Status Report on

Dorn's Twinpod

(*Physaria dornii*)

in Southwestern Wyoming

Prepared for the Bureau of Land Management
Wyoming State Office

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Table of Contents

Figures, Tables, and Appendices

I. INTRODUCTION

Dorn's twinpod (*Physaria dornii*) was first discovered by botanist Robert Dorn in June 1979, while conducting field surveys for *P. condensata*, a related species being considered for listing under the Endangered Species Act (Lichvar 1982). After extensive field and laboratory studies of all Wyoming *Physaria* species, Robert Lichvar described Dorn's plant as a new species and named it in his honor (Lichvar 1983).

At the time it was described, *Physaria dornii* was believed to be restricted to 10 small and essentially contiguous populations on Bureau of Land Management (BLM) lands along Rock Creek Ridge in southern Lincoln County, Wyoming. Due to its limited range and concerns about its status, the species was listed as a Category 2 candidate for listing under the Endangered Species Act by the US Fish and Wildlife Service (USFWS) in 1985. Under BLM Manual 6840, the BLM is directed to manage USFWS candidates on its lands in such a manner that these species and their habitats are conserved and to ensure that agency actions do not contribute to the need to list these species as Threatened or Endangered (Willoughby et al. 1992). *P. dornii* is currently managed as a "Special Status" plant species by the BLM Rock Springs District (Amidon 1994).

In 1996, the BLM Wyoming State Office contracted with the Wyoming Natural Diversity Database (WYNDD) on a cost-share basis to conduct field surveys and evaluate the status of this taxon on BLM lands in southwestern Wyoming. The objective of this report is to summarize new and existing data on the biology, distribution, habitat, population size, and potential threats of *Physaria dornii* to be used in determining its conservation status and potential management needs in Wyoming.

II. METHODS

Information on the habitat and distribution of *Physaria dornii* was obtained from secondary sources, including WYNDD files and computer databases, specimens from the Rocky Mountain Herbarium (RM), scientific literature, and knowledgeable individuals. USGS topographic maps, geologic maps (Love and Christiansen 1985), and BLM land status maps were used to identify areas of potential habitat for ground survey.

Field surveys were conducted by the author in early July 1996 and early to mid-June 1997 (survey routes and collection sites are indicated in Appendix C). Data on the biology, habitat, population size, and management needs of this species were collected using WYNDD plant survey forms (Appendix B). Locations of occurrences were mapped on 7.5 minute USGS topographic maps. If populations were sufficiently large, voucher specimens were collected for deposit at the RM and the Rock Springs District herbarium. Color photographs were taken of twinpod plants and their habitat at each site. Information gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

Two permanent monitoring transects established by Marriott (1988) were resurveyed following the protocol of Lesica (1987). These transects consisted of a single belt 1 m x 30 m long, subdivided into 1 m x 1 m plots. Within each plot individual plants were counted and assigned to one of four age classes: seedling, vegetative (non-reproductive), reproductive, and dead. This technique generated quantitative data on population size, density, age distribution, and reproductive potential. Data from these transects are included in Appendix D.

II. SPECIES INFORMATION

A. CLASSIFICATION

1. SCIENTIFIC NAME: *Physaria dornii* Lichvar (Lichvar 1983). Type specimen: USA, Wyoming, Lincoln County, T42N R106W Sec 31 W ¼, rocky barren hills, 7000 ft., 26 June 1980, Dorn 3476 (RM).

2. SYNONYMS: None.

3. COMMON NAMES: Dorn's twinpod, Tunp Range twinpod.

4. FAMILY: Brassicaceae or Cruciferae (mustard family).

5. SIZE OF GENUS: Rollins (1993) recognizes 22 species in the genus *Physaria*, all of which are restricted to western North America. Dorn (1992) lists 10 species and 2 varieties of *Physaria* for Wyoming. Eight of Wyoming's taxa are state or regional endemics, indicating that the state is a center of speciation within the genus.

6. PHYLOGENETIC RELATIONSHIPS: Based on similarities in replum shape, growth form, and habitat requirements, Lichvar (1983) hypothesized that *Physaria dornii* and *P. condensata* were derived from *P. didymocarpa* var. *integrifolia* [synonym = *P. integrifolia*]. This whole species complex (and the related *P. eburniflora*) may have evolved from populations of the more northerly ranging *P. didymocarpa* that became isolated in the basins and desert mountain ranges of southwestern and central Wyoming during wetter periods in the late Pleistocene (Rollins 1981; Lichvar 1983). All of these species intergrade to some degree, indicating that the group is still actively evolving and therefore taxonomically unstable (Dorn 1988, p. iv).

B. PRESENT LEGAL OR OTHER FORMAL STATUS:

1. NATIONAL:

a. LEGAL STATUS: *Physaria dornii* was formerly a C2 candidate for listing under the Endangered Species Act (US Fish and Wildlife Service 1993). The C2 list included species that might have warranted listing as Threatened or Endangered, but for which the USFWS lacked sufficient biological data to support a listing proposal. In February 1996, the USFWS revised its candidate policy and eliminated the C2 designation (US Fish and Wildlife Service 1996). As a result, *P. dornii* currently has no legal status.

b. HERITAGE RANK: *Physaria dornii* is ranked G1 in The Nature Conservancy's Natural Heritage network system. This rank indicates that the species is "critically imperiled because of extreme rarity, with 5 or fewer extant occurrences or few remaining individuals" (Fertig 1997).

2. STATE:

a. LEGAL STATUS: None.

b. HERITAGE RANK: *Physaria dornii* is ranked S1, indicating that it is critically imperiled because of extreme rarity in the state of Wyoming (Fertig 1997).

C. DESCRIPTION

1. GENERAL NON-TECHNICAL DESCRIPTION: Dorn's twinpod is a tufted, silvery-pubescent perennial herb up to 10 cm high (Figures 1-2). The basal rosette of leaves are erect, 5-7 cm long, oblanceolate to obovate, and acute-tipped. Flowers are yellow, 10-14 mm long, and have styles 4-5 mm long. Fruiting stems spread horizontally to the ground and barely exceed the basal rosette. The fruits are inflated, two-lobed, 1-1.5 cm wide, and pubescent with thinly appressed hairs. The membranous partition (replum) between each half of the fruit is obovate and bears 4 (2-6) stubby stalks (funiculi) on each face (Lichvar 1983; Rollins 1993; Fertig et al. 1994).

2. TECHNICAL DESCRIPTION: Perennial with tap-root, rosulate, completely covered with trichomes except for the inner surface of sepals, petals, stamens, and styles; trichomes stellate, the rays mostly forked and fused towards the center; caudex simple; the stems erect, to 1 dm high, arising from below terminal rosette; leaves of rosette erect and curled from

Figure 1. Line drawing of *Physaria dornii* from Lichvar (1983). Illustration by Robert Wiley.

the middle of the leaf to the tip, silvery, entire, petiolate, (1.5) 5-7 cm long; cauline leaves 1-5 per stem, oblanceolate, entire, 1-2.5 cm long; inflorescence compact to elongate in fruit, to 1 dm long, the pedicels divaricately ascending, slightly curved, 0.7-1.8 cm long; sepals erect, oblong to linear, 5.5-7 mm long, the outer pair usually more saccate than inner pair; petals spathulate, yellow, not differentiated into a definite blade and claw, 10-14 mm long, 3-4 mm wide; filaments of stamens ca 7 mm long, the anthers oblong, 2 mm wide, not constricted; silique didymous, highly inflated at maturity, 1-1.8 mm long, 1-1.5 mm wide, with a deep apical sinus, basal sinus not as deep; valves with elliptical orifice; styles 4-6 mm long, glabrous; stigma capitate; replum obovate, obtusely angled at apex, 4-5 mm long, ca 2 mm wide, not constricted; ovules 4 (2-6 for some fruits) in each locule; seeds oblong to elliptic, brown, thin-margined or not, remaining in the valves after fruit drops, 3-4 mm long, 2-2.5 mm wide (adapted from Lichvar 1983).

3. LOCAL FIELD CHARACTERISTICS: Dorn's twinpod can be recognized by its inflated, 2-parted, balloon-like fruits, 4-5 (6) mm style that barely exceeds the fruit at maturity, and matted growth form with erect, pointed basal leaves. Mature fruit are needed for identification.

4. SIMILAR SPECIES: *Physaria condensata* has shorter leaves (0.5-1.3 cm wide and 1-3.5 cm long), that are arranged in a flattened rosette and narrower fruits (0.5-1 cm wide) with dense pubescence. *P. integrifolia* has erect stems that exceed the basal leaves by 5 cm or more and styles over 6 mm long. *P. eburniflora* has round-tipped leaves in a flattened basal rosette, narrower fruits with coarsely spreading hairs, and pale whitish flowers. *P. didymocarpa* often has toothed leaves and smaller fruits with denser, spreading hairs. Vegetative specimens of *P. dornii* may be confused with vegetative individuals of *Eriogonum brevicaule*, but differ in having shorter and broader leaf blades (Dorn 1992; Fertig et al. 1994).

D. GEOGRAPHICAL DISTRIBUTION

1. RANGE: Dorn's twinpod is endemic to the Overthrust Belt mountains of southern Lincoln County and central Uinta County, Wyoming (Figure 3). The entire known range of the species occupies an area of less than 35 square miles.

Figure 2. (page 9). *Physaria dornii* from the type locality (T21N R119W S1) at the south end of Rock Creek Ridge, Lincoln County, Wyoming. Dorn's twinpod can be recognized

by its basal rosette of erect leaves and short, essentially prostrate fruiting stems with large, inflated 2-lobed fruits. WYNDD photograph by W. Fertig, 1 July 1996.

Figure 2

Figure 3. Wyoming distribution of *Physaria dornii*.

2. EXTANT SITES: Dorn's twinpod is currently known from 4 extant occurrences, three of which have been discovered since 1995. The largest occurrence (EO # 001) consists of 48 essentially contiguous subpopulations in a belt of habitat approximately 2 miles x 10 miles wide. Confirmed colonies occupy an area of at least 350 acres at this site, although much additional unsurveyed habitat is present in the vicinity. The other extant occurrences are significantly smaller and consist of 1-3 subpopulations in a total area of about 105 acres.

Exact locations of extant populations are listed in Table 1. More detailed information is provided in the Element Occurrence Records and maps in Appendix A.

3. SITES WHERE PRESENT STATUS NOT KNOWN: Lichvar (1983) reported an occurrence of this species (EO # 002) from the "Tunp Range, T23N R118W S11 SW4" based on the collection *R. W. Lichvar 5028* (RM) from 6 July 1982. The herbarium label for Lichvar's collection, however, gives the location of this specimen as T22N R119W S14, which places it within the Rock Creek Ridge occurrence (EO # 001). The Tunp Range site was resurveyed on 3 July 1996, but no individuals of *Physaria dornii* were located and no potential habitat was observed. A fresh, unvegetated landslide was observed at the site which may have obliterated any population that was present. More likely, the site may be an erroneous report based on a typographical error in Lichvar's manuscript. This location is not included with other documented *P. dornii* sites in Lichvar's 1982 rare plant survey report for the BLM (Whiskey Basin Consultants 1982).

4. UNVERIFIED/UNDOCUMENTED REPORTS: None are known.

5. AREAS SURVEYED BUT SPECIES NOT LOCATED: Potential habitat was surveyed on the Ham's Fork Plateau, Dempsey Ridge, Sillem Ridge, Fossil Butte, Bear River Divide, Oyster Ridge, The Hogsback, Meyer's Ridge (Bigelow Bench), Aspen Mountain, and Woodruff Narrows areas in 1996-97. Populations of *Physaria condensata* and many other state rare plant species were documented at these sites, but no new occurrences of *P. dornii* were encountered. Survey routes are shown in Appendix C.

6. AREAS OF UNSURVEYED POTENTIAL HABITAT: Additional unsurveyed potential habitat may exist along the slopes of the Antelope Creek Valley northeast of Aspen Mountain (ca 5 miles south of Interstate 80) and on ridges at the south end of The Hogsback just north of Interstate 80. These sites are primarily on private lands or on isolated BLM sections

that are not accessible to the public. Some additional habitat may also

Table 1. Location Information for Known Populations of *Physaria dornii* in Western Wyoming.

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1. Southern Tunp Range

Occurrence #: 001
County: Lincoln.
Legal Description: T21N R119W S1 (NW4NW4, W2NE4, & N2SE4), S2 (SE4NE4), S11 (SE4NE4), S12 (N2N2); T22N R119W S1 (W2NW4), S2 (S2NE4 & NE4SE4NE4), S11 (SE4), S13 (W2NW4 & NE4SW4), S14 (NE4NE4, SW4, S2NW4, & SW4SE4), S23 (NE4NW4 & SE4SE4), S25 (SW4NW4SW4), S26 (NE4NW4 & N4NE4), S35 (center, SE4SE4, & NE4NE4), S36 (NW4SE4 & SW4NE4); T23N R118W S19 (SW4SW4), S30 (S2SW4); T23N R119W S24 (N2NE4SE4 & SW4SE4NE4), S25 (S2SE4 & NE4SE4), S36 (SW4SW4 & N2SW4).
Latitude: 41° 51' 00" N (centrum).
North 41° 57' 36" N.
South 41° 48' 48" N.
Longitude: 110° 53' 05" W.
East 110° 51' 27" W.
West 110° 54' 00" W.
Elevation: 6500-7550 ft (1980-2300 m).
USGS 7.5' Quads: Sage, Nugget, Beckwith, and The Rock Slide.
Location: Rock Creek Ridge from ca 0.5 miles south of WY state highway 30 to 9.5 miles north of the highway (in the vicinity of the south tributary of Horse Creek). Population divided into at least 48 nearly contiguous subpopulations.

Occurrence # 002 (This EO may be based on an erroneous location description).
County: Lincoln.
Legal Description: T23N R118W S11 (SW4).
Latitude: 41° 59' 10" N.
Longitude: 110° 46' 50" W.
Elevation: 6800 ft (2075 m).
USGS 7.5' Quad: The Rock Slide.
Location: North end of Dempsey Ridge, west of the Hams Fork Plateau, ca 11.5 air miles north of WY state highway 30.

Occurrence # 004
County: Lincoln.
Legal Description: T23N R118W S6 (NW4NW4) and T24N R118W S31 (S2SW4 & NW4SW4).
Latitude: 42° 00' 04 N (centrum).
North 42° 01' 00" N.
South 42° 00' 26" N.
Longitude: 110° 51' 40" W.
East 110° 51' 30" W.
West 110° 51' 50" W
Elevation: 6600-7000 ft (2010-2135 m).
USGS 7.5' Quad: Sublette Canyon.
Location: North end of Rock Creek Ridge, along ridge system on the north side of Trail Creek (northwest of Underwood Canyon), just north of the Cokeville-Hams Fork Road, ca 6 air miles southeast of Cokeville.

2. Southern Overthrust Belt

Occurrence # 003
County: Uinta.
Legal Description: T15N R118W S15 (NW4SE4SW4) & S22 (NW4).
Latitude: 41° 16' 29" N.
Longitude: 110° 42' 40" W.

Elevation: 7600 ft (2315 m).
USGS 7.5' Quad: Ragan.
Location: Ridge ca 1 mile east of "The Boilers", ca 1.5 air miles south of Interstate 80, and ca 2.5 miles west of Ragan.

Occurrence # 005
County: Uinta.
Legal Description: T15N R118W S28 (S2SE4SW4, S2SW4SE4).
Latitude: 41° 14' 40" N (centrum).
North 41° 14' 41" N.
South 41° 14' 39" N.
Longitude: 110° 43' 37" W (centrum).
East 110° 43' 35" W.
West 110° 43' 40" W.
Elevation: 7600 ft (2315 m).
USGS 7.5' Quad: Piedmont Reservoir.
Location: West end of a small knoll along the summit of the ridge on the northwest side of Antelope Creek, ca 1 mile northwest of the Union Pacific rail line and 4.5 miles south of the junction of Interstate 80 and US Highway 189.

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extend a short distance north of the Trail Creek population (EO # 004), although no plants were found in the area 1.5-2 miles to the north of this site in 1997.

E. HABITAT

1. ASSOCIATED VEGETATION: In the Rock Creek Ridge area *Physaria dornii* occurs primarily in openings within sparsely vegetated communities of true mountain mahogany (*Cercocarpus montanus*), indian ricegrass (*Oryzopsis hymenoides*) and Sandberg bluegrass (*Poa secunda*) on whitish clay-gravel slopes of the Twin Creek Limestone (Figure 4). Total vegetative cover of these sites is usually less than 15%, but may be as low as 1%. Scattered plants may occur at the edge of mountain mahogany thickets in partial shade. Big sagebrush (*Artemisia tridentata*) and snowberry (*Symphoricarpos oreophilus var. utahensis*) may codominate with true mountain mahogany at some microsites. Occasionally, populations may also occur in openings in shrub stands where mountain mahogany has been replaced by black sagebrush (*Artemisia nova*), green rabbitbrush (*Chrysothamnus viscidiflorus*), or bitterbrush (*Purshia tridentata*). Populations of *P. dornii* from Uinta County are found in cushion plant communities on semi-barren knolls or midslopes with scattered rubber rabbitbrush (*Chrysothamnus nauseosus*) or Utah serviceberry *(Amelanchier utahensis*) and indian ricegrass (*Oryzopsis hymenoides*) (Figure 5). At all sites, *P. dornii* is absent from adjacent north-facing slopes and summits with dense cover of sagebrush and from shrub thickets in washes and draws.

2. FREQUENTLY ASSOCIATED SPECIES:

Amelanchier utahensis (Utah serviceberry)
Astragalus jejunus var. *jejunus* (Starveling milkvetch)
Cercocarpus montanus (Mountain mahogany)
Chaenactis douglasii (Douglas' dustymaiden)
Chrysothamnus nauseosus (Green rabbitbrush)
Chrysothamnus viscidiflorus var. *lanceolatus* (Rubber rabbitbrush)
Cymopterus terebinthinus var. *albiflorus* (Turpentine spring-parsley)
Elymus elymoides (Bottlebrush squirreltail)
Elymus spicatus (Bluebunch wheatgrass)
Eriogonum brevicaule var. *laxifolium* (Shortstem buckwheat)
Haplopappus acaulis (Stemless goldenweed)
Linum lewisii (Blue flax)
Oenothera cespitosa var. *cespitosa* (Tufted evening-primrose)
Phlox hoodii (Hood's phlox)
Physaria integrifolia (Creeping twinpod)
Symphoricarpos oreophilus var. *utahensis* (Mountain snowberry)
Tetradymia canescens (Gray horsebrush)
Zigadenus venenosus (Death camas)

3. TOPOGRAPHY: *Physaria dornii* typically occurs on south and southwest-facing slopes of 0-40° on ridges and low knolls (Figure 6). Individual plants may occur on convex slopes or in shallowly concave draws. Known occurrences range in elevation from 6500-7600 feet (1980-2315 m).

4. SOIL RELATIONSHIPS: Populations of *Physaria dornii* along Rock Creek Ridge (EOs 001 and 004) are found almost exclusively on dry, whitish clay soils with a surface layer of broken, slate-like fragments derived from the Middle Jurassic-age Twin Creek Limestone (M'Gonigle and Dover 1992). At a few sites, populations may extend a short distance onto adjacent reddish-brown outcrops of the Tunp Member of the Wasatch Formation (Ron Kass, personal communication). The Twin Creek Limestone also crops out near Round Mountain and Slate Creek Ridge northeast of Kemmerer, but *P. dornii* appears to be replaced by *P. condensata* at these sites.

Figure 4 (page 15). Habitat of *Physaria dornii* along the ridge system on the north side of South Fork Leeds Creek (Rock Creek Ridge), Lincoln County, Wyoming. *P. dornii* plants occur in scattered clusters on convex slopes of whitish Twin Creek Limestone

amid clumps of *Cercocarpus montanus*. WYNDD photograph by W. Fertig, 8 June 1997.

Populations from Uinta County (EOs 003 and 005) occur on fine-textured red sandstone-clays (with or without surface gravels) or gray sandy-shale soils derived from the Wasatch Formation (Love and Christiansen 1985). Outcrops of this formation are relatively widespread throughout the southern Overthrust Belt, but populations of *Physaria dornii* appear to be highly restricted to suitable microsites.

5. REGIONAL CLIMATE: Average annual precipitation in the Sage area (approximately 3 air miles west of Rock Creek Ridge) is 10.26 inches (260.6 mm), with peak levels from April-June and in September. Mean annual temperature is 37.6° F (3.1° C), with mean maximum and minimum temperatures in January of 28.6° and - 1.6° F (- 1.8° and - 18.6° C) and mean maximum and minimum temperatures in July of 83.7° and 41.5° F (28.7° and 5.2° C) (Martner 1986).

Average annual precipitation in the southern Overthrust Belt area (based on data from the climate station at Mountain View, approximately 18 miles east of EOs 003 and 005) is 8.22 inches (208.7 mm), with peak levels from April-June and in October. Mean annual temperature is 40.8° F (4.8° C), with mean maximum and minimum temperatures in January of 32° and 10.3° F (0° and -12.1° C) and mean maximum and minimum temperatures in July of 80.1° and 46.5° F (26.7° and 8.1° C) (Martner 1986).

6. LOCAL MICROCLIMATE: *Physaria dornii* populations occur on light-colored, barren substrates on slopes. These sites are exposed to high levels of solar radiation and wind, and are likely to be drier and have higher daytime surface temperatures than adjacent, more highly vegetated sites.

F. POPULATION BIOLOGY AND DEMOGRAPHY

1. PHENOLOGY: Flowering occurs primarily from late May-mid June, while fruiting may occur from late May-early July (Whiskey Basin Consultants 1982). Based on field observations and herbarium records, flowering has been documented from May 26-June 24 and fruiting from May 26-July 10.

2. POPULATION SIZE AND CONDITION: *Physaria dornii* is currently known from 4 extant occurrences divided into at least 53 subpopulations.

Figure 5 (page 17). Habitat of *Physaria dornii* on outcrops of gray sandy shale with abundant brownish sandstone gravel on southwest-facing midslopes of a ridge approximately 1 mile east of "The Boilers" (EO # 003). *P. dornii* habitat is located in a

thin band between the lower redbed slopes and the upper ridgecrest. WYNDD photograph by W. Fertig, 5 July 1996.

Figure 6. Topographic position of *Physaria dornii* on the landscape. Plants occur primarily on south-facing slopes of whitish slate-limestone. Illustration by W. Fertig.

Table 2. Demographic Information for Known Populations of *Physaria dornii* in Western Wyoming.

Occurrence # 001
Area: ca 350 acres (48 subpopulations)
Number and Age of Plants: 11,080-15,830 plants estimated in survey of 39 of the 48 known subpopulations by W. Fertig in 1996-97. Often, less than 10% of all plants in flower and less than 50% in fruit. 14,046 plants estimated in 1982 survey by R. Lichvar of 15 colonies (Whiskey Basin Consultants 1982).
Density: Plants mostly clustered, with individual clusters widely scattered. Clumps have an average of 3-7 individuals. Density of 0.7 plants per square meter observed at demographic plots in 1996.
Evidence of Reproduction: Plants observed in flower, fruit, vegetative (mature, non-reproductive) and seedling conditions in 1996 and 1997 surveys.
Evidence of Expansion/Contraction: Population has been known since 1979. Census data from 1982 and 1996-97 suggest that the overall population is probably stable.

Occurrence # 002
Area: Not known.
Number and Age of Plants: No census data available from 1982 survey (not cited in Whiskey Basin Consultants 1982 report).
Density: Not known.
Evidence of Reproduction: Not reported.
Evidence of Expansion/Contraction: Population could not be relocated in 1996 survey and may be erroneous.

Occurrence # 003
Area: 2 acres.
Number and Age of Plants: 47 late fruiting and vegetative plants observed in July 1996. Total population estimated at 50-100.
Density: Plants mostly clustered and restricted to a specialized microhabitat.
Evidence of Reproduction: Variety of size classes present in the population, indicating a mix of ages and evidence of past reproductive success.
Evidence of Expansion/Contraction: Not known; population has only been known since 1995 (Refsdal 1996).

Occurrence # 004
Area: 100 acres (3 subpopulations).
Number and Age of Plants: 150-200 plants observed in largest of 3 small colonies in 1996 survey by W. Fertig.
Density: Plants often in small, widely spaced clusters of 3-10 individuals.
Evidence of Reproduction: Observed in fruit and vegetative condition in 1996.
Evidence of Expansion/Contraction: Site revisited, but not recensused in 1997. Population has only been known since 1996.

Occurrence # 005
Area: 2-3 acres.
Number and Age of Plants: 71 fruiting or vegetative plants counted in survey by W. Fertig in June 1997.

Population estimated at 100-150 plants.

Density: May be locally dense, with up to 15 rosettes per square meter in favorable microsites. Plants usually clumped.

Evidence of Reproduction: Fruits being produced.

Evidence of Expansion/Contraction: Not known (site was newly discovered in 1997).

One additional occurrence (EO # 002) has not been relocated since 1981 and may be extirpated or based on an erroneous report (see page 11). Approximately 11,400-16,300 individuals were observed at 44 of the 53 extant subpopulations inventoried in 1996-97 (Table 2). Based on the amount of additional, unsurveyed potential habitat, the total population of *P. dornii* may be as high as 20,000 individuals.

The largest known occurrence consists of 48 essentially contiguous subpopulations in a 10 mile belt of suitable habitat at the south end of Rock Creek Ridge (EO # 001). In the past, this occurrence has been treated as six (Whiskey Basin Consultants 1982) or seven (Marriott 1988) discrete occurrences containing no more than 20 subpopulations. The southern Rock Creek Ridge colonies were estimated to contain 11,080-15,830 individuals in 1996-97, or about 97% of the total population of the species. Census figures from 1996-97 are approximately equal to Lichvar's estimate of 14,046 individuals in 1982 (Whiskey Basin Consultants 1982), suggesting that this population is stable. It should be noted, however, that the 1982 census covered fewer subpopulations and a smaller geographic area, and so a small decline over the last 15 years cannot be ruled out.

Long-term trend data are not available for the remaining three occurrences, as none of these were known prior to 1995.

Individual subpopulations of *Physaria dornii* may range in size from 50 to nearly 5000 plants and may occupy areas of 0.5-20 acres. Colonies usually consist of widely scattered clumps of 3-7 individuals. Overall density is extremely low, with as few as 0.4 plants per square meter found in demographic plots in 1996 (Appendix D). Most populations consist of a mix of size and reproductive classes including seedlings, non-reproductive adults, and reproductive adults.

3. REPRODUCTIVE BIOLOGY:

a. TYPE OF REPRODUCTION: *Physaria dornii* reproduces primarily by seed. Occasionally, plants may be observed with clustered rosettes, indicating that they may be able to spread vegetatively by branching of the rootstock.

b. POLLINATION BIOLOGY: The specific pollinator of *Physaria dornii* is not known. The plants yellow flowers are likely to attract flies or other small insect pollinators.

c. SEED DISPERSAL AND BIOLOGY: *Physaria dornii* seeds are flattened and often thin-margined, but lack other structural modifications to facilitate dispersal. The seeds remain within the thin, bladdery fruit walls, even after the fruits have dehisced (Rollins 1993). The fruit valves may serve as the primary dispersal unit, possibly accounting for the clumped distribution pattern of seedlings and mature rosettes.

G. POPULATION ECOLOGY

1. GENERAL SUMMARY: *Physaria dornii* occurs primarily on south to southwest-facing slopes of whitish-gray limestone-slate fragments or fine-textured red or gray sandstone-shales of the Twin Creek and Wasatch formations. Populations are largely restricted to sparsely vegetated cushion plant communities in openings within denser shrub thickets. Colonies may range in size from 50-5000 plants, with individual plants usually in small, but widely scattered clusters. Most populations have a mix of size and age classes, indicating that reproduction is occurring successfully and regularly.

2. COMPETITION: Populations of *Physaria dornii* are mostly restricted to habitats with sparse vegetative cover (usually under 15%). These sites probably represent a "climax" condition maintained by edaphic properties, harsh environmental factors, and occasional disturbance. *P. dornii* appears to be well adapted to these barren conditions, but is less successful in areas of dense cover or high competition. Occasional plants can be found at the edge of *Cercocarpus* thickets, but almost always in areas that lack other understory forbs or grasses. It is not known if these plants were originally established in the open and have persisted as shrub cover has increased, or germinated under preexisting shrub cover. Despite its adaptations for barren sites, *P. dornii* is only rarely encountered on roadcuts or other human-disturbed sites.

3. HERBIVORY: No evidence of herbivory by livestock or other large grazers

was observed in surveys in 1996-97. The fruits and seeds of this species may be ingested by insects or rodents. Small drill holes were occasionally observed in fruits on Rock Creek Ridge in 1997. These holes may have been made by weevils or other boring insects seeking access to ovules and seeds. None of the drilled fruits were observed to contain seeds.

4. HYBRIDIZATION: The ranges of *Physaria dornii* and *P. integrifolia* overlap at the north end of Rock Creek Ridge and occasional hybridization between them may occur. Where the two species occur together, each population can usually be segregated by differences in growth form, flowering time, and habitat preference. Temporal and ecological barriers may be sufficient to prevent hybridization between these species, although both mechanisms are prone to failure under atypical circumstances. Despite the potential for hybridization, relatively few putative hybrids were observed in 1996-97 surveys, possibly because hybrids are at a selective disadvantage and rarely survive. Hybrid individuals are typically more robust than average *P. dornii* plants and have longer fruiting branches and a less congested basal rosette.

No hybrids have been encountered in the field between *P. dornii* and its sister taxon, *P. condensata*. Unlike *P. integrifolia*, the ranges of these species do not overlap. Marriott (1988) suggested that captive breeding studies should be conducted to assess the probability of natural hybrids forming between *P. dornii* and its relatives.

H. LAND OWNERSHIP

1. BLM: All or part of the five known occurrences of *Physaria dornii* are found on lands managed by the BLM Rock Springs District (Kemmerer Resource Area). Four subpopulations within the southern Rock Creek Ridge occurrence (EO # 001) are currently managed by the BLM under No-Surface Occupancy stipulations (Figure 7). These sites are not otherwise protected in Areas of Critical Environmental Concern (ACEC) or comparable special management areas (USDI Bureau of Land Management 1986).

2. STATE: A small portion of the southern Rock Creek Ridge population (EO 001) is found on Wyoming state trust lands.

3. PRIVATE: Parts of the southern Rock Creek Ridge and Uinta County occurrences (EOs 001, 003, and 005) extend onto adjacent private lands within the BLM checkerboard.

Figure 7. *Physaria dornii* populations covered by NSO Stipulations (from USDI Bureau of Land Management 1986).

III. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. POTENTIAL THREATS TO CURRENTLY KNOWN POPULATIONS:

A small geographic range makes this taxon vulnerable to large scale natural and human induced disturbances. The following potential threats were observed during 1996-97 surveys or have been reported in the literature:

1. RECREATION: Off-road vehicle (ORV) use may be the most significant potential threat to this species. Vehicles may impact plants directly by dislodging their roots, or indirectly through increased soil erosion or compaction. ORV trails within *Physaria dornii* habitat are currently located primarily near major paved and improved dirt roads. Growth in the number of ORV users may put increasing pressure on the more remote areas of *P. dornii* habitat. Other, non-motorized recreational activities, such as hiking or hunting, do not appear to adversely impact the habitat of this species.

2. GRAZING: The Rock Creek Ridge area is managed for cattle and sheep grazing and is near a major stock driveway. No evidence of grazing by livestock (or native ungulates) has been observed on the stems and leaves of *P. dornii*. The low rosette growth form and presence of unpalatable mustard oils in the foliage and fruit appear to make this species largely inedible. Most populations of *P. dornii* are also found on marginal rangeland sites with sparse forage and no water, and thus receive little use from grazing animals. Trampling could be a problem if animals are herded directly through occupied habitat or induced to use these areas through salt blocks or water tanks.

3. MINERAL DEVELOPMENT: The Overthrust mountains of Wyoming have attracted considerable interest in the last 25 years as a major oil and natural gas area. Large gas fields are currently being developed in the Bear River Divide area to the south of Rock Creek Ridge and in the vicinity of *Physaria dornii* populations in Uinta County. The Overthrust mountains also have high potential for coal and phosphate resources, although neither have been developed within the known range of *Physaria dornii*. To date, most of the industrial development within the range of this species has consisted of powerlines, pipelines, and access roads.

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4. OTHER: Noxious weeds may be a threat at some locations, especially where a high density of roads is present (EO # 005). Fire suppression may be favoring the expansion of *Cercocarpus montanus* in some areas,

reducing the amount of semi-barren habitat favored by *Physaria dornii*. Commercial fossil quarrying occurs on ridges to the east of the Rock Creek

Ridge colonies, but is not active in the less fossil-rich deposits occupied by *P. dornii*. Hybridization may occur where the ranges of *P. dornii* and *P. integrifolia* overlap but the two species appear to maintain their genetic integrity over most of their range.

B. MANAGEMENT PRACTICES AND RESPONSE: No experimental data exist on the response of this taxon to most management actions. A fire at the north end of Rock Creek Ridge (EO # 004) in late 1996 or early 1997 eliminated much of the *Cercocarpus* vegetation in the area, but did not affect populations of *P. dornii* found on adjacent, unburned ridges. It is not known if

the *P. dornii* population will be able to expand into this newly barren habitat. Observations in 1996-97 suggest that this species is not impacted by current levels of grazing, but could be affected by ORV use.

Four subpopulations of *P. dornii* on Rock Creek Ridge are currently managed under No-Surface Occupancy (NSO) stipulations for oil and gas development (Figure 7) (USDI Bureau of Land Management 1986). NSO standards could also be applied, however, to other *P. dornii* locations where "appropriate measures to protect all threatened, endangered, and sensitive plant and animal species will be applied to all actions and use authorizations" (USDI Bureau of Land Management 1986, p. 10). Nearly the entire range of *P. dornii* also falls within areas designated as crucial winter range for mule deer or elk. Such areas are closed to surface disturbing activities from November 15-April 30 (USDI Bureau of Land Management 1986).

C. CONSERVATION RECOMMENDATIONS:

1. RECOMMENDATIONS REGARDING PRESENT OR ANTICIPATED ACTIVITIES: Establishment of additional roads and ORV trails (both planned

and unplanned) should be discouraged on the barren slopes inhabited by *Physaria dornii* to reduce trampling mortality and soil loss. The management needs of this species should be addressed in implementation of the allotment plan for the Rock Creek area (USDI Bureau of Land Management 1986, p. 65). Specifically, the establishment and placement of new water sources needs to be carefully planned in order to reduce livestock use of the barren ridges occupied by *P. dornii*. No-surface Occupancy stipulations should be utilized, as necessary, in areas where mineral development may directly impact known populations.

2. AREAS RECOMMENDED FOR PROTECTION: No populations of

Physaria dornii are currently protected within a designated special management area, such as an ACEC or Wilderness Study Area on BLM lands. Representative examples of the cushion plant habitat of this species should be designated as an ACEC to ensure that this species does not decline and trend toward listing as Threatened or Endangered. Similar "candidate plant ACECs" have recently been designated in the Green River Resource Area management plan (USDI Bureau of Land Management 1997). Based on population size, habitat quality, and low number of conflicts, the most promising areas for ACEC designation are in the Leeds and Antelope creek areas of Rock Creek Ridge (EO # 001).

D. STATUS RECOMMENDATIONS: Lichvar (Whiskey Basin Consultants 1982) and Marriott (1988) observed no major threats to this species, but recommended that it be designated as Sensitive due to its small population size and limited geographic distribution. Although additional populations have been discovered in the past decade, this species remains vulnerable to large scale disturbances within its small global range. The BLM Wyoming State Office should list *Physaria dornii* as a state sensitive species and develop appropriate management strategies to ensure that actions by the agency do not contribute to future endangerment of the species and the subsequent need for listing under the Endangered Species Act.

V. SUMMARY: The entire world population of *Physaria dornii* is restricted to a small section of the Overthrust Belt west of Kemmerer and south of Interstate 80 east of Evanston in southwestern Wyoming. Until 1996, *P. dornii* was a category 2 candidate for listing under the Endangered Species Act and is currently managed as a "Special Status" plant by the BLM Rock Springs District. Surveys in 1996-97 indicated that this species is known from 4 extant occurrences (divided into 53 subpopulations) containing an estimated 11,400-16,300 individuals. Nearly 97% of the entire population is found in a single extensive occurrence along Rock Creek Ridge, west of Kemmerer. *P. dornii* occurs primarily on sparsely vegetated cushion plant communities in openings among *Cercocarpus montanus* and other desert shrubs on slopes of whitish limestone-slate (Twin Creek Formation) or reddish-gray sandstone-clays (Wasatch Formation). Habitat degradation from off-road vehicles and roads is probably the main threat to this species, although mineral development may also be a potential problem. No populations are currently provided formal protection, although several sites are managed under No-Surface Occupancy stipulations and most of the plant's range is seasonally protected as mule deer and elk critical winter range. *P. dornii* should be managed as a Sensitive species by the BLM to ensure that it does not trend toward further endangerment and the need to be listed as Threatened or Endangered.

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Appendix A.

Element Occurrence Records and Population Maps

for *Physaria dornii*

Appendix B.

WYNDD Special Plant Species Survey Form

Appendix C.

1996-97 Survey Routes and Collection Sites

Appendix D.

Demographic Monitoring Data 1988-1996
Physaria dornii (Dorn's twinpod)

Transect Locations:

Transect # 1

County: Lincoln.
Occurrence: EO # 001
Legal Description: T22N R119W S13 center
Orientation: 264° mag. N (30 m).
USGS Quad: Beckwith.
Directions: The origin of the transect is located along the north-central rim of a small, east-west trending ridge near the head of Antelope Creek. The site is accessible by a two-track road paralleling the large powerline (a short hike of ca 1/2 mile is required to reach this and transect # 2). The transect line drops over the north rim of the ridge. The origin of the transect line is nearly due south of the high point of the next ridge system to the north.
Habitat: Rim and north-facing slope of whitish shale with surface of small brownish-gray limestone/slate flakes in community of low *Cercocarpus montanus* with scattered bunchgrasses and cushion plants.
Comments: Re-bars marking the origin are difficult to find due to increased shrub growth since the plot was originally established.

Transect # 2

County: Lincoln.
Occurrence: EO # 001
Legal Description: T22N R119W S13 SE4 of NE4 of SW4.
Orientation: 180° mag. N (25 m).
USGS Quad: Beckwith.
Directions: Low, small whitish knoll within the Upper Antelope Creek wash, due south of Transect # 1.
Habitat: Cushion plant/bunchgrass community on low knoll of whitish limestone-slate.
Comments: This site is located ca 0.15 miles west of the area indicated in the map provided by Marriott (1988; Appendix B) and is on the Beckwith Quad rather than "The Rockslide" Quad.

Transect # 3

County: Lincoln.

Occurrence: EO # 001

Legal Description: T21N R119W S11 NE4 of NE4 of SE4

Orientation: 190° mag. N (30 m).

USGS Quad: Sage.

Directions: South side of Knoll 6574 accessible via the Orr road, ca 0.35 miles south of US Highway 30 at the turnoff for the Rock Creek Ridge Road.

Comments: Area not resampled in 1996 due to "No-Trespassing" signs on private lands along the access road.

Sampling Method: Three permanent 30 x 1 meter belt transects were established by Marriott (1988). Starting points were marked with re-bar and low rock piles. For each transect, 30 1 x 1 meter plots were framed by meter sticks and read from the leaft side of the baseline tape. In each plot, data were collected on percent cover, number of fruits, and number of individual plants ranked by age class (seedlings with 4 or less developed leaves, non-reproducing adults with 5 or more leaves, reproducing adults with flowers or fruits, and dead plants).

Summary of Results: Populations of *P. dornii* along transects 1 and 2 have been essentially stable from 1988 to 1996. The population in transect 1 dropped from 46 to 40 plants, but this loss was offset by an increase in the number of plants in transect 2 from 6 to 10. While the overall size has been stable, changes have occurred in population structure. Most notable has been the shift in age composition from predominantly reproductive in 1988 to mostly seedling and non-reproductive adults in 1996. The large number of seedling and non-reproductive plants bodes well for the short-term survival of these colonies and indicates that reproduction is occurring. Longer trend data may indicate a possible periodic fluctuation in seedling and adult population densities. Data on the number of reproducing adults must be interpreted with some caution, however, given the late time of survey in 1996 (some non-reproductive plants may have been past fruiting).

Recommendations: Plots of 1 square meter size are larger than necessary to adequately monitor this species. Using smaller plots (0.5 x 1 m) would greatly increase the speed of the monitoring process without sacrificing the quality of the data. The transects chosen by Marriott (1988) are located in relatively sparse colonies that are not representative of the whole population on Rock Creek Ridge. Additional monitoring locations should be established in order to capture information on more abundant populations. Due to potential access problems, transect 3 should be abandoned. Monitoring plots should be esta

Physaria dornii
Transect # 1 Census Data

Codes: S = seedling, N = non-reproductive adult, R = reproductive adult, D = dead, Fr = fruit, Veg = vegetative cover.

Date: 17 June 1988
Surveyor: H. Marriott and D. Horning

Plot	#S	#N	#R	#D	#Fr	% Veg
1	0	0	3	0	62	
2	0	0	0	0	0	
3	0	0	0	0	0	
4	0	0	0	0	0	
5	0	0	0	0	0	
6	0	0	0	0	0	
7	0	1	0	0	0	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	2	3	0	38	
11	0	1	0	0	0	
12	0	1	0	0	0	
13	0	0	3	0	33	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	4	0	73	
18	0	1	4	0	66	
19	0	4	2	0	3	
20	0	3	3	0	31	
21	0	1	0	1	0	
22	0	0	3	0	20	
23	0	1	1	0	13	
24	0	0	2	0	21	
25	0	0	2	0	51	
26	0	0	0	0	0	
27	0	0	0	0	0	
28	0	0	0	0	0	
29	0	0	0	0	0	
30	0	0	0	0	0	
Tot	0	15	30	1	411	

Total # plants: 46

seedlings per sq m: 0
non-reproducing adults per sq m: 0.5
reproducing adults per sq m: 1.0
dead plants per sq m: 0.03
Total # plants per sq m: 1.53

Date: 2 July 1996
Surveyor: W. Fertig

Plot	#S	#N	#R	#D	#Fr	% Veg
1	0	1	0	0	0	5%
2	0	1	0	0	0	1%
3	0	0	0	0	0	0%
4	0	0	0	0	0	0%
5	0	0	0	0	0	0%
6	0	4	0	0	0	1%
7	0	5	0	1	0	1%
8	0	2	0	0	0	5%
9	0	0	0	0	0	3%
10	0	2	0	1	0	10%
11	0	0	0	0	0	25%
12	0	0	0	0	0	40%
13	0	0	0	0	0	30%
14	0	1	0	0	0	40%
15	1	1	0	0	0	25%
16	2	1	0	1	0	30%
17	0	1	0	1	0	15%
18	0	0	1	0	2	10%
19	1	0	0	0	0	15%
20	0	2	0	0	0	15%
21	0	1	0	0	0	15%
22	3	0	0	0	0	15%
23	0	0	0	0	0	30%
24	0	2	1	0	28	40%
25	0	0	0	0	0	50%
26	0	2	0	0	0	50%
27	0	1	0	0	0	40%
28	0	0	0	0	0	15%
29	0	0	0	0	0	30%
30	0	0	0	0	0	40%
Tot	7	27	2	4	30	

Total # plants: 40

seedlings per sq m: 0.23
non-reproducing adults per sq m: 0.9
reproducing adults per sq m: 0.06
dead plants per sq m: 0.13
Total # plants per sq m: 1.33

Physaria dornii
Transect # 2 Census Data

Codes: S = seedling, N = non-reproductive adult, R = reproductive adult, D = dead, Fr = fruit, Veg = vegetative cover.

Date: 17 June 1988
Surveyor: H. Marriott and D. Horning

Plot	#S	#N	#R	#D	#Fr	% Veg
1	0	0	0	0	0	
2	0	0	0	0	0	
3	0	0	1	0	1	
4	0	0	0	0	0	
5	0	0	2	0	2	
6	0	0	0	0	0	
7	0	0	1	0	2	
8	0	0	0	0	0	
9	0	0	0	0	0	
10	0	0	0	0	0	
11	0	0	0	0	0	
12	0	0	0	0	0	
13	0	0	0	0	0	
14	0	0	0	0	0	
15	0	0	0	0	0	
16	0	0	0	0	0	
17	0	0	0	0	0	
18	0	0	0	0	0	
19	0	1	0	0	0	
20	0	0	0	0	0	
21	0	0	1	0	14	
22	0	0	0	0	0	
23	0	0	0	0	0	
24	0	0	0	0	0	
25	0	0	0	0	0	
Tot	0	1	5	0	19	

Total # plants: 6

seedlings per sq m: 0
non-reproducing adults per sq m: 0.4
reproducing adults per sq m: 0.20
dead plants per sq m: 0
Total # plants per sq m: 0.24

Date: 2 July 1996
Surveyor: W. Fertig

Plot	#S	#N	#R	#D	#Fr	% Veg
1	0	1	0	1	0	30%
2	0	0	0	0	0	10%
3	0	1	0	0	0	20%
4	0	1	0	0	0	1%
5	0	0	0	0	0	5%
6	0	0	0	0	0	0%
7	0	0	0	0	0	10%
8	0	0	0	0	0	60%
9	0	0	0	0	0	30%
10	0	0	0	0	0	65%
11	0	1	0	0	0	25%
12	0	0	0	0	0	30%
13	0	0	0	0	0	25%
14	0	0	0	0	0	5%
15	0	0	0	0	0	40%
16	0	0	0	0	0	70%
17	0	0	1	0	9	25%
18	0	0	0	0	0	15%
19	0	0	0	0	0	20%
20	0	1	0	0	0	5%
21	0	0	0	0	0	20%
22	0	1	0	0	0	1%
23	0	0	0	0	0	5%
24	1	1	0	0	0	35%
25	0	0	0	0	0	30%
Tot	1	7	1	1	9	

Total # plants: 10

seedlings per sq m: 0.04
non-reproducing adults per sq m: 0.28
reproducing adults per sq m: 0.04
dead plants per sq m: 0.04
Total # plants per sq m: 0.4