

**Status of *Cymopterus williamsii* (Williams' springparsley),
north-central Wyoming**



Prepared for Bureau of Land Management
Worldland Field Office and Wyoming State Office

by Joy Handley

Wyoming Natural Diversity Database
Dept. 3381, University of Wyoming
Laramie, WY 82071
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ABSTRACT

Cymopterus williamsii (Williams' springparsley), a Wyoming endemic, was surveyed for detailed information about known occurrences and to locate possible new occurrences. A potential distribution model and aerial photointerpretation of habitat were used to identify areas for new surveys. Specific location, population distribution, and habitat data were collected for two occurrences that were only known from specimen collections, while more extensive mapping and data were gathered for two other known populations. Three new occurrences were found, providing some verification for the potential distribution model. Species information, status assessment, and management recommendations are provided based on prior knowledge, current and future land uses, and new understanding gained from these surveys.

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Walter Fertig surveyed and addressed the species status in previous reports, and worked with Rob Thurston to develop and refine a potential distribution model for *Cymopterus williamsii* through Wyoming Natural Diversity Database (WYNDD).

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INTRODUCTION

Cymopterus williamsii (Williams' springparsley) is endemic to the southern Big Horn Mountains in north-central Wyoming and is a Bureau of Land Management (BLM) Sensitive Species. The status of *C. williamsii* was partially previously addressed in two reports (Fertig 1993, 1999) and in a state species abstract (Fertig 2000). Need for surveys in the BLM Worland Field Office and updated status information were identified based on: a lack of surveys on the west side of the Big Horn Mountains (in contrast with several surveys on the east side), the one known occurrence (population) of *C. williamsii* on the west side of the Big Horn Mountains being known only as specimen collection with the locality known within a square mile section, and a potential distribution model (Fertig and Thurston 2003; Appendix A) that identified areas of potential habitat in the BLM Worland Field Office. The main objectives of this study were to: make detailed surveys of the two *C. williamsii* occurrences in the BLM Worland Field Office (known from specimen data); conduct surveys in new areas of the BLM Worland Field Office using the potential distribution and photointerpretation; and update rangewide status information.

METHODS

At the start of this project, information on the habitat, distribution, and a potential distribution model of *Cymopterus williamsii* was compiled and reviewed (Hartman and Constance 1985; Fertig 1993, 1999; Hartman and Nelson 1995; Fertig and Thurston 2003; Handley and Heidel 2011; Estes-Zumpf et al. 2014). Wyoming Natural Diversity Database (WYNDD) spatial database (Biotics) records were compared with Rocky Mountain Herbarium (RM) specimens for completeness. National Agriculture Imagery Program (NAIP) 2012 aerial imagery was overlain with the Fertig and Thurston 2003 potential distribution model in the BLM Worland Field Office area, together with private land boundaries and known *C. williamsii* collection sites, in ArcMap for aerial photo interpretation of potential habitat and producing maps. The NAIP imagery maps were printed out by quarter 7.5-minute topographic quadrangle, along with half quadrangle digital raster graphic (DRG) maps with the same layers, for use in the field.

Surveys of *C. williamsii* in the BLM Worland Field Office were conducted between 2 and 9 June 2015, when the species was flowering and fruiting. When *C. williamsii* was found in a survey area, plant numbers were estimated and coordinates were recorded from Global Positioning System receivers for georeferencing population boundaries that were later digitized as polygons into Biotics. Information on habitat, phenology, and plant associates were documented on WYNDD plant species of concern survey forms and later entered into Biotics as permanent electronic spatial database records.

Independent of surveys in the BLM Worland Field Office, there was also multi-disciplinary Sensitive Species research being conducted in the North Fork Wilderness Study Area (WSA) by WYNDD 15-19 June and 20-24 July, 2015. Plant surveys during this research resulted in the documentation of several new subpopulations of *C. williamsii*, which are also included in this report (EO # 023).

RESULTS – SPECIES INFORMATION

Classification

Scientific name: *Cymopterus williamsii* R.L. Hartm. & Constance

Synonyms: none

Common names: Williams' spring-parsley, Williams' desert-parsley, Williams' waferparsnip

Family: Apiaceae or Umbelliferae (Carrot or Parsley family)

Genus: *Cymopterus* is highly polyphyletic and shares overlapping connections with several other polyphyletic western North American genera in Apiaceae, subfamily Apioideae (Downie et al. 2002; Sun et al. 2004; Sun and Downie 2004, 2010a, 2010b; George et al. 2014). Due to lack of resolution among these genera, there may be a change in their delineation in the future.

History of the species: *Cymopterus williamsii* was first described by Ronald Hartman and Lincoln Constance:

Hartman, R.L. and L. Constance. 1985. Two new species of *Cymopterus* (Umbelliferae) from western North America. *Brittonia* 37: 88-95.

Ronald Hartman's type specimen (9200) is deposited at RM. The label states "Wyoming, U.S.A. Big Horn Co. T49N R87W S19 Big Horn Mountains; ca 7.3 air mi WNW of Tyrrell Ranger Station. Sandstone ridge topped by limestone; with *Pinus ponderosa*; flowers yellow. 21 June 1979, Elev. 7000 ft." Isotypes are at BRY, COLO, GH, ID, MO, NY, UC, US, and WS (Hartman and Constance 1985).

The newly discovered species was reported as "...locally common, in rocky meadows, on rocky ridges and slopes, in thickets, or on open, wooded slopes in the mountains and foothills; substrate calcareous and dolomitic; flowering May through mid June; fruiting late June through July" (Hartman and Constance 1985). The specific epithet is in honor of Dr. Louis O. Williams, a

University of Wyoming alumnus, who made many collections in northwestern Wyoming and made important contributions to the understanding of tropical American floras. Two earlier specimens were found and were designated as paratypes: the first was collected in 1900 by Frank Tweedy and originally determined as *Oreoxis alpina*, the other was collected in 1975 by Beverly J. Albee and originally determined as *Musineon divaricatum*

The holotype and isotype specimens were collected in the BLM Worland Field Office by Ronald Hartman with Ann Odasz. This collection site was the only known occurrence on the west side of the Big Horn Mountains prior to the 2015 surveys and had been collected again by Ronald Hartman with Keith Dueholm in 1980. One other population was known in the BLM Worland Field Office, southeast of the Middle Fork Powder River, along the Powder River Trail-Hazelton Road, and had paratype specimens with legal descriptions to Section collected in 1979 by Ronald Hartman and in 1980 by B.E. Nelson. Other paratypes were collected on Wyoming State Lands, the BLM Casper Field Office, the BLM Buffalo Field Office, the Bud Love Wildlife Habitat Management Area, and the Bighorn National Forest by Hartman, Nelson, Robert Lichvar, and Robert Dorn.

David Martin, of the BLM Worland District, collected at or near the type location in 1981. In 1986, *C. williamsii* was collected by June Haines during her floristics survey of the Wind River Basin and vicinity (Haines 1988); this is still the southernmost known population. In 1992, Walter Fertig performed field surveys for *C. williamsii*, and two other species for the BLM Casper District. Fertig revisited some of the paratype areas of *C. williamsii*, mapped populations and subpopulations, and also discovered new subpopulations and occurrences (Fertig 1993). During a floristic survey of the southern Powder River Basin and eastern Plains, B.E. Nelson found a new subpopulation (Hartman and Nelson 1995). Joy Handley and Bonnie Heidel discovered a new occurrence and mapping of some known occurrences while conducting surveys for *Physaria didymocarpa* var. *lanata* (woolly twinpod) in 2010 (Handley and Heidel 2011). Wendy Estes-Zumpf found two new occurrences in the Gardner Mountain Wilderness Study Area in 2013 (Estes-Zumpf et al. 2013).

2015 surveys included mapping the two previously known occurrences in the BLM Worland Field Office (EO #s 005 and 008), as well as the extension of a known occurrence in the BLM Casper Field Office into the BLM Worland Field Office (EO # 004). Three new occurrences were also found in the BLM Worland Field Office (EO #s 027, 028, and 029). There was also expansion of an occurrence in the BLM Buffalo Field Office as the result of multi-disciplinary research in the North Fork WSA (EO # 023) (Table 1).

Legal Status

U.S. Fish & Wildlife Service status: None. (Formerly a Category 2 candidate for listing under the Endangered Species Act. Category 2 applied to taxa for which proposing to list as

Endangered or Threatened was appropriate, but for which persuasive evidence on biological vulnerability and threat were not currently available to support proposed rules. Category 2 was discontinued in 1996.)

BLM status: Sensitive – Wyoming BLM.

Global Heritage rank: G3 (Vulnerable).

State Heritage rank: S3 (Vulnerable).

State legal status: None.

Description



Figure 1. *Cymopterus williamsii* in flower

General non-technical description: *Cymopterus williamsii* is a tufted, perennial herb with basal, once-pinnately compound leaves and a flowering stalk 5-10 cm tall. Leaves are usually hairless, somewhat rubbery, and distinctly bluish or greyish green. The inflorescence is a half ball-like, compound umbel of small yellow flowers (Figure 1). Fruits are hairless, broadly elliptic to oval,

and slightly rounded with prominent ribs on the surface (although these are not thin and wing-like as in many other species of *Cymopterus*) (Figure 2) (Hartman and Constance 1985; Fertig et al. 1994; Fertig 2000, Dorn 2001).



Figure 2. *Cymopterus williamsii* in fruit.

Technical description: Low, tufted, herbaceous perennial 5-15 cm tall, acaulescent, with a usually straight primary root 8-20 cm long; leaves petiolate, subcoriaceous, ovate to lanceolate in outline, 1.5-9 (11) cm long, 0.4-1.8 cm broad, deeply pinnatifid to once-pinnate, bluish- or grayish-green, glabrous except for the scaberulous margins and sometimes veins, or occasionally scaberulous over the abaxial surface; petiole flat to planoconvex in cross section with a scarious wing ca 0.1 mm wide, 0.5-7.5 cm long, gradually expanded below into the narrow sheath; blade (1) 1.5-2.5 (3.5) cm long; lobes or leaflets linear-lanceolate to oblong; leaflets in 3 to 5 opposite or subopposite pairs, the apices apiculate. Inflorescence of subcompact, compound umbels 3-10 mm in diameter; peduncle terminal, erect or nearly so, (3) 5-10 (15) cm long, usually much exceeding the leaves, glabrous; involucre usually wanting; rays 2-6, 1-5 mm long; umbellets andromonoecious, of several pedicellate staminate and 1-5 (or more) subsessile perfect flowers; involucels dimidiate, the bractlets 5-12, ovate to lanceolate, mostly entire, 0.5-5 mm long and about equaling the flowers, connate for $\frac{1}{4}$ - $\frac{3}{4}$ of their length, white-margined; pedicels 1-2 mm long. Flowers yellow; sepals ovate to lanceolate, 0.2-0.6 mm long, not enlarging in fruit; petals 1.6-2 mm long, oblong to ovate below with a narrow, inflexed, plicate apex of nearly equal length; anthers yellow, 0.4-0.6 mm long; filaments 1-1.5 mm long; styles filiform, terete, 1-1.5 mm long, ascending to divergent, not elongating in fruit; stylopodium none; disc present; ovary glabrous; carpophore none. Fruit subterete, broadly elliptic to oblong, not constricted at commissure, (2.6) 3-4.1 mm long, 1.6-2.2 mm broad, glabrous, lustrous, light brown, the dorsal

rib and pair of intermediate ribs low and rounded but prominent, corky, unwinged, the lateral ribs sharp-edged to narrowly winged; oil tubes broad, flat, reddish-brown, solitary in the intervals, 2 on the concave commissural face; seeds slightly compressed dorsally in cross section (Figure 3). Chromosome number $n = 11$ (Hartman and Constance 1985).

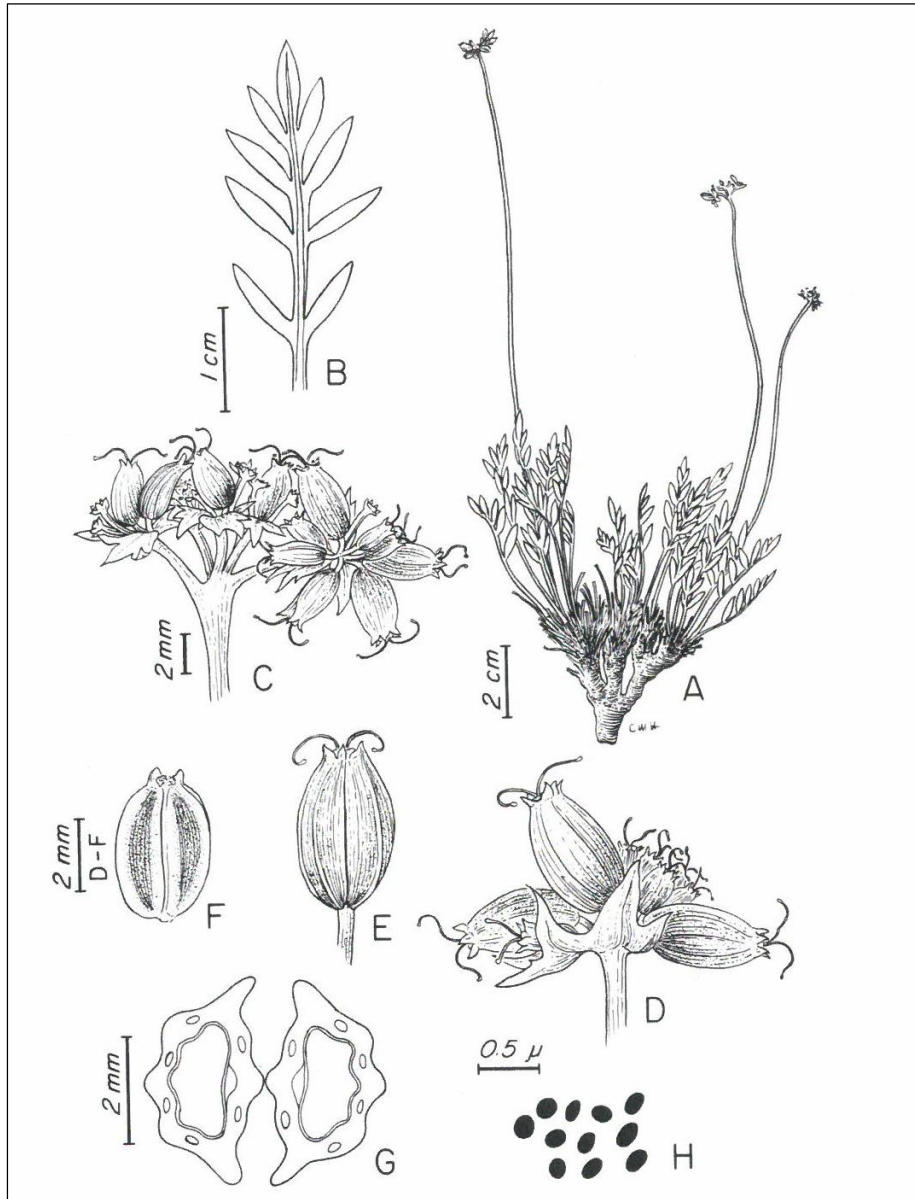


Figure 3. *Cymopterus williamsii* A. Habit. B. Foliage leaf. C. Fruiting umbellet. E. Fruit, lateral view. F. Mericarp, commissural view, showing vestigial carpophore. G. Fruit transection. H. Karyotype.

Illustration by Charlotte M. Hannan. Reproduced with permission of the publisher from: Ronald L. Hartman and Lincoln Constance, Two new species of *Cymopterus* (Umbelliferae) from western North America. *Brittonia* 37(1): 92. © 1985, The New York Botanical Garden, Bronx, New York.

Similar species: Other species of *Cymopterus* in Wyoming have either erect stems, flattened fruit, or leaves that are at least twice compound. *Shoshonea pulvinata* (Shoshone carrot) has scabrous fruit and is not known to occur in the Big Horn Mountains. Vegetative plants of *Astragalus miser* var. *decumbens* (prostrate milkvetch) can resemble *C. williamsii*, and their ranges and habitats overlap, but the *Astragalus* has white pubescence on its leaves (Fertig 1993, 2000).

Geographical Distribution

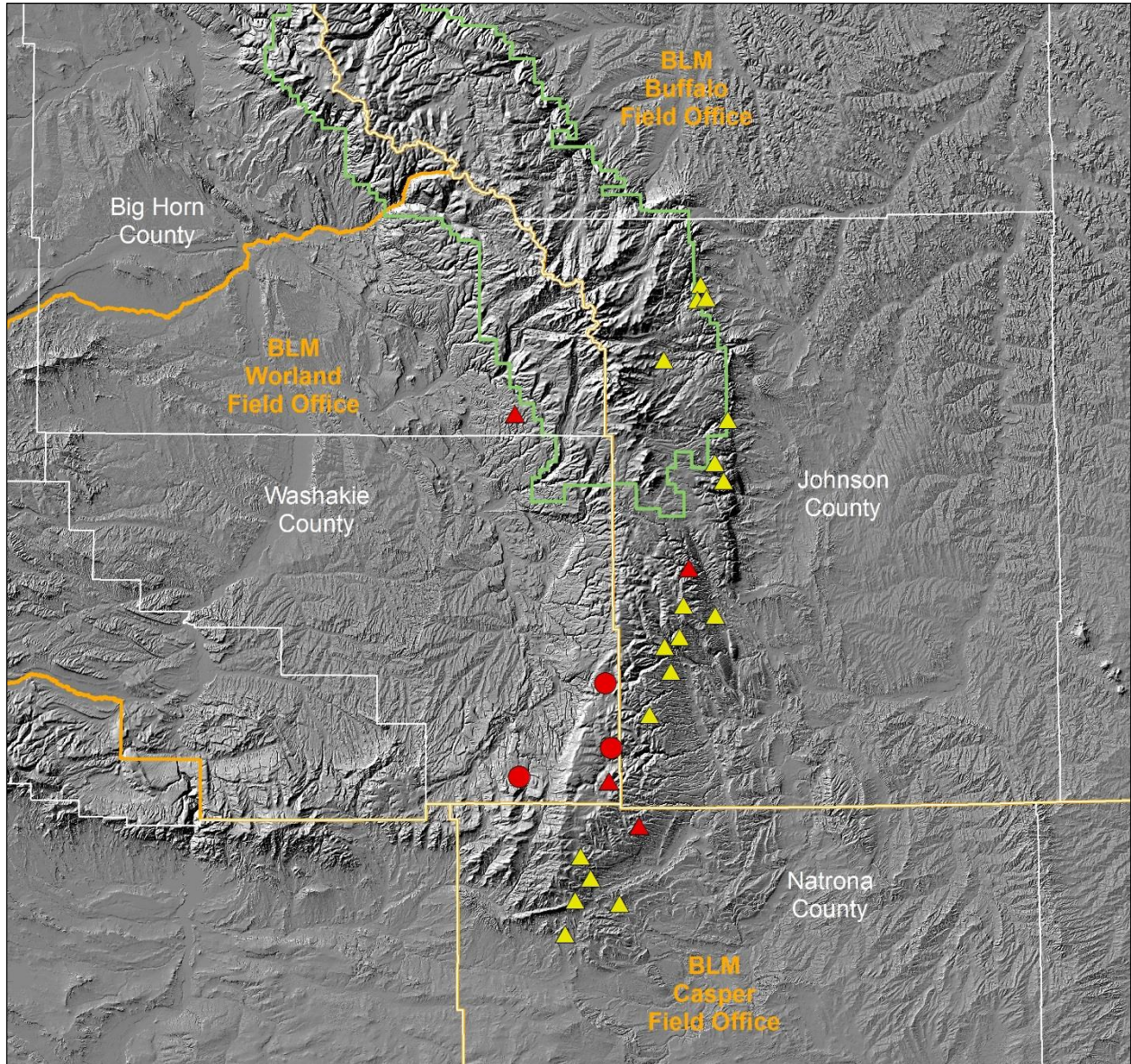


Figure 4. Rangewide distribution of *Cymopterus williamsii*
Previously known *Cymopterus williamsii* populations = triangles, Previously known *C. williamsii* populations surveyed in 2015 = red triangles, *C. williamsii* populations discovered in 2015 = red circles, BLM Field Office boundaries = orange lines, Bighorn National Forest boundary = green lines, County boundaries = white lines

Range: *Cymopterus williamsii* is endemic to the southern Big Horn Mountains of north-central Wyoming. It occurs in Big Horn, Johnson, Natrona, and Washakie counties (Figure 4).

Extant sites: There are 25 known occurrences (populations) of *C. williamsii*, including three new occurrences discovered during the 2015 surveys (Table 1; Appendix C). Also, new subpopulations expanded the mapped area of three occurrences (EO #s 004, 005, and 023). Fourteen occurrences have been visited since 1995 (Appendix C). In general, occurrences are at least 1.5 miles (2 km) apart.

Potential habitat model: The Fertig and Thurston 2003 potential distribution model for *C. williamsii* has only two likelihood classes: medium and low. Two of the new occurrences (EOs #s 027 and 028) are in areas mapped as medium likelihood. The third (EO # 029) is close to the edges of medium likelihood areas, on an outcrop ridge and nearby hillside that are compelling visual cues of habitat, based on geology.

Historical sites: The 1900 collection by Frank Tweedy (3370) has a vague location description (“Eastern slope of the Big Horn Mountains. Headwaters of Clear Creek and Crazy Woman River.”), which may correspond to one of the mapped occurrences within the labeled vicinity. Because the exact location is not known, it is maintained as its own occurrence (EO # 014).

Unverified/undocumented reports: None known.

Sites where present status not known: Beverly Albee’s 1975 collection (2429) (“Barnum Mountain Road.”) does not indicate the Section and it may be on private land or require crossing private lands to access. The site has not been visited since the original collection.

Land ownership: Of the 25 known occurrences of *C. williamsii*, 20 of them are on BLM administered lands (Buffalo, Casper, and Worland Field Offices), three are on National Forest lands (Bighorn National Forest), five are on State lands, and three are on Wyoming Game and Fish lands (Bud Love Wildlife Habitat Management Area), with several of these occurrences having mixed administration (Table 1; Figure 5).

Areas surveyed but species not located: The 2015 surveys were conducted on public lands that fell within areas indicated as potential *C. williamsii* habitat by the Fertig and Thurston 2003 model or seemed to have suitable habitat characteristics based on visual judgement. *Cymopterus williamsii* was not found at several of the sites surveyed (Table 2; Appendix B). However, another Wyoming BLM Sensitive Species, *Penstemon caryi* (Cary’s beardtongue) was found at two areas that were negative for *C. williamsii*: T50N R89W Sec 2 and T49N R88W Sec 23. Both of these were new subpopulations for known occurrences of *P. caryi* (EO #s 018 and 027, respectively) (Appendix E).

Table 1. Location information for known occurrences of *Cymopterus williamsii*

EO #	Location	County	Legal Description	Elevation	USGS 7.5' Quad	Land Ownership
001	Ca 2 miles southwest of Deadman Butte, ca 6 miles north of Arminto	Natrona	T38N R87W Sec 11,14	6600-7000 ft (2012-2134 m)	Deadman Butte, Badwater SE	BLM Casper Field Office
003	Near Cottonwood Creek, ca 2.5 miles west of Buffalo Creek Road	Natrona	T39N R87W Sec 25	7500 ft (2286 m)	Deadman Butte	BLM Casper Field Office
004	Along Thirty-three Mile Road and West Slope Black Rim, ca 21-25 miles north-northeast of Arminto	Johnson, Natrona, Washakie	T40N R85W Sec 5,6,9,10, 13,15,16; T41N R85W Sec 31; T41N R86W Sec 13,14,23,24, 23,25,36	6400-8555 ft (1951-2608 m)	First Water Draw, Roughlock Hill, Cherry Creek Hill, Gordon Creek, Grave Spring	BLM Casper Field Office, BLM Worland Field Office, State of Wyoming
005	Ridges above Middle Fork Powder River along the Hazelton Road, just north of Bar C Creek, ca 17 miles south-southwest of Big Trails	Washakie	T41N R86W Sec 2,11,12; T42N R86W Sec 36	8000-8572 ft (2438-2613 m)	Cherry Creek Hill, Gordon Creek	BLM Worland Field Office, State of Wyoming
006	South and west side of Mayoworth Slip (Slope) Road, ca 4 miles west of Mayoworth	Johnson	T45N R83W Sec 30	5800-6100 ft (1768-1859 m)	Mayoworth, Fraker Mountain	BLM Buffalo Field Office
007	North end of Gardner Mountain, Snow Cave Ridge, Red Spring Hill, and edge of the Mayoworth Slope Road	Johnson	T45N R84W Sec 4,5,8,16, 17,21,26,27, 34,35	7360-8400 ft (2243-2560 m)	Fraker Mountain, Packsaddle Canyon	BLM Buffalo Field Office, State of Wyoming
008	Along BLM Road 1117 (Hyattville Road), ca 7.3 miles west-northwest of Tyrrell Ranger Station	Big Horn	T49N R87W Sec 19	7600-8600 ft (2316-2621 m)	Brokenback Narrows, Pierce Draw	BLM Worland Field Office
009	Bud Love Big Game Winter Range	Johnson	T52N R83W Sec 36	6000 ft (1829 m)	Stone Mountain	State of Wyoming, Bud Love WHMA
010	Barnum Mountain Road	Johnson	T43N R85W?	7500 ft (2286 m)	Turk Springs	BLM Buffalo Field Office, private?
011	North Fork Crazy Woman Creek in the vicinity of Crazy Woman Mountain	Johnson	T49N R83W Sec 21,22,28	6600-7500 ft (2012-2286 m)	Klondike Ranch	State of Wyoming, Bighorn National Forest

EO #	Location	County	Legal Description	Elevation	USGS 7.5' Quad	Land Ownership
014	"Headwaters of Clear Creek and Crazy Woman River"	Johnson	T50N R84W?	7000-9000 ft (2134-2743 m)	Hunter Mesa	Bighorn National Forest?
015	Bighorn Mountains Road, ca 2.5 miles northwest of the junction with the Buffalo Creek Road	Natrona	T39N R86W Sec 8,9	7100 ft (2164 m)	Deadman Butte	BLM Casper Field Office
018	Peak 8741, ca 0.5 miles east of Bighorn Mountains Road, ca 15.5 miles north of Arminto	Natrona	T40N R86W Sec 29,30,31; T40N R87W Sec 25	8300-8600 ft (2530-2621 m)	Grave Spring	BLM Casper Field Office
019	Along Baker Cottonwood Road (County Road 108), between North Fork Cottonwood Creek and the Gray Wall	Natrona	T39N R86W Sec 25	6340-6490 ft (1932-1978 m)	Three Buttes	BLM Casper Field Office
020	Poison Creek Canyon and Billy Creek Access Road	Johnson	T48N R83W Sec 32,33	6600-7640 ft (2012-2329 m)	Robinson Canyon	BLM Buffalo Field Office
022	East side of Billy Creek Road (BLM Road 6207), at sharp southeast bend along divide between Billy Creek and Poison Creek	Johnson	T48N R83W Sec 19	7700-7760 ft (2347-2365 m)	Robinson Canyon	BLM Buffalo Field Office
023	East rim of North Fork Powder River, and north and south of Packsaddle Canyon and Pass Creek especially along rims	Johnson	T46N R84W Sec 14,15,20, 21,22,23,25, 26,27,28,33, 34,35; T45N R84W Sec 3,4	6240-8190 ft (1902-2496 m)	Packsaddle Canyon	BLM Buffalo Field Office
024	Box Elder, A, and Narrow ridges on the east side of the Barnum Slope	Johnson	T44N R84W Sec 29,30,31; T44N R85W Sec 36	6080-6840 ft (1853-2085 m)	Barnum	BLM Buffalo Field Office
025	Ridge east of Firebox Park, between North Fork Sayles Creek and Stone Mountain	Johnson	T51N R84W Sec 1,12	6700-7400 ft (2042-2256 m)	Stone Mountain	Bighorn National Forest, Bud Love WHMA
026	Slopes and rims north and west of trail #051 trailhead (North Fork Sayles Creek), ca 1.5 miles southeast of Stone Mountain	Johnson	T51N R83W Sec 6,7	5850-6100 ft (1783-1859 m)	Stone Mountain	Bud Love WHMA

EO #	Location	County	Legal Description	Elevation	USGS 7.5' Quad	Land Ownership
027	Peak 7922 between Red Fork Powder River and North Fork Little Canyon Creek	Washakie	T43N R86W Sec 2	7900-7922 ft (2408-2415 m)	Horse Butte	BLM Worland Field Office
028	Ridge between Sullivan Creek and Hazelton Road, ca 12 miles west-southwest of Barnum	Washakie	T42N R86W Sec 14,23,24	8200-8330 ft (2499-2539 m)	Cherry Creek Hill	BLM Worland Field Office
029	Along Cherry Creek Stock Drive (County Road 80), ridges and slopes east and west of Deep Creek, ca 15.5 south of Big Trails	Washakie	T41N R87W Sec 6,7; T41N R88W Sec 1,2	6700-7200 ft (2042-2195 m)	Lost Creek, Cornell Gulch	BLM Worland Field Office
030	The V, peak 6778 and ridge ca 1 mile above (west-northwest)	Johnson	T44N R84W Sec 18; T44N R85W Sec 13	6700-7380 ft (2042-2249 m)	Fraker Mountain, Tabletop	BLM Buffalo Field Office
031	Slopes north of Fraker Pass and south of The Arch	Johnson	T44N R84W Sec 5,8	7380-7700 ft (2249-2347 m)	Fraker Mountain	BLM Buffalo Field Office

Numbered rows in **bold** indicate occurrences surveyed in 2015

Table 2. Areas surveyed in 2015 but *Cymopterus williamsii* not located

Location	County	Legal Description	USGS 7.5' Quad	Land Ownership
Shell Canyon	Big Horn	T53N R90W Sec 17	Black Mountain	BLM Worland Field Office
Table Mountain	Big Horn	T52N R90W Sec 4,5	Black Mountain	BLM Worland Field Office
Cold Springs Road	Big Horn	T50N R89W Sec 1,2,11,12,15,22	Allen Draw, Hyatt Ranch	BLM Worland Field Office
Hyattville Road	Big Horn	T49N R88W Sec 23; T49N R87W Sec 16	Pierce Draw, Brokenback Narrows	BLM Worland Field Office, State of Wyoming
Taylor Brothers Road	Washakie	T46N R87W Sec 2	Big Trails NE	BLM Worland Field Office
North Fork WSA	Johnson	T46N R84W Sec 24,25	Packsaddle Canyon	BLM Buffalo Field Office
Crooked Creek	Washakie	T44N R86W Sec 19,30	Tallon Spring, Horse Butte	BLM Worland Field Office, State of Wyoming
Red Fork Powder River	Washakie	T44N R86W Sec 35; T43N R86W Sec 11	Horse Butte	BLM Worland Field Office
Cheever Creek	Washakie	T43N R86W Sec 27	Horse Butte	State of Wyoming
Sullivan Creek	Washakie	T42N R86W Sec 3	Horse Butte	BLM Worland Field Office
Lost Creek	Washakie	T42N R87W Sec 34; T41N R87W Sec 4	Lost Creek	BLM Worland Field Office

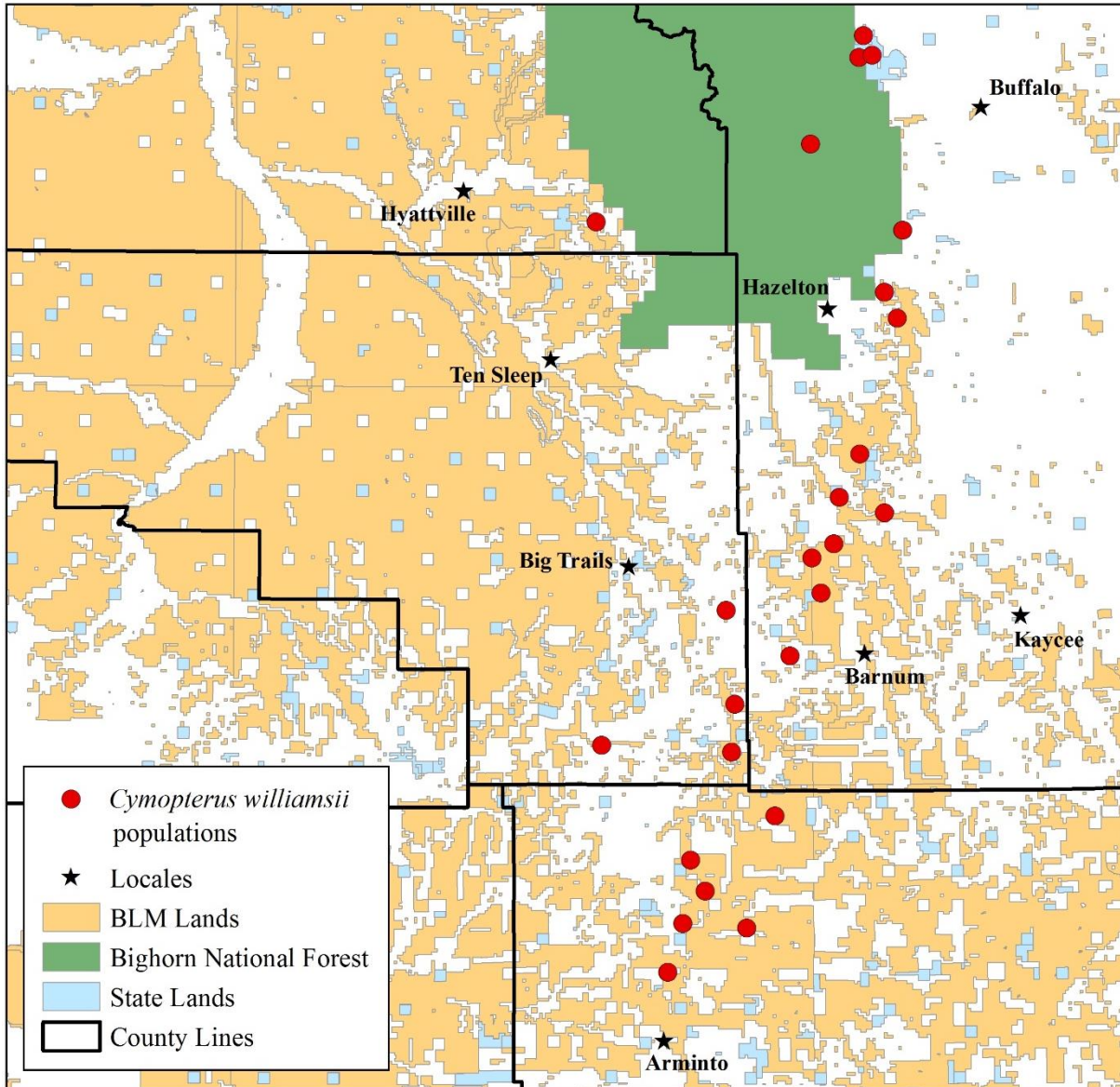


Figure 5. Land ownership of *Cymopterus williamsii* populations

Habitat



Figure 6. *Cymopterus williamsii* habitat between Red Fork Powder River and North Fork Little Canyon Creek (EO #027)

Associated vegetation: Dominant plant species in *Cymopterus williamsii* habitat range from cushion plants to grasses, shrubs, or conifers (Figure 6). Competing species are usually sparse, with much open soil, rocky ground, or duff between plants (Figures 7, 8, 9, 10). Usually *C. williamsii* is most common with cushion plants and other low forbs, and scattered bunchgrasses, for example: *Astragalus spatulatus* (tufted milkvetch), *Tetraneuris acaulis* var. *caespitosa* (caespitose four-nerve daisy), *Paronychia depressa* (spreading nailwort), *Draba oligosperma* (fewseed draba), *Phlox hoodii* ssp. *muscooides* (musk phlox), *Astragalus miser* var. *decumbens* (prostrate milkvetch), *Stenotus acaulis* (stemless mock goldenweed), *Lomatium orientale* (Northern Idaho biscuitroot), *Pseudoroegneria spicata* (bluebunch wheatgrass), *Koeleria macrantha* (prairie Junegrass), and *Festuca idahoensis* (Idaho fescue). In conifer or shrub habitats, *C. williamsii* is usually more scattered, with associates such as: *Pinus flexilis* (limber pine), *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas-fir), *Juniperus communis* (common juniper), *Cercocarpus ledifolius* (curl-leaf mahogany), *Mahonia repens* (creeping barberry), *Ribes aureum* (golden currant), and *Poa secunda* (Sandberg bluegrass) (Fertig 1993, 2000; Abernethy et al. 2016).



Figure 7. *Cymopterus williamsii* habitat along BLM Road 1117 (Hyattville Road) (EO #008)

Associated species of concern: On the eastern slopes of the Big Horn Mountains, *C. williamsii* sometimes shares habitat with *Physaria didymocarpa* var. *lanata* (Handley and Heidel 2011). *Pedicularis contorta* var. *ctenophora* (coiled lousewort) shares habitat with *C. williamsii* on Gardner Mountain (EO # 007). *Eritrichium howardii* (Howard's alpine forget-me-not) was collected on Snow Cave Ridge by Ronald Hartman in 1979 (9775), in the vicinity of EO # 007.

Eritrichium howardii was also found in the south end of The Dry V, and *Pyrocoma clementis* var. *villosa* (hairy tranquil goldenweed) on The Dry V, and slopes and ridges north and south of Packsaddle Canyon sharing habitat with *C. williamsii* (EO # 023) by Bonnie Heidel during the 2015 surveys in the North Fork WSA (Abernethy et al. 2016).

Topography: *Cymopterus williamsii* is found primarily on open ridgetops and upper slopes (Fertig 1993, 2000) at 5850-8700 ft (1783-2652 m) (Figure 9).

Soil and geology: Soils in *C. williamsii* habitat tend to be thin, rocky, and loam or sandy loam. Often they are Mollisols or Alfisols, but also include Entisols, Inceptisols, and Aridisols. Rocky outcrops, surface gravel, and shallow bedrock are common, generally with a high proportion of calcium (Figures 7, 8, 9).

Limestone and dolomite are components of the outcrops and gravel in *C. williamsii* habitat. Bedrock includes: Bighorn Dolomite, Chugwater Formation, Gallatin Limestone, Morrison Formation, Madison Limestone (Figure 6, 8, 9), Sundance and Gypsum Spring Formations, Tensleep Sandstone and Amsden Formation (Figure 7).



Figure 8. *Cymopterus williamsii* habitat above Middle Fork Powder River along the Hazelton Road, just north of Bar C Creek (EO #005)



Figure 9. *Cymopterus williamsii* habitat between Sullivan Creek and Hazelton Road (EO #028)



Figure 10. *Cymopterus williamsii* habitat in Douglas-fir/common juniper forest in the North Fork WSA (EO #023)
Photo by Bonnie Heidel

Regional climate: A representative weather station for the southern Big Horn Mountains is Ten Sleep 16 SSE (488858), about 1.5 miles (2.5 km) northeast of Big Trails, at 4680 ft (1426 m). Data at this station are from 1955-2015. Mean annual temperature is 42.6° F (5.9° C), with mean a January temperature of 15.8° F (-9° C) and a mean July temperature of 69.5° F (20.8° C) Mean annual precipitation is 13.03 in. (33.10 cm), with the highest monthly precipitation in May at 2.12 in. (5.38 cm) (Western Regional Climate Center 2015).

Local microclimate: *Cymopterus williamsii* is typically found in windswept areas with high solar radiation. These settings are conducive to early snowmelt and early start to the growing season compared to surrounding habitats. The pale gravel that often covers much of the soil surface has a high albedo (Figure 9), which reduces evaporation from underlying soils, retaining subsurface moisture (Handley and Heidel 2011).

Unsurveyed Potential Habitat

The Fertig and Thurston 2003 potential distribution model indicated potential habitat on the north-facing slopes of the Bridger Mountains in the Ditch Creek Canyon area, north of Copper Mountain (T42N R93W Sec 13, 24, 25, 26). The access road (County Road 5, Buffalo Creek Road) was closed during the survey period, presumably due to flooding. Access to Mahogany Butte was also problematic. Surveys in that area may be useful, according to the Fertig and Thurston 2003 model (T42N R88W Sec 1, 12, 13, 24; R87W Sec 7, 17, 18). Potential habitat in the approximately 36 mile (57 km) gap on the west side of the Big Horn Mountains between EO # 008 and EO # 027 is predominantly on private lands or public lands that require private permission to access. According to the Fertig and Thurston potential distribution model, there are approximately 4470 acres (1810 ha) of potential habitat on the Bighorn National Forest between those two occurrences (Leigh Creek Vee and vicinity), which have not been specifically surveyed for *Cymopterus williamsii*.

Population Biology and Demography

Phenology: *Cymopterus williamsii* flowers from May through mid-June. Fruiting occurs from June to July.

During the 2015 surveys (2 to 9 June), most of the populations observed were in peak flower with some plants in early fruit (Figures 1 and 2). The proportion of vegetative plants ranged from 5% to 85% (Appendix C).

Population size and condition: Populations surveyed in 2015 ranged from 50-100 to well over 10,000 individuals. One population from past surveys had an estimated 40,000 individuals (Fertig 1993, Appendix C).

Reproductive biology: *Cymopterus williamsii* reproduces sexually, by seed. There is no evidence of vegetative reproduction.

Pollination biology: Members of Apiaceae are insect pollinated and most display a blend of self- and cross-pollination (Koul et al. 1993). The inflorescence of *C. williamsii* has both staminate and perfect flowers. The excess pollen produced is a reward for pollinators. Apiaceae flowers also secrete nectar as an attractant (Koul et al. 1993).

Seed dispersal and biology: The fruits of *C. williamsii* are schizocarps, which split into two one-seeded mericarps. One plant may produce several flowering stalks, but each inflorescence has only one to a few perfect flowers, which have the ability to produce fruit (Figures 2 and 3). Most likely, the small, dry fruit disperse by a combination of gravity and wind for short distances in exposed landscapes (Jongejans and Telenius 2001).

Population Ecology

General summary: *Cymopterus williamsii* is a polycarpic perennial, but little is known about its lifespan. Vegetative rosettes and reproductive plants of different sizes were seen during 2015 surveys but it is difficult to determine age or lifespan (Figure 11). Trend data are not available for any sites.



Figure 11. *Cymopterus williamsii* plants of different sizes Photo by Bonnie Heidel

Competition: Vegetation cover in *C. williamsii* habitat is usually low, although it is found sparsely in a few grassy areas, as well as infrequently along with *Selaginella densa* (lesser spikemoss) (Figure 11). This indicates the species favors low competition conditions.

Herbivory: None observed.

Pathogens: A rust was present on some plants in the north Fork WSA (Heidel pers. comm.).

Hybridization: There is no evidence of *C. williamsii* hybridizing with any related species.

ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

Potential Threats to Currently Known Populations

Grazing: No signs of livestock grazing or trampling of *Cymopterus williamsii* plants were observed during either 1992 (Fertig 1993) or 2015 surveys.

Logging: A few *C. williamsii* occurrences are in or near conifer forests. Reduction in forest canopy may have a positive effect on *C. williamsii*. However, mechanical damage from logging activities or increases in soil erosion are potential threats. Post-harvest practices, such as seeding of non-native species, could also potentially impact *C. williamsii*.

Roads: There are roads nearby or going through several *C. williamsii* occurrences. Road maintenance, changes in road margins, and recreational use of adjacent habitat could affect the species.

Weeds: Non-native species are rarely present. In general, the ridges, outcrops, and cushion plant communities that make up much of *C. williamsii* habitat seem to be too harsh for weedy species, as found by Jones (2004, 2005) in southern Wyoming at elevations of 6931-8966 ft (2057-2660 m).

Fire: Many *C. williamsii* occurrences are in sparsely vegetated habitats with low probability of carrying fire. However, occurrences in forested habitats are vulnerable to fire. The North Brokenback Fire burned about 4900 acres in 1996 (James Wolf, personal comm.) and affected the section that included the type location of *C. williamsii* (EO #008) (Figure 12). Since the population was only known from specimen label information with the location only narrowed down to the square mile section, with no population estimate, it is difficult to ascertain how much damage the fire did to the occurrence. The 2015 visit revealed direct fire effects in the plant communities, as well as water runoff damage in the steeper and less vegetated areas of the burn. Fifty to a hundred *C. williamsii* plants were found on outcrops above the burn (Appendix C). Heidel (2002) found that survivorship of another *Cymopterus*, *C. evertii* (Evert's

springparsley) seemed to vary depending on the local severity of the fire and the size of individual plants. Forested habitats are part of at least nine occurrences.



Figure 12. 2015 remains of the 1996 North Brokenback Fire, in the vicinity of EO #008

Other: *Cymopterus williamsii* occurs on limestone bedrock and quarrying may be possible in potential habitat. There are plans for a gravel pit in the vicinity of EO # 027, but not within the population itself. Also, potential habitat is often at prominent points in the landscape, which may be suitable for telecommunications, radio, microwave, or beacon towers. Several occurrences have cairns, indicating cultural and recreational use. There is an informal campsite along BLM Road 1117 in EO # 008.

Management Practices and Response

There have been no studies of management practices and associated responses involving *Cymopterus williamsii*. The Brokenback Fire has provided an opportunity to monitor the resilience of the population there and to search for other possible remnants of that population (EO #008).

Conservation Recommendations

Recommendations regarding present or anticipated activities: Monitoring and trend, especially of the population disturbed by fire (EO # 008), as well as other populations in forested habitats, would greatly add to knowledge of the species. Access to potential habitat to the Bridger Mountains and Owl Creek Mountains, as well as a survey of Mahogany Butte, may reveal some additional populations. Information on locations of known populations and potential habitat near roads should be provided to weed management personnel, including County Weed and Pest districts and other contractors.

Notification of BLM personnel of locations on BLM lands: To prevent inadvertent impacts to known populations, all appropriate BLM personnel involved in planning and on-the-ground management activities, including: travel planning, grazing, weed control, prescribed burning and logging, should be provided with location data for *Cymopterus williamsii*. Toward this end, the updated state species abstract (Appendix D) and GIS files of all currently known occurrences are provided with this report.

Status recommendations: Wyoming BLM continues to recognize *C. williamsii* a designated BLM Sensitive Species to ensure that agency actions do not contribute to the further endangerment of the species and the subsequent need for listing under the Endangered Species Act (USDI BLM 2001, 2010). The new occurrences and expanded documentation of previously known occurrences reduce the endangerment of this species on the one hand, but the awareness of the chance of fire in some populations signifies a previously unspecified potential threat.

Prior to the 2015 surveys, *C. williamsii* was ranked as S2S3 and G2G3 (State and Globally Imperiled) by WYNDD and NatureServe. Evaluation of the status of *C. williamsii* in 2015 included the use of the Rank Calculator (NatureServe 2015). The Rank Calculator determined a rank of S3 and G3 (State and Globally Vulnerable) based on the number of occurrences, known population size, perceived viability of populations, range extent and area of occupied habitat, and threat scope and severity. WYNDD has decided to update the rank to S3 and G3 due to the Rank Calculator's recommendation.

Summary

2015 surveys produced new information about *Cymopterus williamsii* distribution patterns, habitat, population estimates, threats, and area of occupancy. The new occurrences and expanded documentation of previously known occurrences increase knowledge and management awareness of the species. A few areas of potential habitat that were inaccessible during 2015 surveys may warrant investigation. Questions are raised about potential vulnerability to intense fire in or adjoining occupied habitat. Travel management and weed management may also have bearing on the status of *C. williamsii*.

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