



Status of Winward's goldenweed
(*Ericameria discoidea* var. *winwardii*)
in Wyoming

Report prepared for the
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University of Wyoming

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Cover: Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in flower, ridge south of South Fork Twin Creek, Lincoln County, Wyoming, 23 August 2011. Photo by Walter Fertig.

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INTRODUCTION

In September 1995, University of Wyoming graduate student Charmaine Refsdal Delmatier collected a dwarf, yellow-flowered shrub from the vicinity of the Bear River Divide while conducting a floristic inventory of southwestern Wyoming (Delmater 1998). Initially, the specimen was identified as *Haplopappus macronema* var. *linearis* (now known as *Ericameria discoidea* var. *linearis*), although Robert Dorn raised questions about whether it belonged to a new or different taxon based on the shape and pubescence of the leaves (Fertig 1996). In 2002, Alma Winward (ecologist with the US Forest Service) brought a second collection to the attention of Dorn at a rare plant conference in Laramie. Winward's specimen from Bear Lake County, Idaho, matched Delmatier's Wyoming collection in technical features. Later that summer, Dorn revisited Delmatier's collection site in Lincoln County, Wyoming, and collected additional material. Citing consistent morphological and ecological differences, Dorn and Delmatier (2005) named the plants as a new taxon, *Ericameria discoidea* var. *winwardii*, in honor of Winward.

Due to its apparently limited geographic range and high habitat specificity, *Ericameria discoidea* var. *winwardii* (Winward's goldenweed) is ranked as "critically imperiled" globally and at the state level in Idaho and Wyoming by NatureServe (www.natureserve.org/explorer, February 2012). The plant is listed as a species of concern in Wyoming and Idaho (Heidel 2012, Idaho Native Plant Society 2009) and is formally designated as Sensitive by the Bureau of Land Management (BLM) in Wyoming (BLM 2010).

To date, formal surveys for Winward's goldenweed have been conducted in southeastern Idaho and adjacent Wyoming (Kinter 2009), but not elsewhere in southwestern Wyoming. In 2011, the Wyoming state office of the BLM contracted with the Wyoming Natural Diversity Database (WYNDD) to perform surveys for this species in Wyoming and to assemble information on its life history, habitat, distribution, abundance, and potential threats. The results of this study are discussed in the following report.

METHODS

Prior to conducting field work, I reviewed the existing literature on Winward's goldenweed (Dorn and Delmatier 2005; Kinter 2009; Roberts et al. 2005; Urbatsch et al. 2006) and specimens from the Rocky Mountain Herbarium (RM) of the University of Wyoming. With the assistance of Bonnie Heidel of WYNDD, we compiled digital orthophoto quads, geologic maps, topographic maps, and BLM land status maps to identify areas of suitable habitat for ground survey. Field surveys took place from August 22-27 and September 30-October 1, 2011 and focused on areas of Green River and Twin Creek limestone identified on orthophotos in the Bear River Divide, Fossil Butte National Monument, Ham's Fork Plateau, Rock Creek Ridge, Round Mountain, and Gannett Hills of Lincoln County, Wyoming, and Preuss Range of adjacent Bear Lake County, Idaho. Additional surveys were conducted in the Green River Basin east of La Barge (Sublette County, Wyoming) to relocate a vague historical report from Hall (1928) and Fertig (1996).

I mapped the centrum of each discrete population segment of *Ericameria discoidea* var. *winwardii* using a Global Positioning System unit. At each site I compiled information on the abundance, density, phenology, and vigor of Winward's goldenweed plants, as well as habitat attributes (soil characteristics, dominant vegetation, and cover), associated species, land use practices, and other comments. Digital photos were taken of goldenweed plants and habitat. Voucher specimens were collected for deposit at RM and other regional herbaria (BRY, UTC). Information

gathered in the field was provided to WYNDD and the Idaho Conservation Data Center for updating existing location records in their NatureServe Biotics database.

SPECIES INFORMATION

Classification:

Scientific Name: *Ericameria discoidea* (Nuttall) Nesom var. *winwardii* Dorn & Delmatier.
Type specimen: USA, Wyoming, Lincoln County, ca 11 miles SW of Kemmerer, 41°42.471' N, 110°43.381'W, 2135 m (7000 ft), 26 July 2002, R. Dorn 9393 (holotype RM, isotypes BRY, COLO, MO, NY, IDS (Dorn and Delmatier 2005).

Common Name: Winward's goldenweed, Winward's narrowleaf goldenweed, Winward's goldenbush.

Synonyms: *Ericameria winwardii* (Dorn & Delmatier) Roberts & Urbatsch (Roberts et al. 2005).

Family: Asteraceae or Compositae (Sunflower family).

Phylogenetic Relationships: As currently defined, the genus *Ericameria* contains 36 species of shrubs and subshrubs native to western North America from Canada to northern Mexico (Urbatsch et al. 2006). Until recently, species in *Ericameria* were scattered across several genera in the tribe Astereae, including *Chrysothamnus* (*C. nauseosus* and *C. parryi*) and *Haplopappus*. As originally defined by Nuttall (1841), *Ericameria* was a small genus of subshrubs with narrow, resinous or punctate leaves and small flowering heads. Nuttall also recognized *Macronema* as a separate genus for similar species with woolly or stipitate-glandular leaves and relatively large, bracteate heads. Both genera were later made sections within the polymorphic genus *Haplopappus* by Hall (1928). Nesom (1990) resurrected the genus *Ericameria* to include species from several sections of *Haplopappus* (including *Macronema*). Among the species transferred to *Ericameria* by Nesom were *E. discoidea* and its relatives (including var. *linearis*) that were formerly included in *Haplopappus macronema* (Dorn 1992; Fertig 1996). Recent molecular research by Roberts (2002) affirms the coherence of *Ericameria* as a natural clade within the Astereae separate from *Chrysothamnus* in the strict sense (now reduced to *C. viscidiflorus* and its close relatives).

Dorn and Delmatier (2005) classified Winward's goldenweed as a variety of *Ericameria discoidea* based on similarities in gross appearance, leaf shape, and pubescence. Roberts et al. (2005) raised each of the three varieties of *Ericameria discoidea* to full species (*E. discoidea*, *E. linearis*, and *E. winwardii*) based on differences in nuclear ribosomal DNA, morphology, habitat, and geographic range. Levels of genetic divergence between these taxa are low, suggesting a relatively recent evolutionary radiation (Roberts et al. 2005). Winward's goldenweed appears to be most closely related to *E. discoidea* var. *linearis*, with which it shares the characters of narrow, flat-margined leaves and woolly tomentum (Dorn and Delmatier 2005). Based on my own field experience with these three taxa, I concur with Dorn and Delmatier (2005) in treating each as a variety of *E. discoidea*, with vars. *winwardii* and *linearis* being closer in morphology, ecology, and range than var. *discoidea*.

Legal Status: Winward's goldenweed is listed as Sensitive by the Wyoming state office of the BLM (2010). The BLM Sensitive list includes native species found on BLM lands for which there are concerns about long-term population viability due to current or projected downward population trends or threats to specialized habitats. Without management attention, such species could become listed as Threatened or Endangered under the US Endangered Species Act (BLM 2010).

Ericameria discoidea var. *winwardii* is not listed as Sensitive by the US Forest Service in Idaho, although its close relative, *E. discoidea* var. *linearis* has been designated Sensitive in Region 4 since the mid 1990s (Fertig 1996). Winward's goldenweed has no status under the US Endangered Species Act and receives no formal state protection in either Wyoming or Idaho.

Natural Heritage Rank: G4G5T1/S1. NatureServe ranks the full species *Ericameria discoidea* as G4G5, indicating that the species is apparently to demonstrably secure across its full global range. Var. *winwardii* is ranked T1, indicating that it is critically imperiled across its range in Wyoming and Idaho. If recognized as a separate species, *Ericameria winwardii* would be ranked G1. Both WYNDD and the Idaho Conservation Data Center rank Winward's goldenweed as S1 (critically imperiled) at the state level.

Description: Winward's goldenweed is a low-growing shrub with woolly-tomentose stems 5-20 cm tall (Figures 1, 2). Leaves are alternate, narrowly elliptic to oblanceolate, and nearly sessile. Leaf blades are 6-15 mm long, less than 6 times as long as wide, and are covered by white-tomentose hairs. Occasional individuals have green leaves with glandular pubescence and sparse tomentum (Figure 3). Flower heads are borne in short, leafy, terminal cymes and have top-shaped involucre 10-12 mm long x 3-4 mm wide. The whitish involucre bracts are lance-shaped with short spiny tips. Heads consist of 4-9 yellow disk flowers (ray flowers are lacking), each about 9 mm long with lobes 1-1.5 mm long. The achenes are 5-7 mm long, short-hairy, and topped by a pappus of 40 or more smooth, slightly tawny bristles (Dorn and Delmatier 2005).

Similar Species: Narrowleaf goldenweed (*Ericameria discoidea* var. *linearis*) of southwestern Montana and northwestern Wyoming has leaves mostly six or more times longer than wide, with blades 1-2.5 mm wide. This variety can have green, glandular leaves or white-woolly pubescence (Fertig 1996). Sharp-

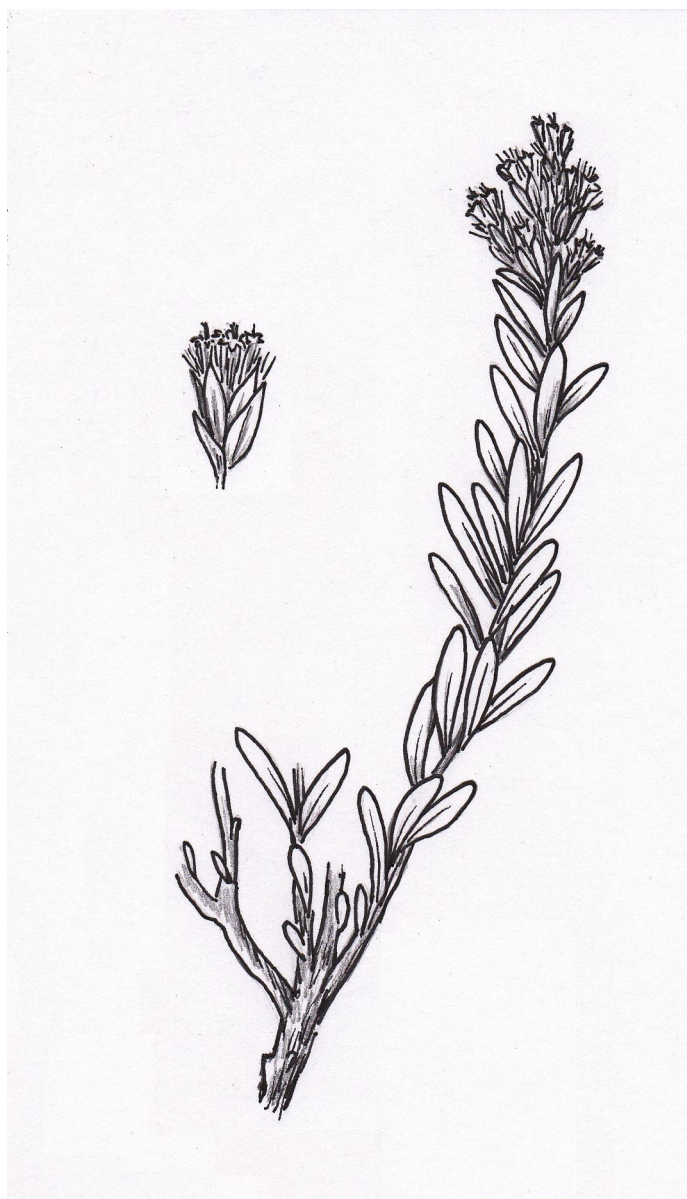


Figure 1. Line drawing of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*). Illustration by W. Fertig.



Figure 2 (above). Typical form of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*). Photo by W. Fertig from the ridge system on the south side of South Fork Twin Creek, Lincoln County, Wyoming, 23 August 2011. See the cover photo for a closeup of the flower head.

Figure 3 (right). Green/glandular phase of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) from the type locality on south side of South Fork Twin Creek, Lincoln County, Wyoming. This growth form is extremely rare (just 4 plants were observed in 2011) and co-occurred with typical, white-tomentose individuals. A similar mix of green/glandular and white/woolly forms occurs in the closely related *Ericameria discoidea* var. *linearis* northwestern Wyoming (Fertig 1996). Photo by Walter Fertig, 23 August 2011.



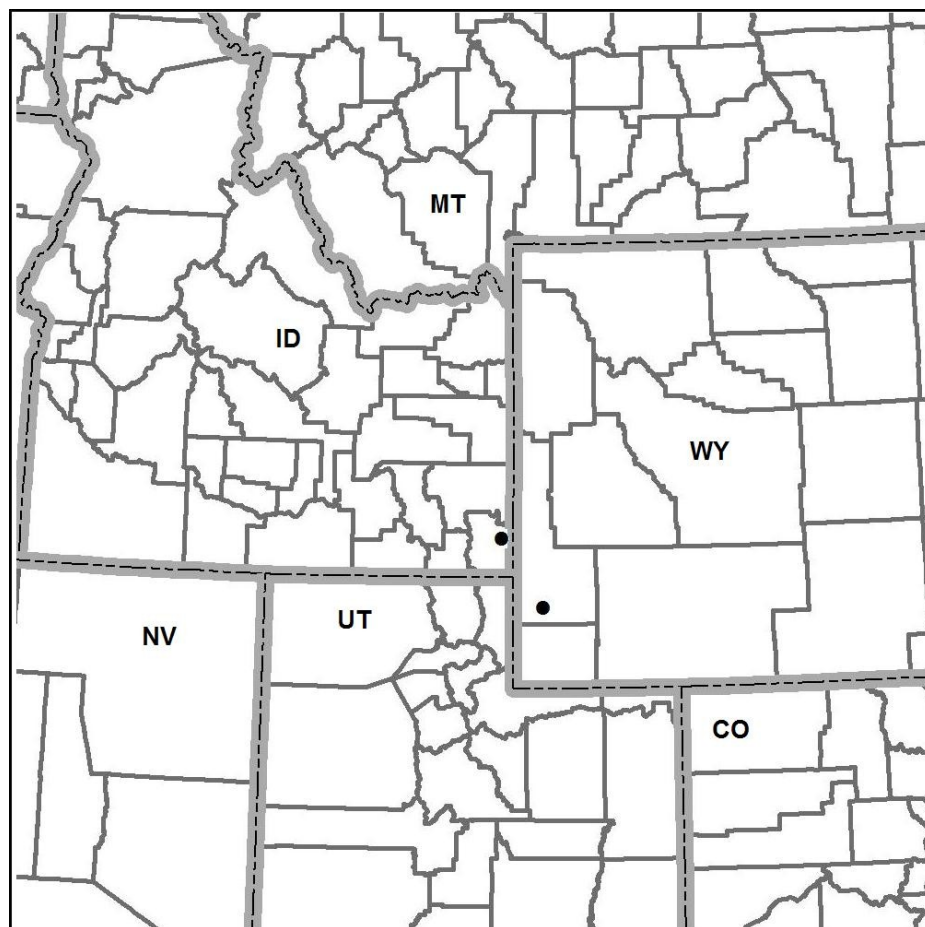
scaled goldenweed (*E. discoidea* var. *discoidea*) occurs from western Montana to southern Oregon and south to California, southern Utah, and central Colorado (but is absent from Wyoming) and has oblanceolate leaves 3-7 mm wide with wavy margins. Parry's rubber rabbitbrush (*Ericameria parryi* var. *howardii* or *Chrysothamnus parryi* var. *howardii*) has smaller and more numerous flower heads and involucre bracts with needle-like tips arranged in vertical rows. Spineless horsebrush (*Tetradymia canescens*) has non-glandular, white-woolly stems and leaves (Dorn 2001; Dorn and Delmatier 2005).

Geographic Distribution:

Range: Winward's goldenweed is a narrow endemic restricted to southwestern Wyoming and southeastern Idaho (Figure 4). The Wyoming population is from north of the Bear River Divide in southern Lincoln County, about 10 air miles (16 km) southwest of Kemmerer. In Idaho, it is known from the Preuss Range in Bear Lake County, 9-12 air miles (14.5-19.3 km) northeast of Montpelier (Kinter 2009). The Idaho and Wyoming populations are separated by a distance of approximately 50 miles (80 km).

Extant Populations: *Ericameria discoidea* var. *winwardii* is currently known from just three occurrences rangewide: two in southeastern Idaho and the type locality in southwest

Figure 4. Global distribution of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*).



Wyoming (Dorn and Delmatier 2005). In Idaho, this species was first documented in August 1985 by Alma Winward from Snowslide Canyon (ID Occurrence # 01). A second population was reported by Forest Service personnel from the Little Beaver and Whiskey Creek drainages about 2.5 miles (4 km) to the north. Kinter (2009) relocated both of these sites in August 2008. The Snowslide Canyon population consisted of 9 sub-populations occupying an area of approximately 0.3 x 0.6 miles (0.5 x 1 km). Kinter mapped 7 subpopulations in the Little Beaver/Whiskey Creek site (ID Occurrence # 02) that covered an area of 0.9 x 1.5 miles (1.4 x 2.5 km). On October 1, 2011, I relocated two subpopulations (numbers 1 and 4) during a brief visit to the Snowslide Canyon site.

Charmaine Refsdal Delmatier made the first collection of Winward's goldenweed in Wyoming at a site north of Beaver Divide "8.2 air miles SW of Kemmerer" in September 1995 (Dorn and Delmatier 2005; Fertig 1996). Robert Dorn made a second collection in the vicinity in July 2002 that became the holotype (Dorn and Delmatier 2005). These two collections have been treated as separate occurrences in the past (Kinter 2009), but should be considered part of a single population (Table 1, Figure 5, Appendix A, B). On August 22-23, 2011, I relocated Dorn's type locality on the ridge system on the south side of South Fork Twin Creek (WY Occurrence # 01). This population consists of 14 sub-populations covering 0.25 x 0.5 miles (0.4 x 0.8 km).

Historical Populations: Hall (1928) reported a specimen of *Haplopappus macronema* var. *linearis* from "La Barge, Uinta County" (Stevenson 191 US). This locality (now in southeastern Lincoln County) is disjunct from the nearest population of var. *linearis* in the Green River Lakes region of the western Wind River Range in Sublette County by 120 miles (193 km), but is only 50 miles northeast of the Twin Creek population. I surveyed potential habitat in the La Barge area of Lincoln and Sublette counties in 2011 (Figure 6) but was unable to relocate the population. The La Barge report is of special interest, as it would represent a stepping stone between the populations of var. *winwardii* and var. *linearis*. It could also represent a second Wyoming population of var. *winwardii*. The Stevenson specimen needs to be re-examined to determine its proper identification.

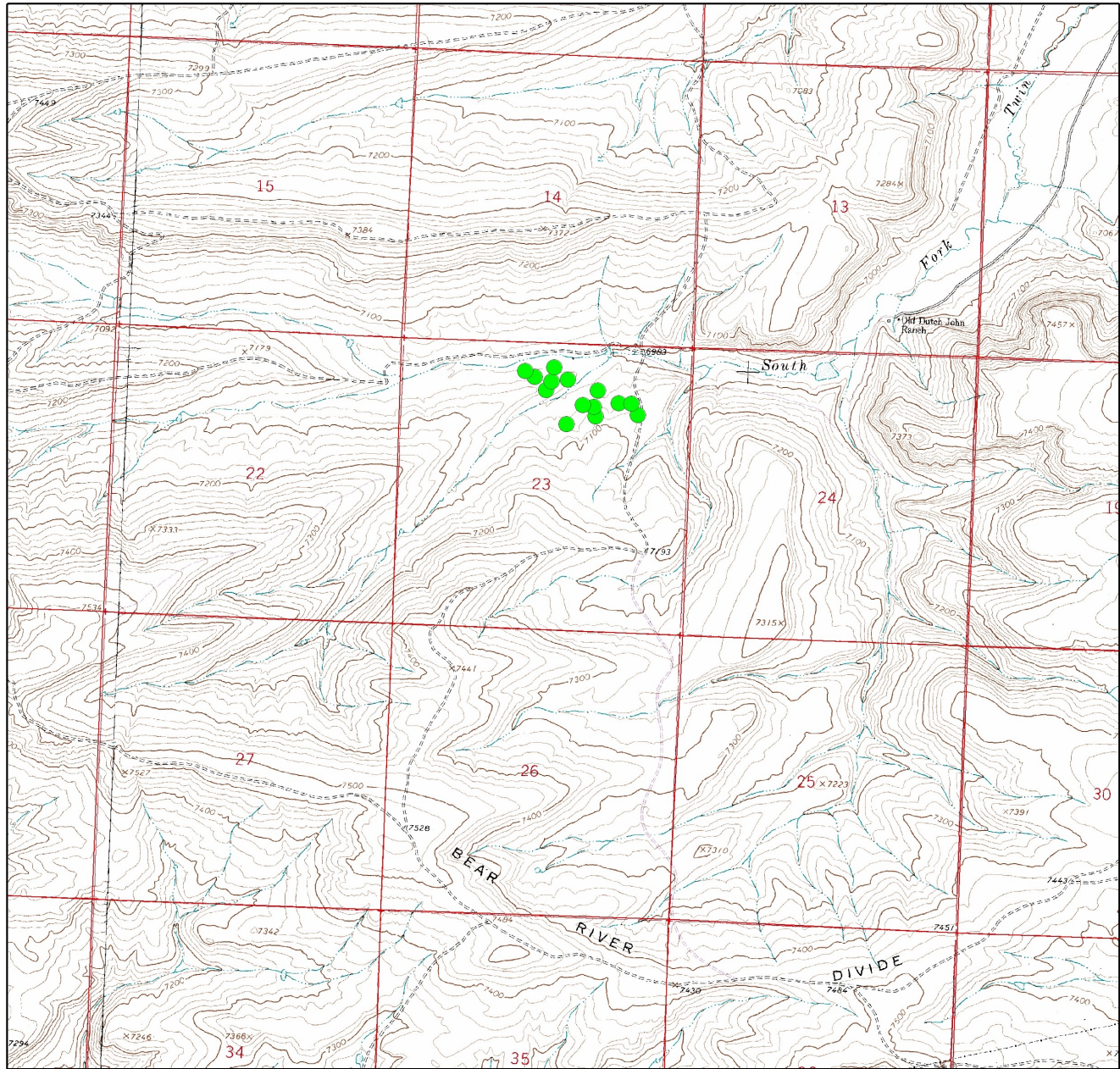
Areas Surveyed But Species Not Located: Surveys in 2011 focused on barren exposures of the Fossil Butte member of the Green River Shale in southern Lincoln and northern Uinta counties, Wyoming (Figure 6). This outcrop is found from Dempsey Ridge north of Fossil

Table 1. Location of known population of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming.

WY Occurrence # 01
 County: Lincoln
 USGS Quad: Warfield Creek
 Latitude: 41° 42' 27" N (centrum)
 Longitude: 110° 43' 06" W (centrum)
 UTM: 12T, 523488E 4617218N NAD83
 Township/Range/Section: T20N R118W S23 N2 of NE4 and NE4 of NW4
 Location: Overthrust Belt, ridge south of South Fork Twin Creek, ca 1.5 miles north of Bear River Divide, ca 7.3 air miles south of US Highway 30, and 10 air miles southwest of Kemmerer.

Figure 5. Distribution of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming

2011 *Ericameria discoidea* var. *winwardii* Survey Sites

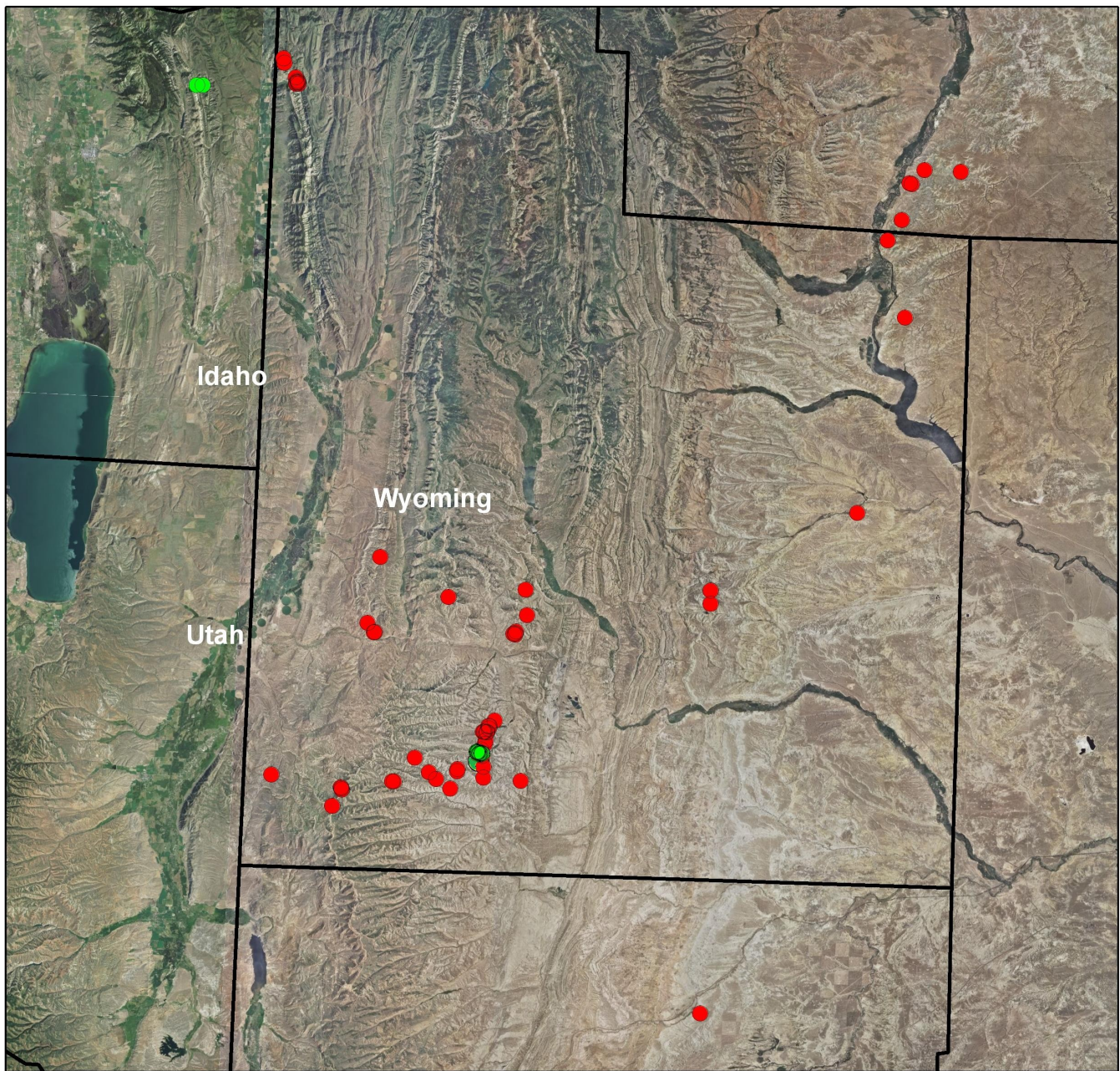


0 0.15 0.3 0.6 0.9 Miles

- *Ericameria discoidea* var. *winwardii*
- Section Boundaries

Figure 6. 2011 survey sites for Winward's goldenweed (*Ericameria discoidea* var. *winwardii*).

2011 *Ericameria discoidea* var. *winwardii* Survey Sites



● Winward's goldenweed present

● Winward's goldenweed absent

□ County boundary



0 4.5 9 18 27 Miles

Butte National Monument west to Rock Creek Ridge and south to Shurtloff Creek in the Overthrust Belt and from the east side of The Hogsback (east of Kemmerer) south to Interstate 80 (Love and Christensen 1985; M'Gonigle and Dover 1992). Surveys of the Fossil Butte member were conducted primarily on low ridges and mesas adjacent to Twin Creek and the Bear River Divide, with additional searches conducted more sporadically along Rock Creek Ridge, Dempsey Ridge, Fossil Butte National Monument (Fertig 2012), and Sillem Ridge (Figure 6). Only areas on BLM or state-managed lands were surveyed; additional areas of potential habitat on privately owned sections within the BLM checkerboard were not visited.

2011 surveys also focused on exposures of the Twin Creek limestone in the hills adjacent to Salt Creek and Shale Hollow in the Sublette Range of extreme western Wyoming, just east of Geneva, Idaho. These areas were within 10 air miles (16 km) of the Snowslide Canyon population of Winward's goldenweed in Idaho and had been identified as potential habitat by Kinter (2009).

In an attempt to relocate the La Barge report of *Ericameria discoidea*, I surveyed several areas of potentially suitable barren limestone ridge and mesa habitat east of La Barge in the Green River drainage of southwestern Sublette and eastern Lincoln counties. These sites were primarily on outcrops of the Wilkins Creek member of the Green River Formation (Love and Christensen 1985).

No new populations of Winward's goldenweed were discovered during 2011. Many sites that seemed promising from aerial photos and maps proved to have unsuitable topography, aspects, or vegetation when examined on the ground. The most promising sites were Shale Hollow, the tributaries north of South Fork Twin Creek, and the Chicken Creek drainage on the south side of the Bear River Divide. Although the survey failed to locate new *Ericameria discoidea* var. *winwardii* occurrences, I was able to document or relocate populations of several other plant species currently or formerly tracked by WYNDD, including Tufted twinpod (*Physaria condensata*), Payson's beardtongue (*Penstemon paysoniorum*), Falcate saltbush (*Atriplex falcata*), Western dodder (*Cuscuta occidentalis*), and Barneby's thistle (*Cirsium barnebyi*) (Appendix C).

Habitat

Associated Vegetation: In Wyoming, Winward's goldenweed occurs primarily in cushion plant communities associated with semi-barren openings (Figure 7) within more densely vegetated Big sagebrush (*Artemisia tridentata*)-Bitterbrush (*Purshia tridentata*)-Basin wildrye (*Elymus cinereus*) or Low sagebrush (*Artemisia arbuscula*)-Winterfat (*Krascheninnikovia lanata*)-Parry's rabbitbrush (*Ericameria parryi* var. *howardii*) communities. Vegetative cover within these openings ranges from 0-30%. Occasionally, Winward's goldenweed is locally dominant (Figure 8), but more often it is a relatively minor component contributing less than 5% of total vegetative cover. Dominant plant species within these cushion plant communities include Shortstem wild buckwheat (*Eriogonum brevicaulis* var. *laxifolium*), Gordon's ivesia (*Ivesia gordonii*), and Sandberg bluegrass (*Poa secunda*) (see Table 2 for a more complete list of associated species).

Winward's goldenweed occurs less frequently along the margins of blowout depressions within densely vegetated shrublands (cover > 40%) of Spineless horsebrush (*Tetradymia*



Figure 7 (above). Habitat of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming. Plants occur on whitish outcrops of the Fossil Butte Member of the Green River Formation in blowout-like depressions (upper right), north-facing slopes (center) and broad basins (bottom) with sparse cover of cushion plants and scattered low shrubs. Photo by W. Fertig from ridge on south side of South Fork Twin Creek, 23 August, 2011.

Figure 8 (right). Habitat of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming. Relatively dense population of Winward's goldenweed on north and east-facing slopes of loose, whitish clay of the Fossil Butte Member of the Green River Formation. Photo by W. Fertig from the type locality on the south side of South Fork Twin Creek, 23 August, 2011.



Table 2. Species commonly associated with Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming. Nomenclature follows Dorn (2001).

Species (Synonym)	Common Name	Family	Growth Form
<i>Achnatherum hymenoides</i> (<i>Oryzopsis hymenoides</i>)	Indian ricegrass	Poaceae (Gramineae)	Perennial Graminoid
<i>Artemisia cana</i> var. <i>viscidula</i>	Silver sagebrush	Asteraceae (Compositae)	Shrub
<i>Astragalus jejunus</i> var. <i>jejunus</i>	Starveling milkvetch	Fabaceae (Leguminosae)	Perennial Forb
<i>Chaenactis douglasii</i>	Hoary dusty-maiden	Asteraceae (Compositae)	Perennial Forb
<i>Chrysothamnus</i> <i>viscidiflorus</i> var. <i>lanceolatus</i>	Green rabbitbrush	Asteraceae (Compositae)	Shrub
<i>Comandra umbellata</i>	Bastard toadflax	Santalaceae	Perennial Forb
<i>Cymopterus terebinthinus</i>	Turpentine wavewing	Apiaceae (Umbelliferae)	Perennial Forb
<i>Ericameria parryi</i> var. <i>howardii</i> (<i>Chrysothamnus parryi</i> var. <i>howardii</i>)	Parry's rubber rabbit- brush	Asteraceae (Compositae)	Shrub
<i>Eriogonum brevicaule</i> var. <i>laxifolium</i>	Shortstem wild buck- wheat	Polygonaceae	Perennial Forb
<i>Eriogonum umbellatum</i> var. <i>dichrocephalum</i>	Sulphur-flower wild buck- wheat	Polygonaceae	Perennial Forb
<i>Gutierrezia sarothrae</i>	Broom snakeweed	Asteraceae (Compositae)	Shrub
<i>Hymenopappus filifolius</i> var. <i>nudipes</i>	Fine-leaf woollywhite	Asteraceae (Compositae)	Perennial Forb
<i>Ipomopsis crebrifolia</i>	Compact gilia	Polemoniaceae	Perennial Forb
<i>Ivesia gordonii</i>	Gordon's ivesia	Rosaceae	Perennial Forb
<i>Linum lewisii</i>	Blue flax	Linaceae	Perennial Forb
<i>Mahonia repens</i> (<i>Berberis repens</i>)	Creeping Oregon-grape	Berberidaceae	Shrub
<i>Minuartia nuttallii</i> (<i>Arenaria nuttallii</i>)	Brittle stitchwort	Caryophyllaceae	Perennial Forb
<i>Packera cana</i> (<i>Senecio canus</i>)	Silver-woolly groundsel	Asteraceae (Compositae)	Perennial Forb
<i>Penstemon paysoniorum</i>	Payson's beardtongue	Scrophulariaceae (Plantaginaceae)	Perennial Forb
<i>Poa secunda</i>	Sandberg bluegrass	Poaceae (Gramineae)	Perennial Graminoid
<i>Purshia tridentata</i>	Bitterbrush	Rosaceae	Shrub
<i>Symphotrichum ascendens</i> (<i>Aster ascendens</i>)	Western American-aster	Asteraceae (Compositae)	Perennial Forb
<i>Tetradymia canescens</i>	Spineless horsebrush	Asteraceae (Compositae)	Shrub

canescens), Green rabbitbrush (*Chrysothamnus viscidiflorus* var. *lanceolatus*), Parry's rabbitbrush, Low sagebrush, and Winterfat. One small subpopulation also occurs on a gentle, north-facing drainage or old roadcut with 50-65% cover of Low sagebrush, Big sagebrush, Sulphur-flower wild buckwheat (*Eriogonum umbellatum* var. *dichrocephalum*), and Sandberg bluegrass (Figure 9). This site was probably once barren and has since become vegetated through succession, suggesting that Winward's goldenweed may be able to persist in the face of competition from other plant species, at least in the short term.

Idaho populations of *Ericameria discoidea* var. *winwardii* are also found in sparsely vegetated openings within a matrix of Mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), Low sagebrush, and Sandberg bluegrass (Kinter 2009). Associated species are similar between the two states, with the exception of Western serviceberry (*Amelanchier alnifolia*) and Stemless goldenweed (*Stenotus acaulis*) being abundant in Idaho but absent from the Wyoming locality. The Idaho populations also differ in being in valley settings surrounded by montane forests of Douglas-fir (*Pseudotsuga menziesii*) and Quaking aspen (*Populus tremuloides*), rather than being restricted to high desert situations, as at the Twin Creek site in Wyoming.

Cushion plant communities associated with barren rims and slopes of the Fossil Butte Member of the Green River Formation or comparable limey-sandstone outcrops are not

Figure 9. Habitat of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming. This site is a densely vegetated north-facing drainage or old road cut dominated by Low sagebrush, Big sagebrush, Sulphur-flower wild buckwheat and Sandberg bluegrass on the south side of South Fork Twin Creek. Photo by W. Fertig, 23 August 2011.



uncommon in the Overthrust Belt of western Wyoming, but no other populations of *Ericameria discoidea* var. *winwardii* have been located in recent floristic surveys of the region (Delmatier 1998; Fertig and Kyte 2009; Hartman et al. 1996; Refsdal 1996). My own observations suggest that Winward's goldenweed is negatively correlated with Gumweed aster (*Machaeranthera grindelioides* or *Haplopappus nuttallii*). Gumweed aster is found commonly throughout southwestern Wyoming in sites that would appear to be suitable for Winward's goldenweed and perhaps is a better competitor within the same or comparable ecological niche.

Topography: Wyoming populations of *Ericameria discoidea* var. *winwardii* are found predominantly on north-facing slopes, but less frequently on east or west-facing aspects. No populations have been found on south-facing slopes. The species occurs mostly in wind-scoured depressions (blowouts) or slopes (5-30°) of clay-rich or rocky ridges or drainage channels. Populations also occur on flats and wash bottoms below these slopes. Occasionally plants are found on raised mounds of wind-blown soil that accumulate around the stems. The single Wyoming occurrence is found at an elevation of 7000-7100 feet (2130-2160 m).

In Idaho, Winward's goldenweed is found on clay-rich flats or barren slopes up to 40° and occurs on all aspects. Despite being found in montane valleys, the Idaho populations occur at a slightly lower elevation than the Wyoming occurrence (6700-6900 feet or 2040-2100 m) (Kinter 2009).

Substrate: Winward's goldenweed populations in Wyoming are restricted to outcrops of the Fossil Butte Member of the Green River Formation (Love and Christensen 1985; M'Gonigle and Dover 1992). This whitish brown marlstone and limestone was deposited in the Eocene (approximately 50 million years ago) within a shallow freshwater lake. Most Winward's goldenweed populations occur on highly weathered, loose, fine-textured clay soils with 10-20% cover of limey-sandstone rock fragments. Occasional populations are found on hard-packed clay slopes and flats. At least one population is found on the rim and slopes of a stony wash with 50-75% cover of broken slate rock over gray clay (Figure 10). This species is absent, however, from ridgecrests and flats with over 50% rock cover.

Idaho populations occur on barren to semi-barren exposures of the Middle Jurassic-age Twin Creek Limestone (Kinter 2009). This formation weathers to a loose, erosive gray clay with 30-40% cover of small limestone rock fragments that superficially resembles the much younger Green River shale outcrops in Wyoming. The Twin Creek Limestone occurs across the border in western Lincoln County, Wyoming, but no populations of *Ericameria discoidea* var. *winwardii* could be found in these sites in 2011.

Climate: Average annual precipitation in Kemmerer, Wyoming (the nearest weather stations to the South Fork Twin Creek population) is 12 inches (227 mm), with peak precipitation occurring in May and June (Martner 1986). Mean annual temperature ranges from 23.7 to 53.3° F (- 4.6 to 11.8° C). January mean low and high temperatures are 4 to 29° F (- 15.5 to - 1.6° C). July mean low temperature is 44° F (6.7° C) and mean high temperature is 80° F (26.7° C) (www.usclimatedata.com). Idaho populations have a higher average annual precipitation (14.5 inches or 36.8 mm, based on climate data from Montpelier) and slightly higher mean annual temperature minima and maxima (26.8 to 56.4° F or - 2.9 to 13.6° C) (Kinter 2009).



Figure 10. Habitat of Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) in Wyoming. Population on banks and rim of dry wash with exposed bedrock of Green River shale and 50-75% cover of limey slate and sandstone rock fragments over gray clay. Photo by W. Fertig from dry wash draining ridge on south side of South Fork Twin Creek, 23 August 2011.

Population Biology

Phenology: Winward's goldenweed flowers from mid July to early October. Fruits are produced from late July or early August until early October (probably until the onset of a hard frost).

Reproductive Biology: *Ericameria discoidea* var. *winwardii* reproduces primarily by seed. Although rayless, the flower heads appear to produce sticky pollen that is transmitted from head to head by insects rather than the wind. I observed flowers being visited by small brown moths, yellowjackets, and large bumblebees at the Twin Creek and Snowslide Canyon populations in 2011. The one-seeded achenes have a pappus of 40 or more smooth bristles that facilitate dispersal by wind.

This species may also be able to spread vegetatively. Although its stems are normally erect, occasional plants can be found with matted branches that are buried by mud. These stems could potentially give rise to "new" individuals through mortality of connecting branches. *Ericameria discoidea* var. *linearis* appears capable of similar vegetative spread (Fertig 1996).

Population Size and Trends: Winward's goldenweed is currently known from a single occurrence in Wyoming (Appendix A, Figures 5, 11). In August 2011, I observed 825 goldenweed plants in the South Fork Twin Creek population and estimated the total population of the site at 2015 to 2740 individuals. This population consists of 14 subpopulations occupying less than 40 acres (16 ha) along a ridge system 0.25 x 0.5 miles long (0.4 x 0.8 km). Individual subpopulations range in size from 4 to 250 plants (with the largest estimated to contain up to 500).

Density of *E. discoidea* var. *winwardii* in Wyoming varies from 1 to 10 plants per square meter, depending on surrounding vegetative cover (densities were generally lower where competing plant cover was higher). Distribution is non-random and clumped. Approximately 90% of the plants I observed in August 2011 were in flower and fruit, 5% were only in fruit, and 5% were vegetative. I did not observe any apparent seedling plants. Only four plants in the entire population (all in one cluster) had the green/glandular growth form.

Neither Refsdal (1996) nor Dorn and Delmatier (2005) estimated the size of the Twin Creek population during their site visits in 1995 and 2002. Thus, population trends cannot be determined yet for this occurrence.

In Idaho, Kinter (2009) estimated 2320 Winward's goldenweed plants at the Snowslide Canyon site and 2260 plants at Little Beaver Creek and Whiskey Creek. The two Idaho occurrences are divided into at least 16 subpopulations, each ranging in size from 3 to approximately 1500 individuals. These populations occupy a total area of less than 10 acres (4 ha) (Kinter 2009). I revisited two of the Snowslide Canyon subpopulations (number 1 and 4) in October 2011 and found the population numbers to be stable (approximately 300 and 200 plants respectively).

Across its entire range, *Ericameria discoidea* var. *winwardii* is known from just 3 main occurrences and 30 subpopulations covering less than 50 acres (20 ha). The entire global population is currently estimated at less than 7320 plants.

Current Management: The Wyoming population of Winward's goldenweed is restricted to public lands managed by the BLM Kemmerer Field Office. In Idaho, this species is known only from the Caribou-Targhee National Forest (Kinter 2009). All of the known populations are found on public lands managed for multiple use and receive no formal protection. These lands are managed primarily for cattle grazing and public recreation.

Existing and Potential Threats: In Wyoming, threats to Winward's goldenweed appear to be relatively low under current management conditions. A dirt road runs along the eastern boundary of the population, partially bisecting one subpopulation. Individual plants in this subpopulation could be impacted by being run over by vehicles. Several plants were observed growing along the edge of the road, however, perhaps due to the lack of competition from other plant species. I did not observe any evidence of off-road recreation by motorized vehicles at the South Fork Twin Creek site in 2011. Such use could be detrimental to this species by compacting loose, erosive clay soils or uprooting and damaging individual plants.

Cattle graze the South Fork Twin Creek drainage and trail through the *Ericameria discoidea* var. *winwardii* population to access water. One area along the dirt track bordering the population appears to be used as a bedding area. Populations could be impacted by trampling if barren sites were to be used to dispense mineral supplements or water to livestock. Current growth of Winward's goldenweed did not appear to be browsed in late August 2011, but there was evidence that older stems were browsed by herbivores. This use may be occurring in fall or winter when other

forage is less abundant or accessible. The impact of native grazers, such as elk, pronghorn, mule deer, rabbits, rodents, and grasshoppers, is not known.

Non-native plant species are present, but contribute relatively little cover within the South Fork Twin Creek population of *Ericameria discoidea* var. *winwardii*. One patch of Canada thistle (*Cirsium arvense*) is present in a dry wash near the gravel road bordering the east side of the population. Common dandelion (*Taraxacum officinale*) and Salsify (*Tragopogon dubius*) were the only other exotic plant species observed in the immediate area, and both were uncommon.

The Wyoming population does not appear to be especially vulnerable to impacts from range fires. There are no active mines in the immediate area.

Kinter (2009) found the most pervasive threats to Winward's goldenweed in Idaho to be compaction and erosion of unstable soils by dispersed off-highway vehicle recreation and cattle trailing. She found this species to be absent from heavily trampled trails. Cattle and native herbivores (moose, elk, and pocket gophers) did not appear to utilize goldenweed plants as forage.

Several noxious weed species are known from the vicinity of the Idaho populations and could become a threat if they become established. These species include Dyer's woad (*Isatis tinctoria*), Musk thistle (*Carduus nutans*), Canada thistle, and Houndstongue (*Cynoglossum officinale*). Other potential threats include expansion of a gravel quarry into occupied habitat, phosphate mining, road construction, fire control activities, and climate change (Kinter 2009).

Research Needs: Existing information suggests that Winward's goldenweed has a highly restricted range in southeastern Idaho and southwestern Wyoming and low population numbers. Surveys of additional areas of suitable habitat in 2008 (Kinter 2009) and 2011 have failed to identify new populations. Habitat modeling, based on information gathered from recent surveys of occupied and unoccupied sites, would be useful to better identify other sites to inventory. Such models should incorporate substrate and topographic variables and be displayed over digital orthophoto images to highlight suitable areas of potential habitat.

Additional information is also needed on the basic life history and population ecology of this species. No monitoring data are currently available to indicate population trends. Tracking individual plants for several years would help determine the longevity of plants, their reproductive potential and fecundity, and better elucidate potential threats. Information is needed on the pollination biology and habitat needs of pollinators. No data are available on growing this species *ex situ* or on the viability of its seeds.

SUMMARY

Winward's goldenweed is a narrow endemic restricted to the Overthrust Belt and Preuss Range of southwestern Wyoming (Lincoln County) and southeastern Idaho (Bear Lake County). This species occurs primarily in cushion plant communities on semi-barren whitish-gray clay slopes, blowout depressions, and wash bottoms. Wyoming populations are restricted to the Eocene-age Fossil Butte Member of the Green River Formation, while those from Idaho occur only on the Jurassic-age Twin Creek Limestone. *Ericameria discoidea* var. *winwardii* is known from only three populations rangewide, with one found on BLM lands in Wyoming and two on US Forest Service lands in Idaho. The Wyoming population contains an estimated 2015 to 2740 plants in 14 subpopulations within an area of 0.25 x 0.5 miles, while those from Idaho are estimated at 4580 individuals in 16 subpopulations. The entire global range occupies less than 50 acres. No trend data

are available for the Wyoming population or most of the Idaho subpopulations, though at least two of the Idaho subpopulations appeared to be stable from 2008-2011. Surveys of other areas of Green River shale and Twin Creek Limestone in Lincoln County and a potential historical site near La Barge, Wyoming, in 2011 failed to document any new occurrences. Presently all known populations of Winward's goldenweed occur on public lands managed for livestock grazing, recreation, and other multiple uses. In Wyoming, this species is largely unthreatened under current management conditions, though sites are potentially vulnerable to soil compaction or disturbance from off-road motorized recreation or trampling by livestock. Additional research is needed on the basic life history, pollination biology, and longevity of Winward's goldenweed. Habitat modeling using data derived from recent surveys of occupied and unoccupied sites would be useful for identifying additional areas of suitable habitat for survey.

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Appendix A. Revised Element Occurrence Records

Element Occurrence Record

Ericameria discoidea var. *winwardii* (Winward's goldenweed)

WY EO # 01 (Figure 11)

Location: Overthrust Belt; ridge south of South Fork Twin Creek, ca 1.5 miles north of the Bear River Divide, ca 7.3 air miles south of US Highway 30, and 10 miles southwest of Kemmerer.

State: Wyoming
County: Lincoln

Township-Range-Section
T20N R118 W S23 N2 of NE4 & NE4 of NW4

UTM (centrum): 12T, 523488E 4617218N NAD83

Habitat: Occurs primarily in the following habitat type:
(1) Barren, wind-scoured "blowouts" on ridgetops or slopes and bottoms of dry washes on north, east, or west facing aspects in cushion plant communities dominated by *Astragalus jejunus* var. *jejunus*, *Ivesia gordonii*, *Poa secunda*, and *Eriogonum brevicaule* var. *laxifolium* within a matrix of *Artemisia tridentata*-*Purshia tridentata*-*Elymus cinereus* or *Artemisia arbuscula*-*Krascheninnikovia lanata*-*Ericameria parryi* var. *howardii* shrublands. Vegetative cover mostly 10-20%. Soil fine, whitish-gray clay of the Fossil Butte member of the Green River shale. Soils either loose and crumbly or less often hard-packed. Rock cover mostly 10-20%.

Found infrequently in the following habitat types:
(2) Edge of blowouts or washes on flats dominated by dense cover (>40%) of *Artemisia tridentata*, *A. arbuscula*, *Tetradymia canescens*, & *Chrysothamnus viscidiflorus* on gray clay of the Green River Formation.

(3) Gently north-dipping drainage or abandoned roadbed within dense *Artemisia tridentata* shrubland dominated by 50-65% cover of *Poa secunda* var. *elongata*, *Eriogonum umbellatum* var. *dichrocephalum*, *Artemisia arbuscula*, and *A. tridentata*. Soils gray, fine-textured clay derived from the Green River Formation. Site was probably once open, but now becoming densely vegetated through succession.

(4) Slopes and rim of stony dry wash of the Fossil Butte Member of the Green River shale with 75-85% cover of rock fragments. Locally dominated by *E. discoidea* var. *winwardii*, *Gutierrezia sarothrae*, and *Eriogonum brevicaule* var. *laxifolium* with scattered *Artemisia cana*.

Elevation: 7000-7100 ft (2135-2165 m)

Managed Areas: Kemmerer BLM

Last Observed: 23 August 2011
First Observed: 1 September 1995

Population data:

22-23 August 2011: 825 plants observed in 14 subpopulations in survey by Walter Fertig. Total population estimated at 2015-2740 plants. Population covers an area of 0.25 x 0.5 miles (0.4 x 0.8 km). Plants in flower and fruit or vegetative. Density of plants ranges from 1-5/square meter to 10/square meter. Often locally dominant in areas with low vegetative cover. Distribution non-random and clumped. Associated species include: *Artemisia arbuscula*, *A. cana*, *Astragalus jejunus* var. *jejunus*, *Cymopterus terebinthinus*, *Ericameria parryi* var. *howardii*, *Eriogonum brevicaule* var. *laxifolium*, *E. umbellatum*, *Gutierrezia sarothrae*, *Hymenopappus filifolius*, *Ivesia gordonii*, *Linum lewisii*, *Lygodesmia juncea*, *Minuartia nuttallii*, *Penstemon paysoniorum*, *Poa secunda*, and *Tetradymia canescens*.

26 July 2002: Observed in flower and fruit by R. Dorn. Occurs with *Astragalus jejunus* and *Ipomopsis crebrifolia*.

1 September 1995: Observed in flower and fruit by C. Refsdal Delmatier. Occurs with *Astragalus jejunus* var. *jejunus*, *Chaenactis douglasii*, *Eriogonum brevicaule*, *Hymenopappus filifolius* var. *nudipes*, and *Krascheninnikovia lanata*.

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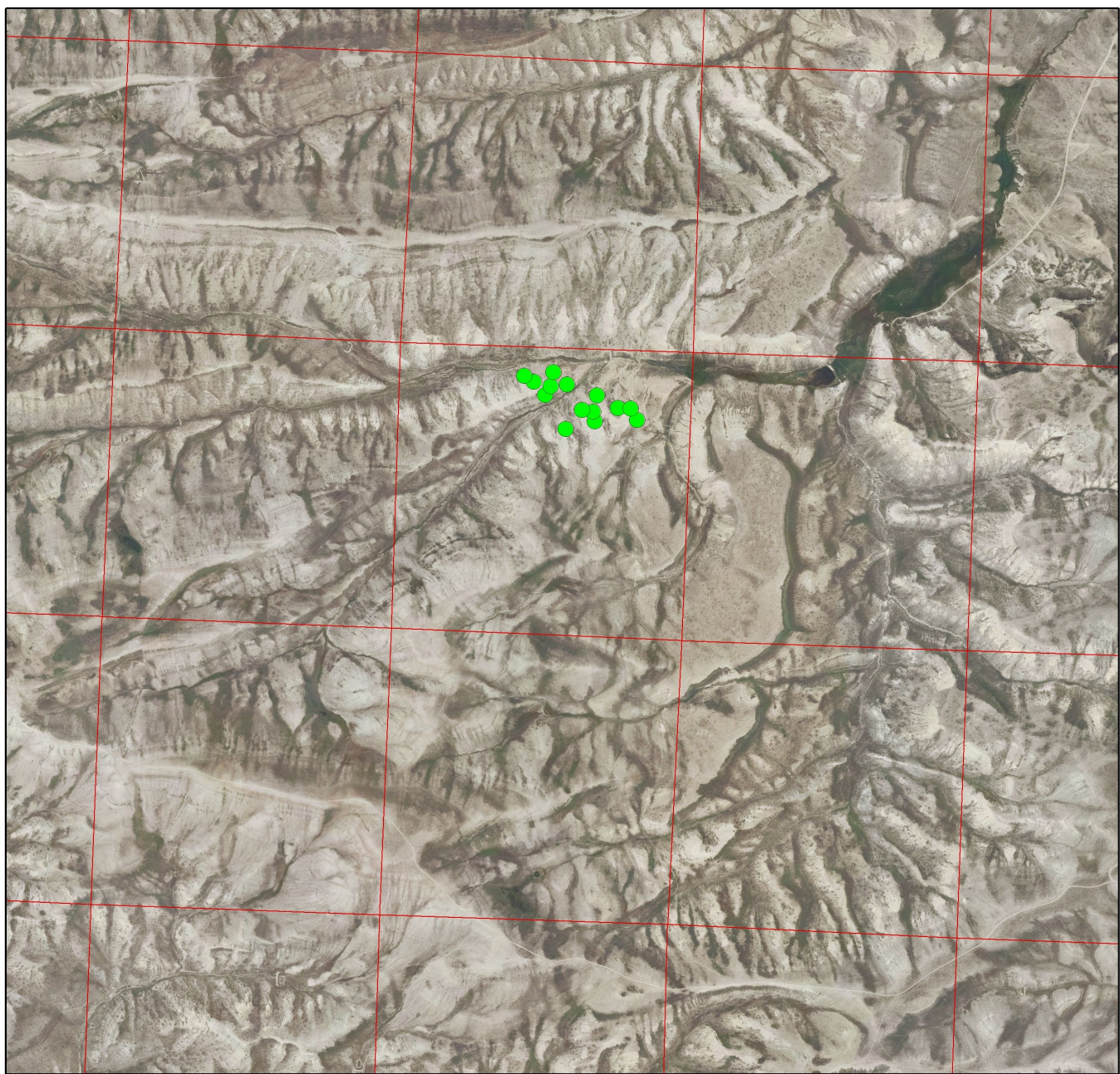
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Edition: 30 June 2012, Walter Fertig

Figure 11. Winward's goldenweed (*Ericameria discoidea* var. *winwardii*) Occurrence # 01.

2011 *Ericameria discoidea* var. *winwardii* Survey Sites



- *Ericameria discoidea* var. *winwardii*
- Section Boundaries

0 0.15 0.3 0.6 0.9 Miles

Appendix B. *Ericameria discoidea* var. *winwardii*
(Winward's goldenweed) 2011 Sample Points

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM).

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
22-Aug-11	3	523599	4617155	7078	53 (50-100)	In flower and fruit; Density of 1-5 pl/sq m (<i>Fertig 26983</i>)
23-Aug-11	5	523363	4617138	7078	60 (150-200)	90% in flower, 5% fruiting, 5% vegetative, with <i>Penstemon paysoniorum</i> (<i>Fertig 26989</i>)
23-Aug-11	6	523351	4617191	7064	110 (250-500)	Locally dominant, density to 10 pl/m ² , in flower, fruit, & vegetative. With <i>Astragalus jejunus</i> . Most abundant in open sites, as veg cover increases, population declines
23-Aug-11	7	523288	4617199	7053	23 (50-75)	In flower/fruit, distribution non-random
23-Aug-11	8	523202	4617088	7053	81 (200-300)	In flower/fruit at edge of erosional depression with <i>Tetradymia canescens</i> . Density variable, 1-5/m ² . Plants taller than usual here, often mounded
23-Aug-11	10	523079	4617274	7053	77 (250-300)	Dorn's holotype locality. In flower/fruit. Locally common, with <i>Gutierrezia sarothrae</i> , <i>Hymenopappus filifolius</i> , <i>Linum lewisii</i> , <i>Ivesia gordonii</i> , <i>Minuartia nuttallii</i> , <i>Eriogonum brevicaulis</i> var. <i>laxifolium</i> . Density to 7 pl/sq m. (<i>Fertig 26997</i>)
23-Aug-11	11	523107	4617322	7034	4	Only site with green, glandular phase (analogous to phases of <i>Ericameria discoidea</i> var. <i>linearis</i> in NW WY). (<i>Fertig 26998</i> RM)
23-Aug-11	12	523012	4617344	7042	7 (10)	In flower/fruit.
23-Aug-11	13	522959	4617376	7023	14 (50)	Unusual site - probably formerly open (possibly an old roadbed), now with dense cover. (<i>Fertig 26999</i>)
23-Aug-11	15	523119	4617402	7029	35 (100-150)	In flower/fruit, in old road bed and opening in <i>Artemisia arbuscula</i> - <i>A. tridentata</i> .
23-Aug-11	16	523199	4617336	7036	60 (200-250)	In flower/fruit. Locally common. Density of 7-8/sq m. Distribution non-random
23-Aug-11	17	523370	4617282	7043	215 (500)	Locally abundant; 9-10/m ² . (<i>Fertig 27000</i>)
23-Aug-11	18	523488	4617218	7067	48 (100-150)	In flower/fruit. With <i>Cirsium arvense</i> , fresh cow pies and trail. Herbivory not observed on var. <i>winwardii</i> .
23-Aug-11	19	523560	4617217	7069	38 (100-150)	In flower/fruit. Density 0-1/sq m in sparse areas, up to 2-4/sq m elsewhere

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM).

Atriplex falcata (Falcate saltbush) G4Q/S2

Falcate saltbush was found at four new locations in 2011 (Figure 12), increasing the total number of known populations in Wyoming to eight. This species is probably more widespread in the state than presently known, as it is easily mistaken for the common Gardner's saltbush (*A. gardneri*), especially if fruiting bracts of pistillate plants are not available for identification. Based on recent surveys at Fossil Butte National Monument (Fertig 2012) and from this study, WYNDD dropped Falcate saltbush from its list of Wyoming plant species of concern in 2012 (Heidel 2012).

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
23-Aug-11	31	499035	4613722	6720	100 (200-300)	Locally common, in fruit (bracts with long pointed tips). On rocky clay flats below S-facing mesa. Community of <i>Artemisia arbuscula</i> - <i>Krascheninnikovia lanata</i> , <i>Gutierrezia sarothrae</i> , <i>Chrysothamnus viscidiflorus</i> , & <i>Atriplex falcata</i> . (Fertig 27015)
24-Aug-11	32	498731	4620395	6640	50 (50-100)	In fruit - bracts with long pointed tips. Brown clay flats dominated by <i>Agropyron cristatum</i> , <i>A. triticeum</i> , <i>Carex filifolia</i> , & <i>Alyssum desertorum</i> at edge of <i>Artemisia tridentata</i> var. <i>tridentata</i> - <i>Chrysothamnus viscidiflorus</i> meadow (Fertig 27019)
25-Aug-11	44	526181	4631618	6880	35 (50-100)	Common, in fruit. Wasatch Formation, veg cover 60%, bare soil 20%, rock 20%. Openings in <i>Artemisia tridentata</i> - <i>Krascheninnikovia lanata</i> community (Fertig 27027)
25-Aug-11	52	549463	4637294	7686	<50	In fruit - bracts with long pointed tips. Summit of Round Mountain, cobblestone and small rock surface over grayish clay in <i>Artemisia tridentata</i> var. <i>wyomingensis</i> - <i>Krascheninnikovia lanata</i> community with scattered <i>Artemisia nova</i> , <i>Elymus elymoides</i> , <i>Eremogone hookeri</i> , & <i>Poa secunda</i> (Fertig 27037)

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM)

Cirsium barnebyi (Barneby's thistle) G3G4/S1

Prior to 2011, Barneby's thistle was known in Wyoming from a single literature report from Carbon County. This species is a regional endemic of northeastern Utah, southern Wyoming, and northwestern Colorado. It resembles Wyoming thistle (*C. pulcherrimum*), but has white to grayish-woolly upper and lower leaf surfaces and leaf bases that do not extend down the stem for more than 12 mm. Barneby's thistle may be more widespread in the Overthrust Belt than presently known and might co-occur with Winward's goldenweed at South Fork Twin Creek (a *C. pulcherrimum*-like thistle was observed there in August 2011 but not collected for confirmation).

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
23-Aug-11	24	520822	4615266	7447	10 (25-50)	Sparse, in flower/fruit. North-draining slope of exposed Green River shale N of Bear River Divide Road. Soft gray clay with <i>Eriogonum brevicaulis</i> var. <i>laxifolium</i> , <i>Poa secunda</i> , <i>Hymenopappus filifolius</i> , <i>Artemisia arbuscula</i> , <i>Astragalus tenellus</i> , & <i>Chrysothamnus viscidiflorus</i> ('puberulus'-like form of var. <i>lanceolatus</i>) (Fertig 27012)

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM).

Cuscuta occidentalis (Western dodder) G4G5/S1

I documented two populations of Western dodder in 2011 field surveys, one in Fossil Butte National Monument (Fertig 2012) and a second on Green River shale barrens north of South Fork Twin Creek while searching potential Winward's goldenweed habitat. These are the only extant occurrences of this species known from Wyoming (a third population near Rock Springs has not been relocated since 1936). This annual parasitic species may be under-surveyed, as it appears late in the growing season and may not germinate every year. Populations can be very localized, covering only a few square feet.

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
24-Aug-11	40	524122	4619716	7063	20 (20-50)	In flower/fruit. Uncommon, limited to 5 x 6 foot area. Parasitizing <i>Linum kingii</i> , <i>L. lewisii</i> , <i>Ipomopsis</i> , <i>Gutierrezia sarothrae</i> , <i>Elymus lanceolatus</i> , & <i>Strep-tanthus cordatus</i> . In shallow depression of exposed white Green River chalky limestone with 30% veg cover of <i>Artemisia arbuscula</i> , <i>Gutierrezia sarothrae</i> , & <i>Elymus lanceolatus</i> below ridgeline in opening in denser <i>Artemisia arbuscula</i> - <i>Krascheninnikovia lanata</i> community.

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM)

Physaria condensata (Tufted twinpod) G2G3/S2S3, WY BLM Sensitive

Tufted twinpod is endemic to southwestern Wyoming, where it occurs on barren ridgcrests, mesa rims, slopes, and low mounds of Green River limestone. In 2011 I documented this species at 15 locations (representing at least 5 separate occurrences) while surveying for *Ericameria discoidea* var. *winwardii*. Most of the populations I encountered were relatively small (often with 30 or fewer plants) in small patches of suitable habitat. Conditions for surveying, however, were not ideal, as most plants were well past fruiting or vegetative and difficult to observe (normally, surveys for this species would be done in June or July when its bright yellow flowers are more noticeable). Based on this study and a recent survey of two large occurrences on Fossil Butte National Monument (Fertig 2012) that found the species to be abundant and largely unthreatened, WYNDD recently reclassified Tufted twinpod as a species of potential concern (Heidel 2012).

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
22-Aug-11	1	523909	4618310	7256	1 (<10)	In late fruit, replum oval, with 4 funiculi; fruit < 1 cm wide. On Green River shale barrens.
22-Aug-11	3	523599	4617155	7078	2 (<10)	In very late fruit, replum oval, funiculi 4. Census not made- difficult to find plants at this late stage of phenology, but not common here. In blowout in white chalky Green River shale in community of <i>Tetradymia canescens</i> , <i>Cymopterus terebinthinus</i> , & <i>Ivesia gordonii</i> .
23-Aug-11	20	523649	4616908	7093	10 (20)	In late fruit, sparse. Blowout patch on stony, bare N-facing ridge to SE of population, across small tributary of South Fork Twin Creek. With <i>Ericameria parrryi</i> , <i>Poa secunda</i> , <i>Artemisia arbuscula</i> .
23-Aug-11	21	523841	4615670	7259	<10	In late fruit, sparse. Small blowout off road to E with sparse veg cover (<15%), with scattered <i>Astragalus jejunus</i> , <i>Achnatherum hymenoides</i> , <i>Chrysothamnus viscidiflorus</i> , <i>Purshia tridentata</i> .
23-Aug-11	25	515818	4616349	7508	25 (150-200)	Locally abundant, in late fr, replum oval, 4-5 funiculi. Windswept slopes of Green River shale, undulating, stony surface. Cushion plant community of <i>Eriogonum brevicaule</i> , <i>Cryptantha sericea</i> , <i>Tetradymia canescens</i> , <i>Purshia tridentata</i> , <i>Astragalus jejunus</i> .

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM)

Physaria condensata (Tufted twinpod), continued

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
23-Aug-11	28	520058	4612949	7093	20 (20-50)	In late fruit, sparse. Cushion plant community on Green River shale slopes with 90% rock cover. Occurs with <i>Eriogonum brevicaule</i> var. <i>laxifolium</i> , <i>Achnatherum hymenoides</i> , <i>Ericameria parryi</i> , <i>Packera cana</i> , <i>Tetradymia canescens</i> .
24-Aug-11	34	524247	4620446	7086	50 (200-300)	In late fruit, sporadic overall but clustered when present. Also with <i>Penstemon paysoniorum</i> . Green River shale outcrop at jet of BLM road with South Fork Road. Cty of <i>Ericameria nauseosa</i> , <i>Tetradymia canescens</i> , <i>Poa secunda</i> .
24-Aug-11	35	524322	4620380	7070	25 (100-150)	In late fruit. Barren Green River shale dominated by <i>Gutierrezia sarothrae</i> - <i>Eriogonum brevicaule</i> var <i>laxifolium</i> , <i>Phlox hoodii</i> . <i>Malcolmia africana</i> present.
24-Aug-11	36	524295	4620146	7037	30 (50-100)	Locally common, in late fruit. With <i>Cymopterus nivalis</i> . Green River shale barrens on rim with 80-90% rock cover. <i>Ericameria parryi</i> - <i>Eriogonum brevicaule</i> community.
24-Aug-11	37	523710	4619710	7038	50 (100-200)	In late fruit. N-facing Green River shale outcrops overlooking small tributary wash; cushion plant community with <i>Eriogonum brevicaule laxifolium</i> , <i>Astragalus jejunus</i> , <i>Cryptantha sericea</i> .
25-Aug-11	46	526888	4631210	7265	NA	Well past fruit; not censused. Potential site for <i>Lesquerella prostrata</i> . Upper rim of mesa and summit of south arm on Green River shale over Wasatch Formation. Cushion plant community with <i>Eremogone hookeri</i> , <i>Eriogonum brevicaule</i> , <i>Artemisia frigida</i> , <i>Packera cana</i> , occasional <i>Atriplex confertifolia</i> .
25-Aug-11	47	526882	4631399	7270	NA	Well past fruit - widely scattered. Rim of Green River shale heading to NE; cushion plant community with <i>Eriogonum brevicaule</i> var. <i>laxifolium</i> , <i>Poa cusickii</i> , <i>Achnatherum hymenoides</i> , <i>Machaeranthera grindelioides</i> .

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM)

Physaria condensata (Tufted twinpod), continued

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
25-Aug-11	48	526995	4631577	7220	50 (50-100)	In late fruit (4 funiculi) or past fruit. Upper slopes below rim heading to NE. Cushion plant community on Green River rubble with <i>Elymus spicatus</i> locally abundant, <i>Cymopterus longilobus</i> , <i>Packera cana</i> , <i>Machaeranthera grindelioides</i>
25-Aug-11	49	528208	4633545	7425	(100-150)	Locally common, in late fruit. With <i>Phlox hoodii</i> , <i>Castilleja flava</i> , <i>Cymopterus terebinthinus</i> , <i>Machaeranthera grindelioides</i> . Small mounds of white Green River shale clay beds embedded in big sagebrush meadows of mesa top (Hams Fork Plateau). Barrens locally dominated by <i>Artemisia arbuscula</i> , <i>Elymus spicatus</i> , <i>Achnatherum hymenoides</i> . With <i>Astragalus jejunus</i> . Veg cover 25-40%.
26-Aug-11	67	513260	4613525	7310	10 (20-50)	In very late fruit or vegetative; replums with 4 funiculi. Also with <i>Astragalus jejunus</i> var. <i>jejunus</i> . Series of cliffs of Green River shale on S-facing aspect; white clay barrens with erosional features. Community of <i>Cymopterus terebinthinus</i> , <i>Mahonia repens</i> , <i>Hymenopappus filifolius</i> , <i>Comandra</i> , <i>Machaeranthera grindelioides</i> , <i>Tetradymia canescens</i> .

Appendix C.
Other Rare Plant Species Documented in 2011 Survey

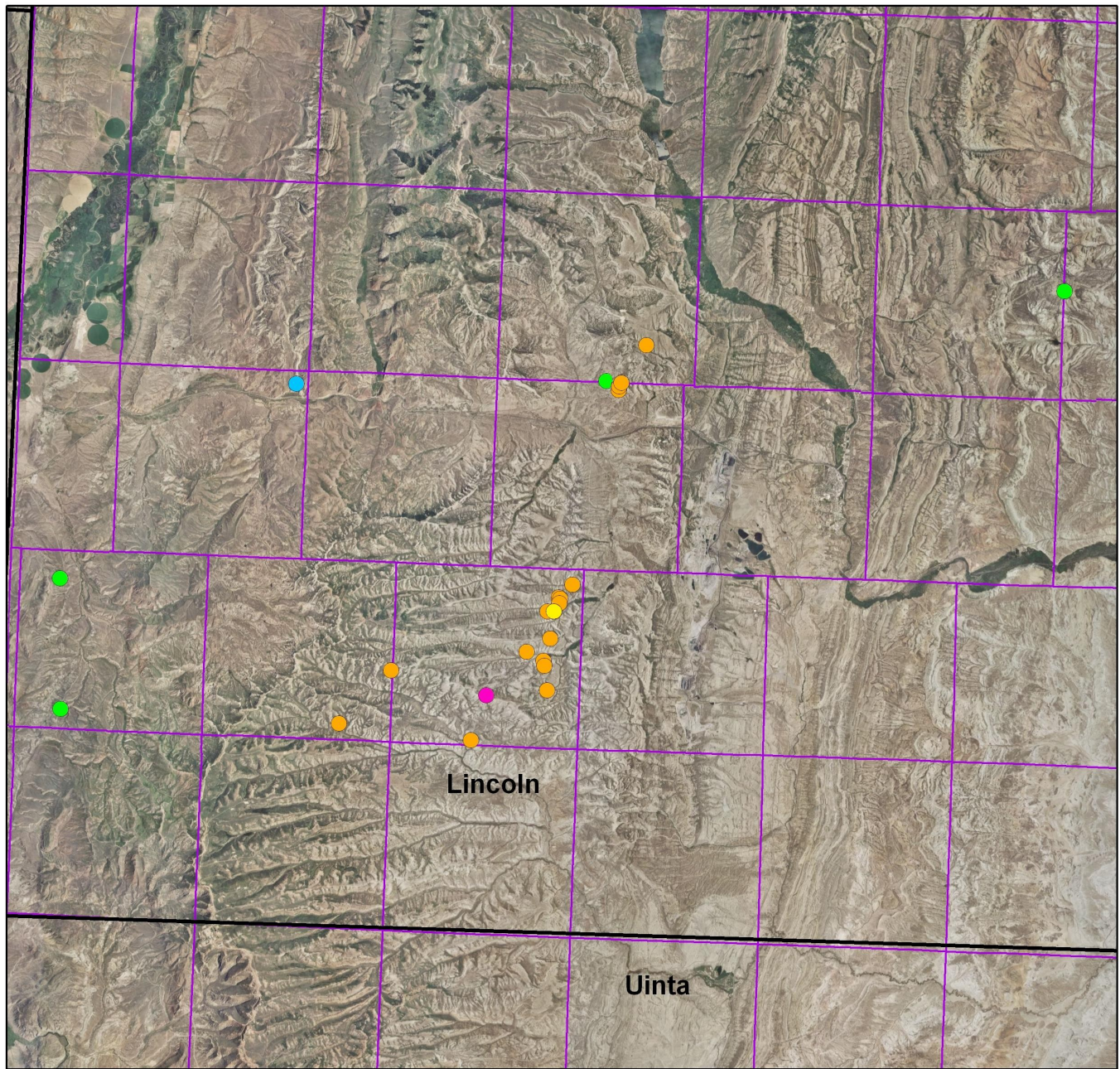
Note: All UTM coordinates from zone 12T and NAD 83. All cited specimens deposited at Rocky Mountain Herbarium (RM)

Physaria dornii (Dorn's twinpod)

Dorn's twinpod is a local endemic known only from Rock Creek Ridge west of Fossil Butte National Monument and the Overthrust Belt south of Interstate 80 in Lincoln and Uinta counties, Wyoming. A portion of the Rock Creek Ridge population was relocated in August and October 2011 while searching potential habitat for Winward's goldenweed. Twinpod plants were mostly vegetative at this time or had remnants of their distinctive fruiting pods. Because they were difficult to observe, no attempt was made to resurvey the entire occurrence.

Date	Point #	UTM East	UTM North	Elev (ft.)	Population Count (Estimate)	Notes
26-Aug-11	62	510412	4630822	6725	5 (25-50)	In late fruit, - pods large, replum with 4 funiculi. Hard to spot - probably much more widespread than observed. Slate barrens on W-dipping slope; veg cover 5-20% (denser on adjacent slopes), with scattered <i>Cercocarpus montanus</i> , <i>Achnatherum hymenoides</i> , <i>Cymopterus terebinthinus</i> , & <i>Eriogonum microthecum</i> .

Figure 12. Other rare plants documented in 2011 survey.



- | | |
|---|---|
|  Township Boundary |  <i>Atriplex falcata</i> |
|  County Boundary |  <i>Cirsium barnebyi</i> |
| |  <i>Cuscuta occidentalis</i> |
| |  <i>Physaria condensata</i> |
| |  <i>Physaria dornii</i> |