

Plant Species of Special Concern
Of the Ross Butte Ecosystem,
Sublette County, Wyoming

Prepared for the Bureau of Land Management
Wyoming State Office and Rock Springs District

by

Walter Fertig

Wyoming Natural Diversity Database
1604 Grand Ave.
Laramie, WY 82070

6 May 1998

Cooperative Agreement # K910-A4-0011
Task Order # TO-013

Acknowledgements

I would like to thank the following individuals for their assistance with this project: Laura Welp of the Wyoming Natural Diversity Database assisted with data entry, Tim Chumley of the Rocky Mountain Herbarium provided a list of Ross Butte collections from Tom Cramer and Ron Hartman, Jeff Carroll and Barbara Amidon of the BLM helped provide funding, and Steve Laster of the Pinedale BLM provided useful suggestions and shared field data.

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INTRODUCTION

Ross Butte and Ross Ridge are a pair of desert mesas located on the south bank of the New Fork River in south-central Sublette County, Wyoming (Figure 1). These mesas are composed of Eocene-age lake sediments and support a mixture of cushion plant, low grassland, and black sagebrush/rabbitbrush communities. The mesas and intervening clay and fluvial sediment valleys support a rich assemblage of cold desert plant species typical of the Green River Basin flora. More importantly, the area also provides habitat for nineteen state rare and regionally endemic plant species.

Despite the area's relative accessibility (several four-wheel drive roads provide access from Wyoming State Highway 351), the flora of the Ross Butte ecosystem was poorly studied until the mid 1990s, when Tom Cramer and Ron Hartman of the University of Wyoming conducted the first comprehensive floristic inventory of the region (Cramer and Hartman 1996; Cramer 1997). This preliminary work, coupled with studies by Steve Laster (BLM Pinedale Resource Area), Ron Kass (Intermountain Ecosystems), and Walt Fertig (Wyoming Natural Diversity Database) revealed that the Ross Butte area was unusually rich in both common and uncommon plant species. Given the rapid development of oil and natural gas reserves elsewhere in the Green River Basin, the Ross Butte ecosystem was identified as a priority natural area for the conservation of locally endemic plant species (Wyoming Natural Diversity Database 1996).

In 1997, the Bureau of Land Management (BLM) Wyoming State Office contracted on a cost-share basis with the Wyoming Natural Diversity Database (WYNDD) to inventory plant species in the Ross Butte ecosystem. The objectives of this project were to:

- * collect biological information and map populations of plant species of special concern identified by the US Fish and Wildlife Service, BLM, and WYNDD within the study area;
- * develop a list of vascular plants of the Ross Butte Ecosystem
- * identify and map major vegetation units
- * identify an area within the ecosystem that is suitable for special management area recognition.

STUDY AREA

The Ross Butte ecosystem extends from the west toe of Ross Butte and Ross Ridge east approximately 6 air miles to the west end of Blue Rim. The area includes the valley between Ross Butte and Ross Ridge and the basin immediately south of Burma Point, but does not include the floodplain of the New Fork River or North Alkali Draw (Figure 1). The entire area is approximately 10,880 acres and consists entirely of lands managed by the BLM Pinedale Resource Area or the state of Wyoming.

Figure 1. Map of the Ross Butte Ecosystem (from the Pinedale 1:100,000 topographic quad).

Ross Butte and Ross Ridge are comprised of laminated, buff, gray and brown marlstones, shales, and tuffaceous sandstones of the Laney Shale member of the Green River Formation (Bradley 1964). These sediments were deposited in Lake Gosiute, an ancient deep water or playa lake that covered much of the Green River Basin during the Eocene. Sediments in the surrounding valley consist primarily of sandy gray mudstones, red sandstones, and coal beds derived from Eocene-age river deposits (Bradley 1964). Numerous dry washes drain the area, but no perennial streams are present. The entire ecosystem consists of a mosaic of desert cushion plant, bunchgrass, and shrub communities, although scattered limber pine groves are present at the southwest end of Ross Ridge.

METHODS

Surveys of plant species of special concern were conducted by the author in mid July 1995, mid June 1996, and late May-early June 1997. Prior to conducting fieldwork, information on the habitat needs and known distribution of target species was obtained from WYNDD files and computer databases, collections of the Rocky Mountain Herbarium (RM), pertinent literature, and knowledgeable individuals. USGS topographic maps and geologic maps were used to identify areas of potential habitat for ground surveys.

In the field, data were collected on the biology, habitat, population size, and management needs of target species. Locations of rare plant populations were mapped on 1:24,000 scale USGS topographic maps. When populations were sufficiently large, voucher specimens were collected for deposit at the RM. Information gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

A list of all vascular plant species observed in the study area was compiled during field surveys in 1995-97. Voucher specimens were collected for species that could not be reliably identified in the field. These specimens were later identified and deposited at the RM. Additional species were added to the list based on RM records.

RESULTS

Vascular Plant Checklist

Based on 1995-97 surveys and herbarium records, 151 vascular plant species are known from the Ross Butte ecosystem (Table 1). For additional information on the flora of the Green River Basin, consult Cramer (1997) and Cramer and Hartman (1996).

Vegetation

The Ross Butte ecosystem contains a mosaic of desert cushion plant and shrub communities that vary according to topographic position, moisture availability, and substrate (Figure 2). Much of the basin vegetation of the area consists of a mix of Gardner saltbush/rubber rabbitbrush and Wyoming big sagebrush/rubber rabbitbrush/Sandberg bluegrass communities on rolling sandy-clay hills and flats. Greasewood, Wyoming big sagebrush, and thickspike wheatgrass may

become

Table 1. Vascular Plants of the Ross Butte Ecosystem

The following species checklist is based on floristic studies conducted by Tom Cramer and Ron Hartman of the Rocky Mountain Herbarium in 1994-95 and on field studies by the author from 1995-97. Nomenclature follows Dorn (1992) for scientific names and Hitchcock and Cronquist (1973) and Welsh et al (1993) for common names. Family acronyms are based on Weber (1982).

Scientific Name	Common Name	Fam
Trees		
<i>Pinus flexilis</i>	Limber pine	PIN
Shrubs		
<i>Amelanchier utahensis</i>	Utah serviceberry	ROS
<i>Artemisia nova</i>	Black sagebrush	AST
<i>Artemisia spinescens</i>	Bud sagewort	AST
<i>Artemisia tridentata</i> var. <i>wyomingensis</i>	Wyoming big sagebrush	AST
<i>Atriplex confertifolia</i>	Shadscale	CHN
<i>Atriplex gardneri</i> var. <i>gardneri</i>	Gardner's saltbush	CHN
<i>Cercocarpus montanus</i>	True mountain mahogany	ROS
<i>Chrysothamnus nauseosus</i>	Rubber rabbitbrush	AST
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush	AST
var. <i>lanceolatus</i>		
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush	AST
var. <i>viscidiflorus</i>		
<i>Grayia spinosa</i>	Spiny hopsage	CHN
<i>Krascheninnikovia lanata</i>	Winterfat	CHN
[<i>Ceratoides lanata</i>]		
<i>Leptodactylon pungens</i>	Sharp prickly-phlox	PLM
<i>Ribes cereum</i> var. <i>pedicellare</i>	Wax currant	GRS
<i>Sarcobatus vermiculatus</i>	Greasewood	CHN
<i>Symphoricarpos oreophilus</i>	Mountain snowberry	CPR
var. <i>utahensis</i>		
<i>Tetradymia canescens</i>	Gray horsebrush	AST
<i>Tetradymia nuttallii</i>	Nuttall's horsebrush	AST
Forbs		
<i>Abronia mellifera</i>	White sand verbena	NYC
<i>Agoseris glauca</i> var. <i>laciniata</i>	Short-beaked agoseris	AST
<i>Allium textile</i>	Textile onion	LIL

<i>Alyssum desertorum</i>	Desert alyssum	BRA
<i>Antennaria dimorpha</i>	Low pussytoes	AST
<i>Antennaria microphylla</i>	Small-leaved pussytoes	AST
<i>Antennaria rosea</i>	Rosy pussytoes	AST
<i>Arabis holboellii</i> var. <i>secunda</i>	Holboell's rockcress	BRA
<i>Arabis lignifera</i>	Woody-branched rockcress	BRA
<i>Arenaria hookeri</i> var. <i>hookeri</i>	Hooker's sandwort	CRY
<i>Arenaria nuttallii</i>	Nuttall's sandwort	CRY
[<i>Minuartia nuttallii</i>]		
<i>Artemisia frigida</i>	Fringed sagebrush	AST
<i>Aster ascendens</i>	Long-leaved aster	AST
<i>Astragalus bisulcatus</i> var. <i>major</i>	Great Basin two-groove milkvetch	FAB
<i>Astragalus diversifolius</i> var. <i>campestris</i>	Lesser rushy milkvetch	FAB
[<i>A. convallarius</i>]		
<i>Astragalus drabelliformis</i>	Big Piney milkvetch	FAB
<i>Astragalus flavus</i>	Yellow milkvetch	FAB
<i>Astragalus gilviflorus</i> var. <i>gilviflorus</i>	Plains orophaca	FAB
<i>Astragalus jejunus</i> var. <i>jejunus</i>	Starveling milkvetch	FAB
<i>Astragalus miser</i> var. <i>decumbens</i>	Sagebrush weedy milkvetch	FAB
<i>Astragalus purshii</i>	Woolly-pod milkvetch	FAB
<i>Astragalus sericoleucus</i> var. <i>aretioides</i>	Cushion milkvetch	FAB
<i>Atriplex powellii</i>	Powell's saltbush	CHN
<i>Atriplex saccaria</i>	Stalked orache	CHN
<i>Calochortus nuttallii</i>	Sego-lily	LIL
<i>Calyptridium roseum</i>	Rosy pussy-paws	POR
[<i>Cistanthe rosea</i>]		
<i>Camissonia parvula</i>	Hairy evening-primrose	ONA
<i>Camissonia scapoidea</i>	Scapose evening-primrose	ONA
<i>Castilleja angustifolia</i> var. <i>angustifolia</i>	Narrowleaf paintbrush	SCR
<i>Castilleja angustifolia</i> var. <i>dubia</i>	Desert paintbrush	SCR
<i>Castilleja flava</i>	Yellow paintbrush	SCR
<i>Chaenactis douglasii</i> var. <i>montana</i>	Douglas' dustymaiden	AST
<i>Chenopodium pratericola</i>	Mountain goosefoot	CHN
<i>Cirsium pulcherrimum</i>	Pretty thistle	AST
<i>Comandra umbellata</i> var. <i>pallida</i>	Pale bastard toadflax	SAN
<i>Cordylanthus ramosus</i>	Bushy birdbeak	SCR
<i>Crepis modocensis</i>	Modoc hawksbeard	AST
<i>Cryptantha caespitosa</i>	Tufted cryptantha	BOR
<i>Cryptantha circumcissa</i>	Cushion cryptantha	BOR
<i>Cryptantha fendleri</i>	Fendler's cryptantha	BOR
<i>Cryptantha flavoculata</i>	Yellow-eye cryptantha	BOR
<i>Cryptantha scoparia</i>	Desert cryptantha	BOR
<i>Cryptantha sericea</i>	Silky cryptantha	BOR
<i>Cryptantha watsonii</i>	Watson's cryptantha	BOR

<i>Cymopterus acaulis</i>	Plains spring-parsley	API
<i>Cymopterus longipes</i>	Sprawling spring-parsley	API
<i>Cymopterus terebinthinus</i> var. <i>albiflorus</i>	Turpentine rock-parsley	API
<i>Cymopterus</i> (undescribed)	Constance's spring-parsley	API
<i>Descurainia pinnata</i> var. <i>nelsonii</i>	Nelson's tansymustard	BRA
<i>Erigeron compositus</i> var. <i>discoideus</i>	Cut-leaved daisy	AST
<i>Erigeron engelmannii</i>	Engelmann's daisy	AST
<i>Erigeron pumilus</i> var. <i>concinus</i>	Vernal daisy	AST
<i>Eriogonum acaule</i>	Stemless buckwheat	PLG
<i>Eriogonum brevicaule</i> var. <i>micranthum</i>	Shortstem buckwheat	PLG
<i>Eriogonum caespitosum</i>	Mat buckwheat	PLG
<i>Eriogonum cernuum</i>	Nodding buckwheat	PLG
<i>Eriogonum microthecum</i> var. <i>laxiflorum</i>	Slenderbush buckwheat	PLG
<i>Eriogonum ovalifolium</i> var. <i>purpureum</i>	Cushion buckwheat	PLG
<i>Eriogonum umbellatum</i> var. <i>dichrocephalum</i>	Cream buckwheat	PLG
<i>Erysimum asperum</i> var. <i>arkansanum</i> [E. <i>capitatum</i>]	Western wallflower	BRA
<i>Erysimum inconspicuum</i>	Small wallflower	BRA
<i>Gayophytum ramosissimum</i>	Hairstem groundsmoke	ONA
<i>Gilia tweedyi</i>	Tweedy's gilia	PLM
<i>Gymnosteris parvula</i>	Small-flowered gymnosteris	PLM
<i>Halogeton glomeratus</i>	Halogeton	CHN
<i>Haplopappus acaulis</i>	Stemless goldenweed	AST
<i>Haplopappus armerioides</i>	Thrifty goldenweed	AST
<i>Haplopappus nuttallii</i> [Machaeranthera <i>grindelioides</i>]	Gumweed aster	AST
<i>Hymenopappus filifolius</i> var. <i>luteus</i>	Columbia cutleaf	AST
<i>Hymenoxys acaulis</i>	Stemless hymenoxys	AST
<i>Hymenoxys richardsonii</i> var. <i>richardsonii</i>	Richardson's hymenoxys	AST
<i>Ipomopsis congesta</i> var. <i>congesta</i>	Ballhead gilia	PLM
<i>Ipomopsis crebrifolia</i> [I. <i>congesta</i> var. <i>c.</i>]	Compact gilia	PLM
<i>Kochia americana</i>	Red sage	CHN
<i>Lappula redowskii</i> var. <i>redowskii</i>	Western stickseed	BOR
<i>Lepidium densiflorum</i> var. <i>ramosum</i>	Common peppergrass	BRA
<i>Lesquerella alpina</i> var. <i>condensata</i>	Condensed bladderpod	BRA
<i>Lesquerella macrocarpa</i>	Large-fruited bladderpod	BRA
<i>Lewisia rediviva</i>	Bitterroot	POR
<i>Linanthus septentrionalis</i>	Northern linanthus	PLM
<i>Linum lewisii</i>	Blue flax	LIN
<i>Lithophragma tenellum</i>	Slender fringe-cup	SAX
<i>Lithospermum incisum</i>	Yellow gromwell	BOR

<i>Lomatium foeniculaceum</i>	Fennel-leaved biscuitroot	API
<i>Lomatium nuttallii</i>	Nuttall's biscuitroot	API
<i>Lupinus argenteus</i> var. <i>argenteus</i>	Silvery lupine	FAB
<i>Lupinus sericeus</i>	Silky lupine	FAB
<i>Machaeranthera canescens</i> var. <i>canescens</i>	Hoary aster	AST
<i>Mentzelia</i> sp.	Stickleaf sp.	LOA
<i>Mimulus suksdorfii</i>	Suksdorf's monkeyflower	SCR
<i>Monolepis nuttalliana</i>	Povertyweed	CHN
<i>Oenothera cespitosa</i> var. <i>cespitosa</i>	Tufted evening-primrose	ONA
<i>Oenothera pallida</i> var. <i>trichocalyx</i>	Pale evening-primrose	ONA
<i>Opuntia polyacantha</i> var. <i>polyacantha</i>	Plains prickly-pear	CAC
<i>Orobanche ludoviciana</i> var. <i>ludoviciana</i>	Louisiana broomrape	ORO
<i>Oxytropis sericea</i> var. <i>sericea</i>	Silky crazyweed	FAB
<i>Paronychia</i> sp.	Nailwort	CRY
<i>Penstemon arenicola</i>	Red Desert beardtongue	SCR
<i>Penstemon caespitosus</i>	Mat beardtongue	SCR
<i>Penstemon laricifolius</i> var. <i>laricifolius</i>	Larch-leaved beardtongue	SCR
<i>Penstemon paysoniorum</i>	Payson's beardtongue	SCR
<i>Phacelia glandulosa</i> var. <i>deserta</i>	Desert glandular phacelia	HYD
<i>Phacelia ivesiana</i>	Ives' phacelia	HYD
<i>Phacelia salina</i>	Nelson phacelia	HYD
<i>Phlox hoodii</i>	Hood's phlox	PLM
<i>Phlox muscoides</i>	Moss phlox	PLM
<i>Phlox opalensis</i>	Opal phlox	PLM
<i>Phlox pungens</i> "Ross Butte morph"	Beaver Rim phlox	PLM
<i>Physaria acutifolia</i>	Southern twinpod	BRA
<i>Potentilla ovina</i> var. <i>ovina</i>	Sheep cinquefoil	ROS
<i>Schoenocrambe linifolia</i>	Flax-leaved plainsmustard	BRA
<i>Senecio canus</i>	Woolly groundsel	AST
<i>Sphaeralcea coccinea</i>	Scarlet globe-mallow	MLV
<i>Stanleya viridiflora</i>	Desert plume	BRA
<i>Stenogonum salsuginosum</i>	Stenogonum	PLG
<i>Stephanomeria runcinata</i>	Desert wire-lettuce	AST
<i>Taraxacum</i> sp.	Dandelion	AST
<i>Townsendia nuttallii</i>	Nuttall's Easter-daisy	AST
<i>Townsendia spathulata</i>	Sword-leaf Easter-daisy	AST
<i>Townsendia strigosa</i>	Strigose Easter-daisy	AST
<i>Trifolium gymnocarpon</i>	Hollyleaf clover	FAB
<i>Vicia americana</i> var. <i>minor</i>	Plains vetch	FAB
<i>Viola praemorsa</i> var. <i>altior</i>	Upland yellow violet	VIO

Graminoids

<i>Elymus elymoides</i> var. <i>elymoides</i> [<i>Sitanion hystrix</i>]	Bottlebrush squirreltail	POA
<i>Elymus lanceolatus</i> var. <i>lanceolatus</i> [<i>Agropyron dasystachyum</i>]	Thickspike wheatgrass	POA
<i>Elymus lanceolatus</i> var. <i>riparius</i>	Riparian thickspike wheatgrass	POA
<i>Leucopoa kingii</i>	King spike-fescue	POA
<i>Oryzopsis contracta</i>	Contracted Indian ricegrass	POA
<i>Oryzopsis hymenoides</i>	Indian ricegrass	POA
<i>Poa secunda</i> var. <i>secunda</i>	Sandberg bluegrass	POA
<i>Stipa comata</i> var. <i>comata</i>	Needle-and-thread	POA

locally important in dry washes. Occasional patches of bud sagewort/winterfat/Gardner saltbush vegetation may be found on low terraces with fine sandstone gravel over fine brown clays.

The slopes of Ross Butte and Ross Ridge support a variety of shrub communities, with black sagebrush dominating rocky sites with poor soil development and Wyoming big sagebrush, mountain snowberry, true mountain mahogany, and rubber rabbitbrush predominant on concave slopes of fine clay and sandstone rock. Total vegetative cover of these shrublands may range from 50-95%, with most having relatively low proportions of graminoids. Small patches of limber pine occur on the upper north-facing slopes of Ross Ridge. Dry, south-facing slopes may be dominated by sparse stands of Gardner saltbush and rubber rabbitbrush or are mostly devoid of vegetation.

The rim of Ross Butte and Ross Ridge support cushion plant communities and sparse grasslands of Sandberg bluegrass and thickspike wheatgrass. Concave depressions are often dominated by Beaver Rim phlox, Big Piney milkvetch, Hooker sandwort, larch-leaved beardtongue, and thickspike wheatgrass. Adjacent convex rims are similar, but stemless goldenweed, cushion buckwheat and Sandberg bluegrass largely replace Beaver Rim phlox and thickspike wheatgrass. Stunted shrubs may also occur in these wind-blasted rim sites. These cushion plant communities are typically found on fine gray clay-shale soils with a surface layer of white sandstone or limestone rock. The summit flats of Ross Butte and Ross Ridge are dominated by dense Wyoming big sagebrush/Sandberg bluegrass communities, although cushion plant vegetation may be present in small openings.

Plant Species of Special Concern

Surveys in 1995-97 targeted twelve plant species tracked by WYNDD as high priority or "watch list" species of special concern (Fertig 1997). Ten of these species are now known to occur in the Ross Butte ecosystem (Table 2). Two of the target species (*Cirsium aridum* and *Oryzopsis swallenii*) were not located in the Ross Butte area, despite their documented occurrence in the

nearby Yellow Point Ridge and Cretaceous Mountain regions (Fertig 1993, 1995 b; Hartman and

Figure 2. General vegetation patterns in the Ross Butte Ecosystem

Vegetation Types:

- A. Mosaic of Wyoming big sagebrush/Sandberg bluegrass, black sagebrush grassland, and true mountain mahogany/mountain snowberry/sagebrush thickets
- B. Cushion plant/Sandberg bluegrass/thickspike wheatgrass communities
- C. Mosaic of Wyoming big sagebrush grassland, Gardner saltbush/rubber rabbitbrush, Gardner saltbush/bud sagewort, and greasewood fan communities and bare soil/rock.

Table 2. Plant Species of Special Concern in the Ross Butte Ecosystem

<u>Species</u>	<u>Federal Status</u>	<u>Heritage Rank</u>
! <i>Astragalus drabelliformis</i> [Big Piney milkvetch]	USFWS: former C2 Rock Springs BLM Special Status	G2G3/S2S3
<i>Calyptridium roseum</i> [Rosy pussy-paws]	None	G5/S1
<i>Cryptantha scoparia</i> [Desert cryptantha]	None	G4/S2 *
! <i>Ipomopsis crebrifolia</i> [Compact gilia]	None	G3/S2S3
<i>Lesquerella macrocarpa</i> [Large-fruited bladderpod]	USFWS: former C2 Rock Springs BLM Special Status	G2/S2
! <i>Penstemon paysoniorum</i> [Payson's beardtongue]	None	G3/S3
<i>Phacelia glandulosa</i> var. <i>deserta</i> [Desert glandular phacelia]	None	G4T1T2/S1
<i>Phacelia salina</i> [Nelson's phacelia]	None	G3Q/S1
! <i>Phlox opalensis</i> [Opal phlox]	USFWS: former C2	G3/S3
<i>Phlox pungens</i> "Ross Butte morph" [Beaver Rim phlox]	USFWS: former C2 Rock Springs BLM Special Status	G2/S2

! On WYNDD "Watch List" (Fertig 1997)

* Rank has changed since publication of Fertig (1997)

Nelson 1993; Kass 1993). Potential habitat for these taxa still needs to be investigated along the northeast slope of Ross Ridge.

Four species of special concern in the Ross Butte ecosystem are found primarily on sparsely vegetated rims in cushion plant communities. Big Piney milkvetch (*Astragalus drabelliformis*) and Beaver Rim phlox (*Phlox pungens*) are found extensively on the uppermost slopes and rims of Ross Butte and Ross Ridge, and less commonly on low, gravelly knolls in the valley bottom. Both species may be locally abundant and contribute over 10% of total vegetative cover in favorable rim sites. These species also may be present in sandy openings within Wyoming big sagebrush grasslands on the summit flats of the large mesas. Desert cryptantha (*Cryptantha scoparia*) and Compact gilia (*Ipomopsis crebrifolia*) are much less abundant and appear to be restricted to chalky barren slopes or the edges of Gardner saltbush/fringed sagebrush and cushion plant stands.

Barren clay-shale slopes and flats provide habitat for large-fruited bladderpod (*Lesquerella macrocarpa*), Payson's beardtongue (*Penstemon paysoniorum*), Desert glandular phacelia (*Phacelia glandulosa* var. *deserta*), and Nelson phacelia (*Phacelia salina*). These habitats are well-represented on the south and east slopes of Ross Butte and in the basins on the northeast and south side of Burma Point. Populations of these plants are often highly localized and relatively small. Opal phlox (*Phlox opalensis*) may also occur in these barren sites, but is more typical of washes and flats dominated by greasewood, Wyoming big sagebrush, or Gardner saltbush communities. Rosy pussy-paws (*Calyptidium roseum*) is found in sandy sagebrush habitats.

Eight other regionally endemic plant species formerly tracked by WYNDD were located in the study area from 1995-97. The status of each of these taxa is briefly summarized below:

Abronia mellifera: White sand verbena occurs in sparsely vegetated cushion plant communities and on bare sandstone slopes on the north side of Ross Butte. Recent surveys by Marriott (1993) and Steve Laster (BLM Pinedale Resource Area) have demonstrated that this species is more widespread and numerous in the Green River Basin than formerly suspected.

Astragalus jejunus var. *jejunus*: Starveling milkvetch is found in sparsely vegetated cushion plant communities and redbed flats in the Ross Butte ecosystem. This species is restricted to extreme southeastern Idaho, northeastern Utah, and southwestern Wyoming and is classified as Sensitive by US Forest Service Region 4 (Fertig et al. 1994). It is locally abundant and largely unthreatened in southwest Wyoming and is not tracked as a species of concern by WYNDD.

Cryptantha caespitosa: Tufted cryptantha is locally abundant in cushion plant communities on chalky sandstone slopes and rims of Ross Butte and Ross Ridge. This species is known from approximately 50-60 locations in southwestern Wyoming, nearly half of which have been discovered in the past decade. Due to low threats, it is no longer considered a species of special concern.

Eriogonum acaule: Stemless buckwheat is found sporadically on dry, barren clay flats south of

Burma Point. This species is restricted to southwest Wyoming and northwestern Colorado, and is known from fewer than 40 locations. It is not currently tracked by WYNDD due to low threats.

Lesquerella alpina var. *condensata*: Condensed bladderpod is common, but widely scattered

along shaley clay to chalky rims of Ross Butte and Ross Ridge. This species is a regional

endemic of southwestern Montana, southwestern Wyoming, and northwestern Colorado and is known from approximately 20 locations in Wyoming. It is not currently tracked

as a

species of concern by WYNDD.

Lomatium nuttallii: Nuttall's biscuitroot is locally abundant on semi-barren clay shale slopes on the north side of Ross Butte and Ross Ridge. This species is largely restricted to central Wyoming, although populations also extend into western Nebraska and eastern Colorado. Recent surveys have found it to be widespread and largely unthreatened in basin areas of Wyoming.

Oryzopsis contracta: Contracted Indian ricegrass is found sporadically on sandy rims and valley bottoms throughout the study area. This species was formerly a C2 candidate for listing under the Endangered Species Act, but has recently been documented from over 100 locations in central Wyoming, southern Montana, and northeast Utah (Fertig 1994). It appears to be secure throughout most of its range and is no longer tracked by WYNDD.

Townsendia nuttallii: Nuttall's Easter-daisy is found sporadically in sandy-clay openings in sagebrush communities on Ross Ridge. This species is known from fewer than 50 locations rangewide (southern Montana and western Wyoming), but is largely unthreatened at the present time.

Townsendia spathulata: Sword-leaf Easter-daisy is commonly found in wind-blasted cushion

plant communities along the rim of Ross Butte and Ross Ridge, although individual colonies are often small and localized. This species is restricted to southern Montana and

central Wyoming, where it is presently known from 35-50 locations. Although most populations are small, the low degree of threat has resulted in it being dropped as a species

of special concern.

Species Summaries

Information on the biology and conservation status of the ten plant species of special concern known from the Ross Butte ecosystem is presented in the following species summaries. Element Occurrence Records (formatted database reports) and location maps for these species are included in Appendix A.

Astragalus drabelliformis Barneby
Big Piney milkvetch or Bastard draba milkvetch
Fabaceae or Leguminosae (Pea Family)

Heritage Rank: G2G3/S2S3 (WYNDD Watch List).

Legal Status: None. Formerly a USFWS Category 2 Candidate.

Description: Big Piney milkvetch is a mat-forming perennial herb with flowering stems mostly less than 2.5 cm high (Figure 3). The leaves are silvery-hairy, spoon-shaped to linear, 5-25 mm long, and simple (not divided into 3 or more leaflets). Flowers are pink-purple, less than 7 mm long, and loosely arranged in a 1-4 flowered raceme. Fruit pods are approximately 5.5-8.5 mm long, thinly hairy, and triangular in cross-section with a distinctly keeled ridge on the lower edge and a groove on the upper edge (Barneby 1964; Fertig 1993; Fertig et al. 1994; Kass 1993, 1995)..

Similar Species: *Astragalus spatulatus* has fruits that are two-edged in cross-section (flattened laterally) and flowers 6-9 mm long. *A. simplicifolius* forms dense, bun-like mats, has larger flowers (10-16 mm long), and has narrow, sharp-pointed leaves (Fertig et al. 1994). Mature fruits are needed to reliably distinguish these species.

Geographic Distribution: Endemic to the Green River Basin in Sublette County, Wyoming (Kass 1993). Although potential habitat is present, recent reports from adjacent Lincoln County appear to be misidentifications of *A. spatulatus*.

Occurrences Within the Study Area: Big Piney milkvetch is known from 19 subpopulations in 4 main areas of the Ross Butte ecosystem. A nearly continuous population is found along the rim of Ross Butte, with smaller satellite colonies on lower terrace flats of its north and southwest slopes. Large colonies are also found on the north and south rim of Ross Ridge and at the east end of the ridge near Burma Point. At least 7 small colonies occur on scattered knolls in the valley floor between Ross Butte and Ross Ridge.

Habitat: Rangeland, this species is found mostly in sagebrush and cushion plant communities on sandstone, stony clay, limestone, redbed, and clay slopes and ridges (Marriott 1988; Fertig et al. 1994).

In the Ross Butte ecosystem, Big Piney milkvetch is found commonly on windswept rims of pinkish-tan to white clay sandstone or siltstone in cushion plant communities. Populations may also occur in scattered sandy-clay/gravel openings within Wyoming big sagebrush or black sagebrush grasslands on summit flats. Smaller populations also occur sporadically in cushion plant communities on lower terrace slopes or small knolls on the valley floor. Commonly associated species include *Arenaria hookeri*, *Lomatium nuttallii*, *Oxytropis sericea*, *Phlox pungens*, *Erigeron*

compositus, *Elymus lanceolatus*, and *Poa secunda*.
Flowering/Fruiting Period: May-July/June-August.

Population Size and Condition: The total population in the Ross Butte ecosystem is estimated at 500,000-1,000,000 individuals, based on the amount of known and potential habitat and the average density of 12-14 plants per square meter. Big Piney milkvetch may be locally dominant on convex-shaped rim slopes.

Existing and Potential Threats: Overall threats are relatively low under current management. Individual colonies may be impacted by trampling from livestock or off-road vehicles. Disturbance associated with oil and gas exploration is a potential threat.

Notes: Recent surveys by Hartman and Nelson (1993), Kass (1993, 1995), Cramer (1997), S. Laster, and W. Fertig have demonstrated that this species is much more abundant within its small geographic range than originally suspected. Observations by Steve Laster (personal communication) suggest that Big Piney milkvetch is capable of quickly recolonizing recently disturbed quarry and roadside areas. Despite the proliferation of natural gas exploration in southwest Wyoming, this species appears to be secure, so long as patches of undisturbed habitat persist to serve as a seedbank. No populations are currently found within areas specifically managed for biological resources.

Robert Dorn (1988) has noted that *A. drabelliformis* intergrades with *A. spatulatus* in parts of its range (especially the Blue Rim area), suggesting that *A. drabelliformis* may warrant varietal status.

Figure 3. *Astragalus drabelliformis*. Illustration by W. Fertig and Steve Laster from Fertig et al. 1994.

Calyptridium roseum Wats.
Rosy pussy-paws
Portulacaceae (Purslane Family)

Synonym: *Cistanthe rosea*.

Heritage Rank: G5/S1.

Legal Status: None.

Description: Rosy pussy-paws is a small, sprawling, taprooted plant about 2-8 cm high (Figure 4). The narrowly spoon-shaped, alternate leaves are 5-30 cm long and located mostly at the base of the plant. The small (< 1 mm long) white flowers have two petals and one stamen and are clustered in a long, curled stalk at the top of the stem. Fruits are 2-3 mm long and contain 6-10 black seeds about 0.5 mm broad (Hitchcock and Cronquist 1964; Dorn 1992).

Similar Species: *Polygonum kelloggii* and *P. watsonii* have eight stamens and 6 perianth segments (sepals and petals). *Spraguea umbellata* var. *caudicifera* has four petals and three stamens, and the flowers are clustered in a round head.

Geographic Distribution: *C. roseum* occurs from central Oregon to central California and east to Idaho and Wyoming. In Wyoming, it is known from the Green River Basin, western and southern foothills of the Wind River Range, and Saratoga Valley in Carbon, Fremont, and Sublette counties.

Occurrences Within the Study Area: Tom Cramer discovered a population of this species at the east end of Ross Ridge (near Burma Point) in 1995 (Cramer and Hartman 1996). This species was not relocated during 1996-1997 surveys.

Habitat: Typically occurs in sandy sagebrush desert to arid montane forest (Hitchcock and Cronquist 1964). The Burma Point population is found on sandy sagebrush mounds (Cramer and Hartman 1996).

Flowering/Fruiting Period: May-June.

Population Size and Condition: No census data are available.

Existing and Potential Threats: Not known.

Notes: Until 1990, this species was known from a single extant population in Wyoming. Surveys by Tom Cramer and the author have added six additional locations in the last 7 years, suggesting

that *Calyptridium roseum* may be even more widespread than currently recognized. This species is easily overlooked due to its small stature and seedling-like appearance. Its current status as a species of conservation concern needs to be restudied and possibly changed.

Figure 4. *Calyptridium roseum*. Illustration from Hitchcock and Cronquist 1964.

Cryptantha scoparia A. Nels.
Desert cryptantha
Boraginaceae (Borage Family)

Heritage Rank: G4/S2 (formerly G3/S1S2)

Legal Status: None.

Description: Desert cryptantha is a slender, multi-branched, annual herb with stems 5-30 cm tall (Figure 5). The stems and leaves have short, appressed to spreading hairs, with those of the leaves often having enlarged, wart-like bases. Leaves are linear, alternate, 1-4 cm long and 1-3 mm wide. The leafless flower spikes are elongate, 2-15 cm at maturity, and often paired at the tips of branches. In fruit, the calyx is narrow, 4-6 mm long, and densely pubescent with a mix of closely ascending hairs and stiff, spreading bristles. The corolla is white, about 1 mm wide, and barely exceeds the calyx in length. Each fruit is composed of four equally-sized, lance-shaped nutlets 0.5-0.7 mm wide, and covered with tiny, upward-pointing, curved spines (Hitchcock et al. 1959; Cronquist et al. 1984; Dorn 1992; Jones and Fertig 1996).

Similar Species: *Cryptantha kelseyana* has nutlets of two size classes within the same blossom. *C. fendleri* and *C. watsonii* have smooth nutlets. *C. ambigua* has wider, more oval nutlets covered by rounded tubercles. *C. circumcissa* has a partially deciduous calyx (the green, upper lobes fall off when the fruits are mature) and has stems shorter than 6 cm (Dorn 1992).

Geographic Distribution: *C. scoparia* occurs from eastern Washington and Oregon to northern Nevada, south-central Montana, northern Utah, and southwestern Wyoming. In Wyoming, it is known from the Green River and Great Divide basins in Lincoln, Sublette and Sweetwater counties (Jones and Fertig 1996).

Occurrences Within the Study Area: This species is known from a single location on the north slope of Ross Butte, last observed by the author in July 1995.

Habitat: Occurs on dry, open flats and slopes, typically among sagebrush (Cronquist et al. 1984). Wyoming populations have been reported from sandy, clay, or gravelly slopes, flats, and rims (Jones and Fertig 1996). The Ross Butte colony is found in an *Atriplex gardneri*-*Artemisia frigida*-*Poa secunda* community on white gravelly-chalky slopes just below the windy summit rim with *Astragalus drabelliformis*, *Oryzopsis hymenoides*, *Arenaria hookeri*, *Lesquerella alpina* var. *condensata*, *Eriogonum brevicaulis*, and *Krascheninnikovia lanata*.

Flowering/Fruiting Period: May-June/June-July.

Population Size and Condition: No census data are available for the Ross Butte population. This species may only appear during years with high spring and summer moisture, surviving only in the seedbank in drought years.

Existing and Potential Threats: Not known.

Notes: Ward et al. (1998) report this species from 12 extant locations in the state, 11 of which have been discovered since 1995. Due to its small size, desert cryptantha is easily overlooked and is probably more abundant in the state than previously suspected. The state rank has been adjusted from S1S2 to S2 to reflect its greater abundance and lower degree of threat in Wyoming. This species is no longer considered a high priority conservation target and will be dropped from the next edition of Wyoming's "Plant Species of Special Concern" list.

Figure 5. *Cryptantha scoparia*. Illustration from Cronquist et al. 1984.

Ipomopsis crebrifolia (Nutt.) Dorn
Compact gilia
Polemoniaceae (Phlox Family)

Synonym: *Ipomopsis congesta* var. *crebrifolia*; *Gilia congesta* var. *crebrifolia*.

Heritage Rank: G3/S2S3 (WYNDD Watch List).

Legal Status: None.

Description: Compact gilia is a perennial herb with unbranched, low, matted stems 3-12 cm tall (Figure 6). Leaves are crowded in a basal rosette and scattered along the erect flowering stems. The leaves are linear, mostly glabrous, unlobed, and 1-2.5 cm long. Flowers are crowded in a terminal, rounded, head-like inflorescence beset with short hairs. The corolla is white with a 3-5 mm long tube and 5 spreading, elliptic lobes 1.5-3 mm long. Stamen filaments are longer than the anthers. The fruit is a capsule 2.5-4 mm long (Cronquist et al. 1984; Dorn 1992; Jones and Fertig 1996).

Similar Species: *Ipomopsis congesta* var. *congesta* has whitish-gray pubescent, pinnately compound leaves and heads with long, tangled hairs. *I. spicata* has an elongate (often drooping) inflorescence and pubescent, pinnately divided leaves (Dorn 1992).

Geographic Distribution: *I. crebrifolia* is a regional endemic of southwestern Montana, western Wyoming, western Utah, and northern New Mexico (Cronquist et al. 1984). In Wyoming, this species is found in the Great Divide and Green River basins and the foothills of the Wind River and Wyoming ranges in Fremont, Lincoln, Sublette, Sweetwater, and Teton counties (Jones and Fertig 1996).

Occurrences Within the Study Area: Three small colonies occur on the north-facing slope of Ross Butte and the northwest rim of Ross Ridge. An additional population is reported from a ridge on the south side of North Alkali Draw (Cramer and Hartman 1996).

Habitat: Found on barren or semi-barren clay, shale, or sandstone slopes in cushion plant-bunchgrass communities or on the fringes of sagebrush grasslands (Jones and Fertig 1996). In the Ross Butte and Ross Ridge area, this species occurs primarily on whitish to whitish pink upper slopes and rims of limey-sandstone with abundant dolomite rock and gravel. Populations may be found in sparsely vegetated cushion plant communities or in openings among stands of Wyoming big sagebrush, rubber rabbitbrush, or true mountain mahogany. Common associates include *Poa secunda*, *Phlox pungens*, *Cirsium pulcherrimum*, *Elymus lanceolatus*, and *Oxytropis sericea*.

Flowering/Fruiting Period: Late May-early June/late June-August.

Population Size and Condition: Populations within the Ross Butte ecosystem are small and localized, often being restricted to dolomite-rich microsites.

Existing and Potential Threats: Colonies on Ross Butte and Ross Ridge occur on steep upper slopes and rims where threats from grazing, recreational vehicle use, and oil and gas exploration appear low. The North Alkali Draw colony is found near a road and is potentially more impacted.

Notes: Welsh et al. (1993) suggest that Utah populations attributed to *I. crebrifolia* may have evolved independently from *I. congesta*. Until 1990, this species was known from fewer than 5 locations in Wyoming. Surveys since then have documented at least 23 extant occurrences in the state. Due to its greater distribution and low degree of threat, WYNDD downlisted this taxon to "Watch list" status in 1997.

Figure 6. *Ipomopsis crebrifolia*. Illustration from Cronquist et al. 1984.

Lesquerella macrocarpa A. Nels.
Large-fruited bladderpod
Brassicaceae or Cruciferae (Mustard Family)

Heritage Rank: G2/S2.

Legal Status: Rock Springs BLM: Special Status. Formerly a USFWS Category 2 Candidate.

Description: Large-fruited bladderpod is a densely silvery-gray pubescent perennial herb with decumbent stems 5-30 cm long (Figure 7). The basal leaf blades are oval to oblanceolate, 0.5-3 cm long, 3-20 mm wide, and petioled. Stem leaves are narrower and stalkless. Flowers have 4 yellow petals 4-7 mm long. The inflated, globose fruits are 4-8 mm long and borne on recurved stalks. The fruits are slightly hairy on the outer wall and glabrous on the inner surface (Rollins and Shaw 1973; Dorn 1980; Fertig et al. 1994; Fertig 1995 a).

Similar Species: *Lesquerella fremontii* has smaller fruits that are slightly flattened and densely pubescent on the outer walls and lightly hairy on the inner walls. Other Wyoming species of *Lesquerella* differ in having linear leaves or fruits borne on ascending or S-shaped fruitstalks. The large fruits of *L. macrocarpa* resemble those of twinpods (*Physaria* sp.) but are rounded at the top rather than notched and are not divided into two balloon-like bladders (Dorn 1992; Fertig et al. 1994; Fertig 1995 a).

Geographic Distribution: Endemic to the Great Divide and Green River basins of central and southwestern Wyoming in Fremont, Lincoln, Sublette, and Sweetwater counties.

Occurrences Within the Study Area: Large-fruited bladderpod was discovered by Tom Cramer at three sites along Ross Butte, Blue Rim, and the head of North Alkali Draw in 1994-95 (Cramer and Hartman 1996). Surveys by the author in 1996-97 resulted in the relocation of the Blue Rim population and the discovery of 7 additional colonies along the south and east toe of Ross Butte and the basin south of Burma Point. An additional colony may occur on the north side of Ross Ridge (T30N R110W S25), but consisted only of dead and dried stems in 1997.

Habitat: Typically occurs in sparsely vegetated Gardner saltbush-squirreltail (*Atriplex gardneri*-*Elymus elymoides*) communities on low knolls and colluvial fans of barren, fine-textured clays and shales, often with gypsum or bentonite present (Dorn 1980; Fertig 1995 a; Jones and Fertig 1996). Most populations in the Ross Butte ecosystem occur on barren clay knolls at the base of shale-siltstone ridges in communities of Gardner saltbush/green rabbitbrush or Gardner saltbush/bud sagewort. Occasionally, colonies may also be found on steep, nearly unvegetated clay slopes with small shale fragments or rocky clay-shale toeslopes with cushion plants and scattered Wyoming big sagebrush.

Associated species include *Elymus elymoides*, *Lomatium foeniculaceum*, *Phlox opalensis*,

Ipomopsis congesta, and *Stenogonum salsuginosum*.

Flowering/Fruiting Period: Mid May-late June; late May-early July (Fertig 1995 a).

Population Size and Condition: Surveys in 1996-97 documented 775-875 flowering, fruiting, and vegetative plants in 8 colonies on Ross Butte and the basins on the north and south side of Burma Point. Individual colonies ranged in size from 3 to over 200 plants. A mix of reproductive and seedling plants was observed at the Burma Point colonies in 1997, suggesting that reproduction was taking place. Based on long-term monitoring studies of other occurrences (Fertig 1995 a; Jones and Fertig 1996), populations in the Ross Butte area may fluctuate widely from year to year depending on moisture conditions and seed production. These fluctuations may account for the low plant numbers reported by T. Cramer (personal communication) in the study area in 1994-95.

Existing and Potential Threats: Trampling by off-road vehicles and other surface disturbing activities (such as road construction) appear to be the main threats to this species (Fertig 1995 a). These threats are probably most significant during drought years when populations may be at naturally low levels and stresses are high. Demographic plot studies have shown that population size and structure can fluctuate greatly from year to year, probably in relation to short-term climate changes. Maintenance of a seed bank is probably critical for the long-term survival of the plant at a given site. Impacts from wild horses and livestock appear to be less significant than once suspected (Fertig 1995 a).

Notes: *L. macrocarpa* is one of several bladderpod species currently being studied for potential development as an oil-seed crop by the US Department of Agriculture (Fertig 1995 a). This species is currently known from nine occurrences in Wyoming, only six of which are probably extant (Jones and Fertig 1996).

Figure 7. *Lesquerella macrocarpa*. Illustration by Jane Dorn from Fertig et al. 1994.

Penstemon paysoniorum Keck
Payson's beardtongue
Scrophulariaceae (Figwort Family)

Heritage Rank: G3/S3 (WYNDD Watch List).

Legal Status: None.

Description: Payson's beardtongue is a many-branched, erect, tufted perennial herb with stems 0.8-20 cm tall (Figure 8). Leaves are linear to lance-shaped, glabrous, and less than 1 cm wide and 6.5 cm long. Upper stem leaves are often folded along the midrib and are sessile. The flowers are 15-22 mm long, bright blue, and arranged in a dense, one-sided, glabrous inflorescence. The four pollen-bearing anthers are bluish-black and short-hairy, while the fifth, sterile stamen (staminode) is bearded at the tip (Keck 1947; Cronquist et al. 1984; Jones and Fertig 1996).

Similar Species: *Penstemon fremontii* differs in having light gray pubescence on the leaves and stems. *P. strictus* has long, tangled hairs on the anthers that equal or exceed the length of each anther sac. *P. cyananthus* is a taller plant with leaves broader than 1 cm (Dorn 1992).

Geographic Distribution: The entire global range of *P. paysoniorum* is restricted to the basins of southwestern and central Wyoming in Fremont, Lincoln, Natrona, Sublette, Sweetwater, and Uinta counties (Jones and Fertig 1996).

Occurrences Within the Study Area: Two small populations of Payson's beardtongue are found on the north slope of Ross Butte and on the east side of a small isolated mesa southwest of Burma Point and east of Ross Ridge. An additional population is known from the slopes of a mesa south of North Alkali Draw, just outside the study area.

Habitat: Found in barren hills, sandy creek bottoms, alkaline shale bluffs, and dry hills among sagebrush (Fertig 1993). Populations in the Ross Butte ecosystem are found on sandy or clay-shale badlands slopes or in openings in Wyoming big sagebrush/rubber rabbitbrush communities on slopes of silty clay below siltstone caprock. Common associated species include *Cryptantha caespitosa*, *Lomatium nuttallii*, *Astragalus jejunus* var. *jejunus*, *Haplopappus acaulis*, *Astragalus bisulcatus* var. *major*, and *Eriogonum cernuum*.

Flowering/Fruiting Period: June-July.

Population Size and Condition: Populations within the Ross Butte ecosystem appear to be small and localized, although much additional unsurveyed habitat is probably present.

Existing and Potential Threats: Threats appear to be low under present management. Small population numbers, however, could make this species vulnerable to large scale disturbances.

Notes: Payson's beardtongue is restricted to southwestern Wyoming and often occurs at low population densities. Recent floristic and rare plant surveys in southwest Wyoming have found this species to be more widespread than previously known, prompting it to be dropped to "watch list" status by WYNDD.

Figure 8. *Penstemon paysoniorum*. Illustration from Cronquist et al. 1984.

Phacelia glandulosa Nutt.
var. *deserta* (A. Nelson) Brand
Desert glandular phacelia
Hydrophyllaceae (Waterleaf Family)

Heritage Rank: G4T1T2/S1.

Legal Status: None.

Description: Desert glandular phacelia is an annual or biennial herb with erect, branched or unbranched stems 0.6-20 cm tall (Figure 9). The stems are densely pubescent with short grayish hairs and occasional glands. Leaves are lanceolate to oblong and pinnately divided into 5-9 round-toothed segments. The inflorescence is a dense panicle of coiled cymes that elongates to 6.5 cm in fruit. Flowers have a bright blue, open bell-shaped corolla consisting of 5 rounded lobes, conspicuously exserted stamens, and deeply cleft styles. Fruits are oval, pubescent capsules bearing elliptic to oblong, pitted seeds (Nelson 1898; Coulter and Nelson 1909; Atwood 1975).

Similar Species: *Phacelia glandulosa* var. *glandulosa* has densely glandular pubescent stems and inflorescences. *P. sericea* is a perennial from a branched, woody rootstalk (Coulter and Nelson 1909; Dorn 1992). Other *Phacelia* species in the Ross Butte area have tiny white or yellow flowers.

Geographic Distribution: Var. *deserta* is apparently endemic to the Green River Basin in southwestern Wyoming (Lincoln, Sublette, and Sweetwater counties), although potential habitat may also occur in northeastern Utah.

Occurrences Within the Study Area: Desert glandular phacelia is known from 3 locations on the north and south slopes of Ross Butte and the northernmost rim of Ross Ridge. An additional colony may occur on the north side of Ross Ridge (T40N R110W S25), based on dead, dried plants observed in 1997. The colony on the north side of Ross Butte (Secs 13/14) reported by Cramer and Hartman (1996) could not be relocated in surveys in 1996-97.

Habitat: Occurs on open slopes and badlands with intermittent sagebrush in clay soil. Associated species include *Lesquerella macrocarpa*, *Cryptantha caespitosa*, *Eriogonum microthecum*, and *Lomatium nuttallii*.

Flowering/Fruiting Period: June-August.

Population Size and Condition: Individual colonies are small (usually with fewer than 25 plants) and widely scattered. Populations in 1996-97 were observed in vegetative condition (although this

may have been an artifact of surveys being conducted in early summer).

Existing and Potential Threats: Surface disturbing activities, such as road construction, mineral exploration, and soil compaction by vehicles are likely threats. Impacts from livestock grazing are not fully understood.

Notes: This taxon was originally named as a distinct species by Aven Nelson in 1898, but was later reduced to synonymy (Nelson 1898; Atwood 1975). Duane Atwood (personal communication) has been studying the taxonomy of *P. glandulosa* and now believes that *deserta* warrants recognition at the varietal level. Several populations in Wyoming appear to be intermediate between vars. *deserta* and *glandulosa*, making it difficult to assess the overall status of the taxon.

Figure 9. *Phacelia glandulosa* var. *deserta*. Illustration from Atwood (1975).

Phacelia salina (A. Nels.) Howell
Nelson phacelia
Hydrophyllaceae (Waterleaf Family)

Synonym: Included in *Phacelia lutea* var. *scopulina* by Hitchcock et al. 1959.

Heritage Rank: G3Q/S1.

Legal Status: None.

Description: Nelson phacelia is an annual herb with 2-several prostrate or short-ascending, glandular stems 0.5-3 cm long (Figure 10). Leaf blades are entire, coarsely-toothed, wavy-margined, or pinnately-lobed, 0.5-1.5 cm long, and elliptic to oval. The leaves are wedge-shaped at the base with stalks 0.5-3 cm long and are finely pubescent with short, stiff hairs. Flowers are often borne near the ground at the base of the stems and are exceeded by the leaves. The calyx is 2-4 mm long at flowering time (4-6 mm long in fruit), and approximately equal to the corolla in size. The corolla is bright yellow (although often tinted with lavender), tubular, and 5-lobed. Stamens are shorter than the corolla tube. Styles are 0.5-1 mm long, and shorter than the calyx lobes (even in fruit). The fruit is a pubescent, pointed capsule 3-4 mm long with 7-10 ovules (Howell 1944; Halse 1981; Dorn 1992; Jones and Fertig 1996).

Similar Species: *Phacelia scopulina* has styles 1-2 mm long that typically exceed the calyx in fruit. *P. demissa* has purple-white flowers, fewer ovules, and rounded leaves. *P. tetramera* has a four-lobed, white or pale yellow corolla less than 2 mm long. *P. ivesiana* has leaves lobed more than halfway to the midrib (Dorn 1992).

Geographic Distribution: *P. salina* occurs from southwestern Wyoming to western Utah and east-central Nevada (Halse 1981). In Wyoming, it is known from the Green River and Great Divide basins and the foothills of the Overthrust Belt and Rock Springs Uplift in Lincoln, Sublette, and Sweetwater counties (Jones and Fertig 1996).

Occurrences Within the Study Area: Tom Cramer discovered two small populations in the Blue Rim and North Alkali Draw areas at the east end of the Ross Butte ecosystem in 1995 (Cramer and Hartman 1996). The author located an additional small colony in the saddle between the east slope of Ross Butte and the north end of Ross Ridge in 1997.

Habitat: Occurs on alkaline flats and clay slopes (Halse 1981). Populations in the Ross Butte area are found on purplish clay-shale barrens in sparsely vegetated Gardner saltbush/Indian ricegrass communities or on sandy to clay sagebrush mounds. Associated species include *Lesquerella macrocarpa*, *Monolepis nuttalliana*, *Stenogonum salsuginosum*, and *Camissonia*.

Flowering/Fruiting Period: May-July.

Population Size and Condition: The Ross Butte saddle population contained 75-100 flowering and vegetative plants in an area of 0.5 acres in 1997. No population estimates are available for the Blue Rim and North Alkali Draw colonies.

Existing and Potential Threats: Populations may be vulnerable to habitat disturbance from off-road vehicles.

Notes: This species has been considered only a form of *P. scopulina* with shorter styles (Hitchcock et al. 1959; Cronquist et al. 1984). Halse (1981) found the unique characters of *P. salina* to be stable throughout its range and recommended recognizing the taxon as a full species. Nelson phacelia is currently known from seven extant locations in Wyoming, six of which have been discovered since 1995. The species may be an ephemeral that only appears during wet springs and summers.

Figure 10. *Phacelia salina*. Illustration from Cronquist et al. 1984.

Phlox opalensis Dorn
Opal phlox
Polemoniaceae (Phlox Family)

Heritage Rank: G3/S3 (WYNDD Watch List).

Legal Status: None. Formerly a USFWS Category 2 Candidate.

Description: Opal phlox is a perennial herb that forms loose mats of semi-erect stems typically less than 7 cm high (Figure 11). Internodes of the stem are elongate, whitish-transparent, and have long, crinkly-spreading hairs. The leaves are 2-10 mm long, less than 1 mm wide, abruptly tapered to a sharp tip, and crinkly-pubescent (but not glandular) at the base. Flowers are white or occasionally pink and strongly aromatic. The corolla is 12-15 mm wide when fresh and has 5 (rarely 6) wedge-shaped lobes. Dried herbarium material may have corollas as little as 10 mm in diameter. The calyx is 6-8 mm long and crinkly pubescent with 5 sharp-tipped, triangular to linear lobes that are typically shorter than the fused calyx tube (Dorn 1992; Fertig et al. 1994; Fertig 1996).

Similar Species: *Phlox muscoides* is densely matted and has shorter, woolly leaves and smaller flowers. *P. hoodii* has a more congested growth form, lacks elongate internodes, and has smaller flowers that rarely exceed 8 mm in diameter. *P. albomarginata* and *P. pungens* have broader leaves with thickened leaf margins and are prominently glandular (Cronquist et al. 1984; Dorn 1992; Fertig 1996).

Geographic Distribution: Opal phlox is restricted to the Green River Basin in southwestern Wyoming (Lincoln, Sublette, Sweetwater, and Uinta counties) and northeastern Utah (Fertig 1996).

Occurrences Within the Study Area: Two extensive populations of Opal phlox are found at the east end of the Ross Butte ecosystem in basins on the northeast and south sides of Burma Point. Three small colonies also occur in the basin at the east end of Ross Butte. Additional potential habitat may occur along the northeast toe of Ross Ridge and in the North Alkali Draw area.

Habitat: Occurs primarily in semi-barren *Atriplex gardneri*/*Chrysothamnus nauseosus* or cushion plant communities on fine-textured clay-shale flats, slopes, and rims with an abundance of chert or reddish sandstone gravel (Fertig 1996). In the Ross Butte ecosystem, Opal phlox occurs mostly on the banks of fine clay gullies and broad washes with *Sarcobatus vermiculatus* and *Artemisia tridentata* var. *wyomingensis* or on chert-rich clay-shale flats with *Atriplex gardneri* and *Chrysothamnus nauseosus*.

Populations are less abundant on low gravelly knolls with cushion plants and sparse grasses.

Common associated species include *Arenaria hookeri*, *Elymus elymoides*, *Poa secunda*, *Kochia americana*, *Oxytropis sericeus*, *Hymenoxys richardsonii*, and *Astragalus bisulcatus* var. *major*.

Flowering/Fruiting Period: May-June.

Population Size and Condition: Approximately 100,000 plants were observed in 120 acres of habitat during surveys in 1997. This species was often locally common, especially in basin sites at the east end of Ross Ridge. This population extends for several miles to the east along Blue Rim.

Existing and Potential Threats: This species appears to be tolerant of many disturbances, including off-road vehicle traffic and grazing. Mineral development is a potential threat in some areas, although populations are often found on muddy slopes that are unsuitable for development (Fertig 1996). Threats in the Ross Butte area are low under current management, although any increases in road density could impact local colonies.

Notes: Opal phlox was described as a new species by Dorn in 1992. Surveys in 1994-95 resulted in the discovery or relocation of 28 large populations (Fertig 1996). Due to low threats and high population size, this species was downlisted to "watch-list" status by WYNDD in 1997.

Figure 11. *Phlox opalensis*. Illustration by Jane Dorn from Fertig et al. 1994.

Phlox pungens Dorn "Ross Butte morph"
Beaver Rim phlox
Polemoniaceae (Phlox Family)

Heritage Rank: G2/S2.

Legal Status: Rock Springs BLM: Special Status. Formerly a USFWS Category 2 Candidate.

Description: Beaver Rim phlox is a leafy perennial herb that forms loose mats of prostrate or short erect stems less than 5 cm high (Figure 12). The stiff, prickly leaves are lance-shaped, 1-1.5 mm wide, and have glandular or ciliate margins. The margins and midribs of the leaves are prominently thickened and gradually taper to a sharp tip. The white-petaled flowers are usually over 15 mm in diameter and have a glandular-hairy calyx tube (Dorn 1990, 1992; Fertig et al. 1994).

Populations of *Phlox pungens* from the Green River Basin differ from the "typical" populations of the southeast Wind River Range and Beaver Rim in having short-stalked glandular hairs on the leaves and narrower leaf blades (under 1 mm wide) that lack thick midribs and margins. These populations are referred to here as the "Ross Butte morph" and may represent an undescribed variety.

Similar Species: *Phlox kelseyi* has soft leaves without thickened midribs or margins. *P. multiflora* has glabrous leaves and calyces. *P. hoodii* has flowers less than 12 mm wide and more slender, non-glandular leaves. *P. opalensis* is non-glandular.

Geographic Distribution: Endemic to the Wind River and Green River basins and southeastern foothills of the Wind River Range in Fremont, Lincoln, and Sublette counties. Within this range, the "typical" growth form is restricted to Fremont County and the "Ross Butte morph" is restricted to the Green River Basin in Lincoln and Sublette counties.

Occurrences Within the Study Area: Nineteen subpopulations of *Phlox pungens* were found along the flanks of Ross Butte and the northwest and southwest slopes and rim of Ross Ridge during 1995-97 surveys. Two additional colonies were reported from the Burma Ridge and North Alkali Draw areas at the east end of Ross Ridge by Tom Cramer in 1995 (Cramer and Hartman 1996). Neither of these colonies could be relocated in 1997.

Habitat: Rangewide, *Phlox pungens* is typically found in sparsely vegetated cushion plant communities on slopes of limestone, volcanic-rich sandstone, siltstone, or redbed clays (Fertig et al. 1994). In the Ross Butte ecosystem, it is commonly found in concave washes along summit rims, midslopes, and ridgetops on gray to reddish-brown clay-shale soils with a surface layer of white

limey-sandstone. Populations most often occur in communities of cushion plant-thickspike wheatgrass or in openings within a matrix of Wyoming big sagebrush/Sandberg bluegrass, mountain snowberry thickets, or black sagebrush grasslands. In favorable sites, *P. pungens* may provide 5-20% of the total ground cover.

This species is less frequently found on sandy clays with Gardner saltbush or rocky slopes with rubber rabbitbrush and true mountain mahogany. Common associated species include *Astragalus drabelliformis*, *Erigeron compositus*, *Lomatium foeniculaceum*, *Eriogonum brevicaule*, *Linum lewisii*, and *Cirsium pulcherrimum*.

Flowering/Fruiting Period: June-July.

Population Size and Condition: In 1997, the total population on Ross Butte and Ross Ridge was conservatively estimated at over 100,000 flowering and vegetative clumps. More exact estimates were difficult to derive due to the clonal nature of the species. Populations were especially large on the northeast slopes of Ross Butte and the northwest side of Ross Ridge, where individual colonies often numbered in the low thousands. No population estimates are available for isolated colonies at the far east end of the Ross Butte ecosystem.

Existing and Potential Threats: Most populations of this species on the upper slopes of Ross Butte and Ross Ridge appear to be secure under present management. No evidence of herbivory by livestock was observed in 1996-97 surveys (the plants spiny-tipped leaves may make it unpalatable). Populations on lower slopes may be vulnerable to damage by off-road vehicles.

Notes: The Ross Butte morph of *Phlox pungens* is currently known from only eight locations in the Green River Basin (WYNDD records). Additional habitat may occur along mesas bordering the Green River east of Big Piney and LaBarge. The taxonomic status of this entity still needs to be resolved.

Figure 12. *Phlox pungens*. Illustration by Isobel Nichols from Fertig et al. 1994.

Summary and Management Recommendations

The Ross Butte ecosystem contains a mosaic of cold desert shrub and cushion plant community types that provide habitat for mule deer, pronghorn antelope, and other wildlife species. More importantly, the area contains healthy populations of 19 state rare or regionally endemic plant species, four of which were formerly C2 candidates for listing as Threatened or Endangered under the Endangered Species Act. The Ross Butte ecosystem contains one of the highest known concentrations of regionally endemic basin plant species in southwestern Wyoming. Given the growing pressures to develop natural gas and oil resources in southwest Wyoming, the Ross Butte area stands out as a significant potential conservation site.

Recent floristic and sensitive plant surveys of the Green River Basin have determined that many of the regionally endemic species present in the Ross Butte area are not imminently threatened or as critically imperiled as once believed (Hartman and Nelson 1993; Kass 1993, 1995; Fertig 1994, 1996). Nevertheless, the cumulative impacts from current and projected development of natural gas resources on the endemic flora of the basin is poorly understood. The long-term survival of these species may depend on maintaining selected areas in near natural condition to serve as a refugium for future recolonization after the current development cycle is over. To date, no special management areas have been created to address the endemic flora of the upper Green River Basin. The Ross Butte ecosystem is a strong candidate for special management consideration because of its unusually high density of regional endemic species.

Under present management, the entire Ross Butte area is open to locatable minerals, including oil and gas (USDI Bureau of Land Management 1987). Potential for gas development appears to be low, despite the ongoing development of the Jonah Field and Blue Rim areas to the south and east (Steve Laster, Pinedale BLM, personal communication). The Ross Butte ecosystem is also managed for livestock grazing, communications facilities, offroad vehicle recreation, and as big game crucial winter range (USDI Bureau of Land Management 1987). Seasonal use restrictions (November 15-April 30) are in place to protect wintering mule deer populations.

At the present time, most populations of plants of special concern in the Ross Butte ecosystem are minimally impacted by existing uses. Livestock grazing is not an important impact under current stocking levels, and most of the plants of conservation interest do not appear to be grazed due to their compact stature and low palatability. Important rare plant habitats in the area receive relatively little livestock use anyway, due to the low amount of suitable forage and lack of water. Changes in livestock management, such as the construction of water tanks, salt licks, or stock driveways, could result in trampling damage and increased erosion. Off-road vehicles are a more significant potential threat, especially in low-lying basin areas at the east end of Ross Ridge and Burma Point. Vehicle use may dislodge plants, compact soils, or lead to increased soil erosion. Development of access roads for oil and gas development may have similar effects. Limiting off-road vehicles to the existing road network and implementation of No-Surface Occupancy or other avoidance standards for siting mineral developments may be sufficient to protect rare plant habitats in the Ross Butte area. Designation of the area as some type of "special management area" is desirable in that it would bring added management attention to the significant biological resources

of the Ross Butte ecosystem.

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Appendix A.

Element Occurrence Records
and Population Maps for Plant Species of
Special Concern
in the Ross Butte Ecosystem

Appendix B.

Photographs

- A. Fruiting *Astragalus drabelliformis* (center) and *Phlox pungens* (lower left) from the north rim of Ross Butte. Note the trigonous fruit of *Astragalus*. WYNDD photograph by W. Fertig, 9 July 1995.
- B. *Ipomopsis crebrifolia* from the north slope of Ross Butte. WYNDD photograph by W. Fertig, 9 July 1995.
- C. *Lesquerella macrocarpa* from clay-shale slopes at the south end of Ross Butte. Plants mostly in flower and clustered. WYNDD photograph by W. Fertig, 21 May 1996.
- D. *Phlox pungens* ("Ross Butte morph") from the north slope of Ross Butte. This population is more notably glandular and has narrower and less prominently thickened leaves than other populations in the Wind River Basin, suggesting that it may be an undescribed variety. WYNDD photograph by W. Fertig, 21 May 1996.