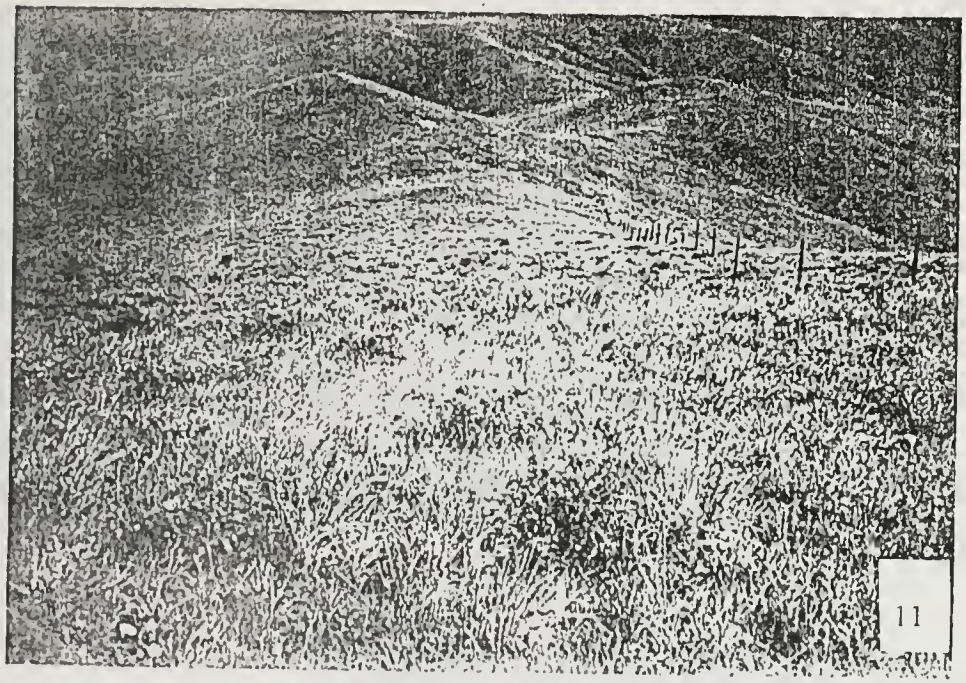
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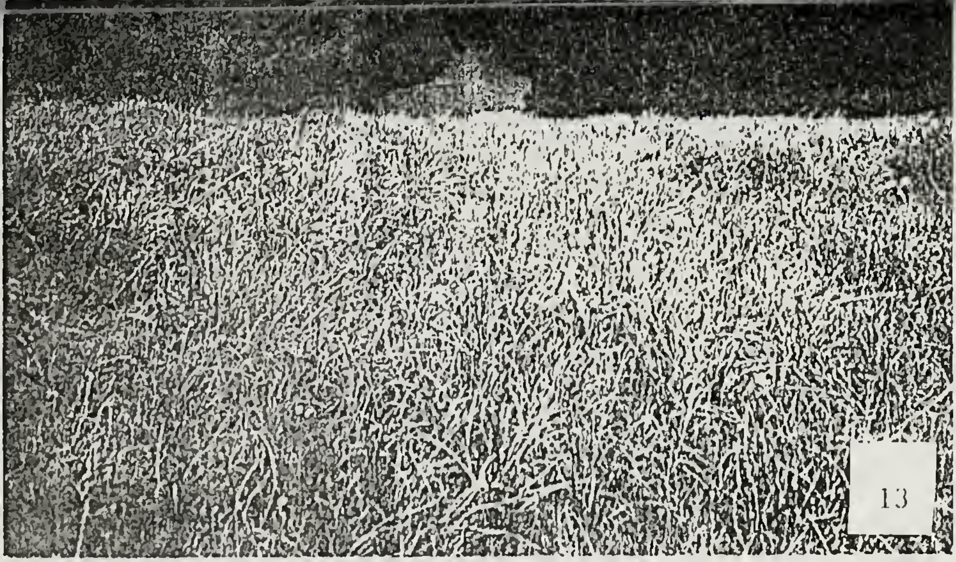
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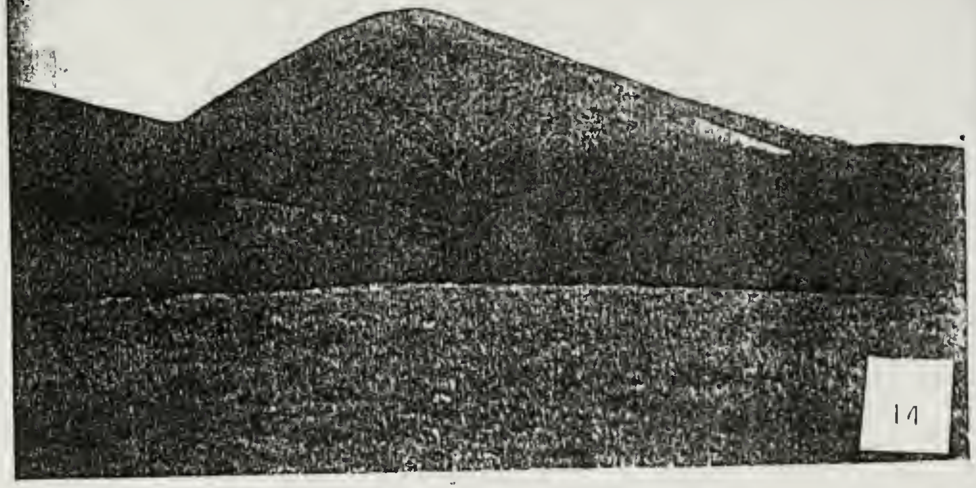
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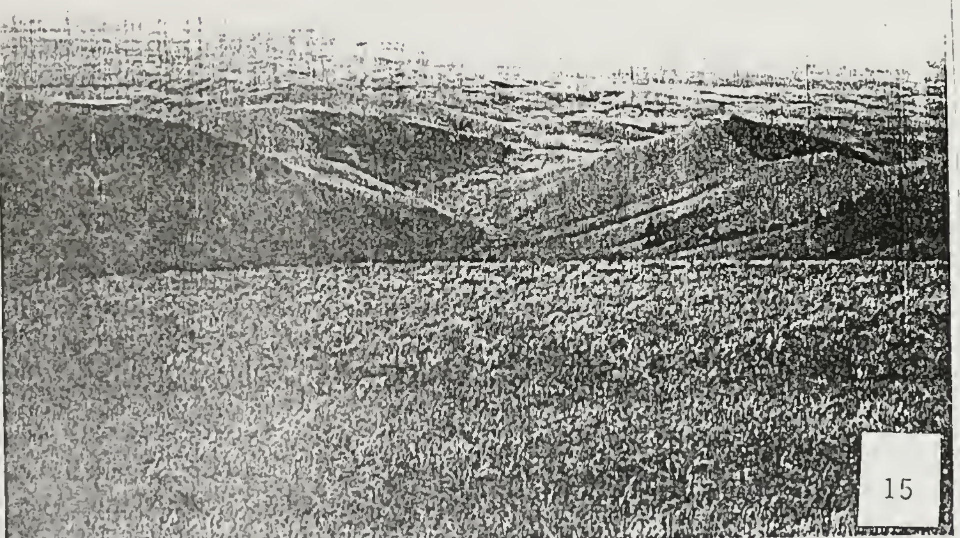
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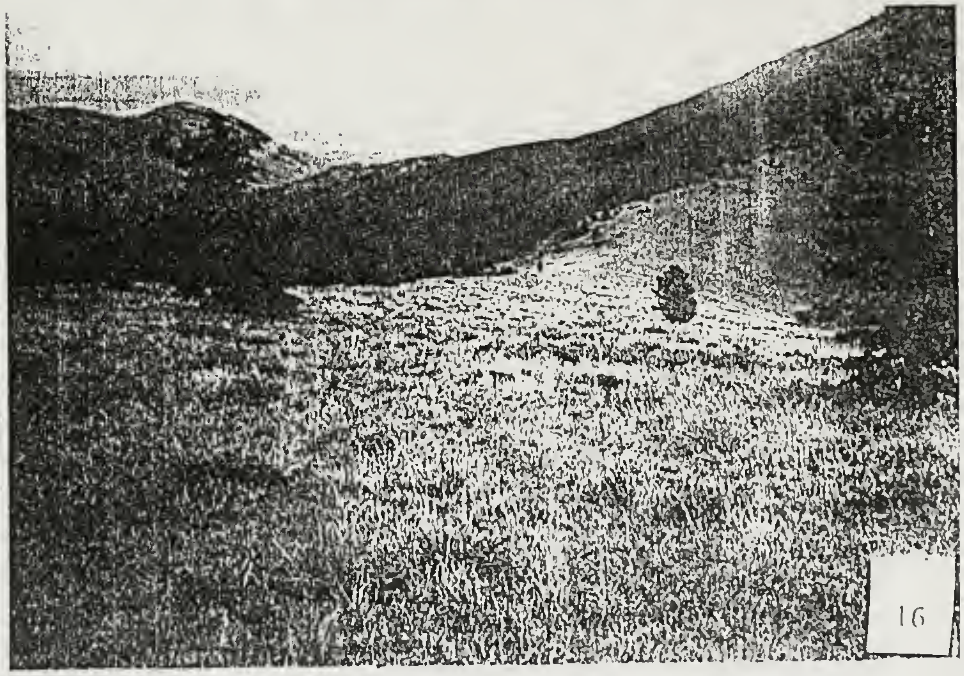
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