

Status Report on
Evert's waferparsnip
(*Cymopterus evertii*)
in Northwestern Wyoming

Prepared for the Bureau of Land Management
Wyoming State Office

By

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8 February 1999

Agreement # K910-A4-0011
Task Order No. TO-015

Abstract

Cymopterus evertii (Evert's wafer-parsnip) is a regional endemic of northwestern Wyoming and northeastern Utah that was first described as a new species in 1986. The species is currently known from 20 occurrences, 18 of which are found in the Absaroka and Owl Creek mountains and western Bighorn Basin in Hot Springs and Park counties, Wyoming. Based on surveys in 1988 and 1996-98, the current Wyoming population is conservatively estimated at over 30,000 individuals in over 300 acres of habitat. *C. evertii* typically occurs on sparsely vegetated, montane or alpine rocky slopes and ridgetops of volcanic andesitic soils in the Absaroka and Owl Creek ranges or in openings on sandstone ridges or knolls within limber pine/Rocky Mountain juniper or big sagebrush/Idaho fescue communities in the Bighorn Basin. Populations at higher elevations are largely protected by their ruggedness and inaccessibility, while those in the Bighorn Basin are potentially threatened by development associated with oil and gas development and recreation. At least 8 populations are currently protected in the Washakie Wilderness on Shoshone National Forest or in the BLM Carter Mountain ACEC. This species was formerly a candidate for listing under the Endangered Species Act, but was dropped from consideration due to its low threats and local abundance in the Shoshone National Forest. Although it does not warrant Sensitive designation on BLM lands at present, the plant's small range and specialized habitat makes it sufficiently vulnerable that it should continue to be monitored for potential downward trends in the future.

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I. INTRODUCTION

Evert's waferparsnip (*Cymopterus evertii*) was discovered by David Martin of the Bureau of Land Management (BLM) Worland District along the Squaw Teats Road south of Meeteetse, Wyoming, in April 1981. Martin brought his discovery to the attention of Dr. Ronald Hartman of the University of Wyoming, who visited the site in May 1981 and recognized the plant as a new, undescribed species. At Martin's suggestion, Hartman named the plant in honor of Erwin Evert, one of the foremost contemporary botanical explorers of northwest Wyoming (Hartman and Kirkpatrick 1986).

Shortly after its discovery, *Cymopterus evertii* was designated a Category 2 candidate for listing under the Endangered Species Act. Status surveys on Shoshone National Forest in the late 1980s documented that this species was more abundant than initially thought, and it was subsequently dropped as a candidate in 1990 (US Fish and Wildlife Service 1990). Due to its limited geographic distribution, however, the species remains a potential candidate for "sensitive" designation on BLM and Forest Service lands.

In 1998, the BLM Wyoming State Office contracted with the Wyoming Natural Diversity Database (WYNDD) on a cost-share basis to conduct field surveys and evaluate the status of this taxon on BLM lands in northwestern Wyoming. The objective of this report is to summarize new and existing data on the biology, distribution, habitat, population size, and potential threats to *Cymopterus evertii* to be used in determining its conservation status and potential management needs in Wyoming.

II. METHODS

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

Field surveys were conducted by Laura Welp in July 1998 (survey sites are indicated in Appendix C). Data on habitat, reproduction, phenology, and associated species were collected using WYNDD plant survey forms. Locations of occurrences were mapped on 7.5 minute USGS topographic maps. If populations were sufficiently large, voucher specimens were collected for deposit at the RM. Information gathered in the field was entered into the computerized Element Occurrence database of WYNDD.

Two 0.5 x 50 meter and one 0.5 x 30 meter permanent belt transects were established following the protocol of Lesica (1987), with some modification. The transects consisted of a single belt, subdivided into 0.5 x 1 meter plots. Within each plot, individual plants were counted and their canopy diameter was measured. Number of fruiting heads on reproductive individuals were recorded and dead plants were noted. This technique generated quantitative data on density, size distribution, and reproductive potential.

Percent total vegetative cover and a subjective assessment of shading by surrounding trees were also estimated for each plot. Data from these transects are included in Appendix B.

III. SPECIES INFORMATION

A. CLASSIFICATION

1. SCIENTIFIC NAME: *Cymopterus evertii* Hartman and Kirkpatrick. Type specimen: USA, Wyoming, Park County, T48N R99W Sec 35. North side of Squaw Teats Road, ca 3.2 air km east of Highway 120. Sandstone outcrop on hills with *Pinus flexilis*. 1800 m., 27 May 1981. Hartman 12799 (RM) (Hartman and Kirkpatrick 1986).
2. SYNONYMS: None.
3. COMMON NAME: Evert's waferparsnip, Evert's spring-parsley.
4. FAMILY: Apiaceae or Umbelliferae (carrot family).
5. SIZE OF GENUS: The genus *Cymopterus* contains about 45 species, all found in western and central North America (Cronquist *et al.* 1997). In the past, the genus has been divided into several segregate genera, including *Oreoxis*, *Pseudocymopterus*, and *Pteryxia*. Dorn (1992) recognizes 13 species in Wyoming, including an undescribed taxon closely allied with *C. bulbosus*.
6. PHYLOGENETIC RELATIONSHIPS: *Cymopterus evertii* is closely related to *C. nivalis* (synonym *C. bipinnatus*), a species with which it co-occurs in the mountains of northwest Wyoming (Cronquist *et al.* 1997; Hartman and Kirkpatrick 1986). Both species are also related to *C. aboriginum* and *C. cinerarius* of California and Nevada. *C. evertii* is unusual in having terete fruits with poorly developed wings and a functional carpophore, but none of these features are unique for the genus (Hartman and Kirkpatrick 1986).

B. PRESENT LEGAL OR OTHER FORMAL STATUS

1. NATIONAL

- a. LEGAL STATUS: *Cymopterus evertii* was formerly a C2 candidate for listing under the Endangered Species Act (US Fish and Wildlife Service [USFWS] 1985). The C2 list included species that might have warranted listing as Threatened or Endangered, but for which the USFWS lacked sufficient biological data to support a listing proposal. *C. evertii* was dropped to Category 3C status in 1990,

indicating that it was more abundant or widespread than previously considered (US Fish and Wildlife Service 1990). The species currently has no legal status.

- b. HERITAGE RANK: *Cymopterus evertii* is ranked G2G3 in The Nature Conservancy's Natural Heritage network system. This rank indicates that this species is somewhat imperiled to rare or local throughout its restricted range and is known from approximately 20-25 occurrences (Fertig 1997).

2. STATE:

a. WYOMING

- i. LEGAL STATUS: None.

- ii. HERITAGE RANK: *Cymopterus evertii* is ranked S2S3, indicating that it is somewhat imperiled to rare within its restricted range in Wyoming (Fertig 1997). In light of a recent revision of existing state records, this species may warrant a ranking of S2.

b. UTAH

- i. LEGAL STATUS: None.

- ii. HERITAGE RANK: Ranked S1, indicating that this species is considered critically imperiled because of extreme rarity and is known from 5 or fewer extant occurrences (Ben Franklin, Utah Natural Heritage Program, personal communication).

C. DESCRIPTION

- 1. GENERAL, NON-TECHNICAL DESCRIPTION: Evert's wafer-parsnip (Figures 1-2) is a tufted perennial herb 1-19 cm tall from a multi-branched root crown that is covered by persistent leaf bases. The rough-pubescent, lance-shaped blades are 1.5-6 cm long and 0.5-1.6 cm wide, and once or twice pinnately compound with 5-8 pairs of crowded pinnae. Crushed foliage is strongly aromatic, with the odor of orange peels. The inflorescence is a compact umbel of white flowers borne on a leafless stalk that exceeds the leaves at maturity. Fruits are flattened on their dorsal side, reddish-brown to purplish with thick white ribs, and covered with short, rough hairs (Hartman and Kirkpatrick 1986; Mills and Fertig 1996; Scott 1997).

Figure 1. Line drawing of *Cymopterus evertii* by W. Fertig from Scott (1997).



2. **TECHNICAL DESCRIPTION:** Low, tufted, herbaceous perennial, 1-19 cm tall, acaulescent; strongly aromatic when crushed, with odor of orange peels; primary root 5-50 cm long, the crown with few to many branches arising 1-9 cm above ground, the branches enveloped throughout or nearly so by persistent leaf petioles or their frayed remnants that increase the true diameter 2-4 times; leaves all clustered at the base, evidently to obviously granular-scabrous, the blade oblong in outline, 1.5-6 cm long, up to 1.5 cm wide, bipinnatifid to subtripinnatifid, with 5-8 pairs of primary pinnae, the lower pairs remote in well-developed plants, the upper more crowded, the primary pinnae close pinnately or almost palmately cleft into small segments only 1-3 mm long, the petiole shorter than to about as long as the blade; inflorescence a subcompact compound umbel 6-18 mm in diameter; peduncle terminal, ascending to erect or arcuate-spreading in fruit, shorter than to much-exceeding the leaves, pubescent like the leaves or sometimes glabrous; involucre lacking; rays 3-8, up to 15 mm long in fruit; umbellets mostly andromonoecious, of 3-7 staminate and (2) 6-11 (or more) perfect flowers; involucels dimidiate, the bractlets 4-9, linear to lanceolate or elliptic, entire to erose, acute, 1.5-4.5 mm long, distinctly white or purple margined, connate for up to 1/3 their length, pubescent or glabrous; pedicels to 8 mm long in fruit; flowers white or cream; sepals narrowly triangular to lanceolate, 0.5-0.9 mm long, subequal, not enlarging in fruit, white or purple-margined; petals 1.5-1.7 mm long; obovate in lower 2/3 with a narrow, inflexed, plicate apex; anthers greenish-yellow to yellow or purple, 0.4-0.6 mm long; filaments 1.7-2 mm long; styles filiform, terete, 1.4-1.8 mm long, or to 2.5 mm in fruit; stylopodium none; disc present; ovary puberulent; carpophore none; fruit suborbicular, not constricted at commissure, 3.5-5.2 mm long, 2.3-3.5 mm broad, moderately to densely covered with irregular tubercles or crests, dull, reddish-brown to purplish, with tan to whitish ribs; dorsal and intermediate ribs 0.2-0.5 mm broad, 0.2-0.5 mm thick, rounded, usually broadly so; lateral ribs or wings 0.5-0.8 mm broad, 0.4-0.6 mm thick, rounded; oil tubes flat, reddish-brown; seed face flat to concave (Cronquist et al. 1997; Hartman and Kirkpatrick 1986).
3. **LOCAL FIELD CHARACTERISTICS:** Evert's wafer-parsnip can be recognized by its low, tufted growth form, aromatic, pinnately compound, coarse-hairy, basal leaves, persistent petioles, compact inflorescence of white flower on a leafless flowering stem, and semi-flattened hairy fruits with white ribs (Dorn 1992; Fertig 1992; Mills and Fertig 1996).
4. **SIMILAR SPECIES:** *Cymopterus longilobus* has glabrous foliage, leaf blades over 5 cm long with sharp-tipped leaflets, yellow flowers, and green bracteoles. *C. nivalis* has glabrous ovaries and fruits with thin wings (Cronquist et al. 1997; Dorn 1992).

D. GEOGRAPHICAL DISTRIBUTION

1. RANGE: *Cymopterus evertii* is a regional endemic of northwestern Wyoming and northeastern Utah (Figure 3). In Wyoming, it is restricted to the Absaroka and Owl Creek mountains and the western rim of the Bighorn Basin in Park and Hot Springs counties. Utah populations are found only in the Ashley Creek Gorge in northern Uintah County (Welsh *et al.* 1993).
2. EXTANT SITES: Evert's waferparsnip is currently known from 18 extant occurrences in Wyoming, many of which are in the same general vicinity. At least 6 additional occurrences were formerly recognized by WYNDD, but have recently been combined with nearby records (Fertig 1998). Six populations have been resurveyed or newly discovered since 1996. Rangelwide, this species is known from about 20 locations.

Exact locations of extant populations are listed in Table 1. More detailed information is provided in Appendix A.

3. UNVERIFIED/UNDOCUMENTED REPORTS: None
4. AREAS SURVEYED BUT TAXON NOT LOCATED: The following areas were surveyed in 1998, but no populations of *Cymopterus evertii* were found:

T45 R100 S2: Ridge to west of Occurrence # 022

T45 R98 S1-2: Ilo Ridge

T46 R98 S2-3, 11-12: Red Ridge

T50 R101 S12: Ridge near Dry Creek

T47 R99 S4-6, 15, 22-23

T48 R99 S31-32.

T48 R100 S35.

T46 R99 S8-9, 15-17

5. AREAS OF UNSURVEYED POTENTIAL HABITAT: Additional habitat may occur along ridges bordering North Fork Owl, Cottonwood, Grass, Enos, Gooseberry, and Rose creeks at the west edge of the Bighorn Basin and adjacent foothills of the Absaroka Range. Habitat may also occur on Meeteetse Rim, Red Cabin Ridge, and in the Owl Creek Mountains on the Wind River Indian Reservation.

Figure 2 (page 11). Photograph of *Cymopterus evertii* illustrating the winged, semi-terete nature of the fruits and pinnately divided basal leaves. Population from the Greybull River, near Warehouse Creek on Shoshone National Forest. WYNDD photograph by Hollis Marriott, 28 June 1988.

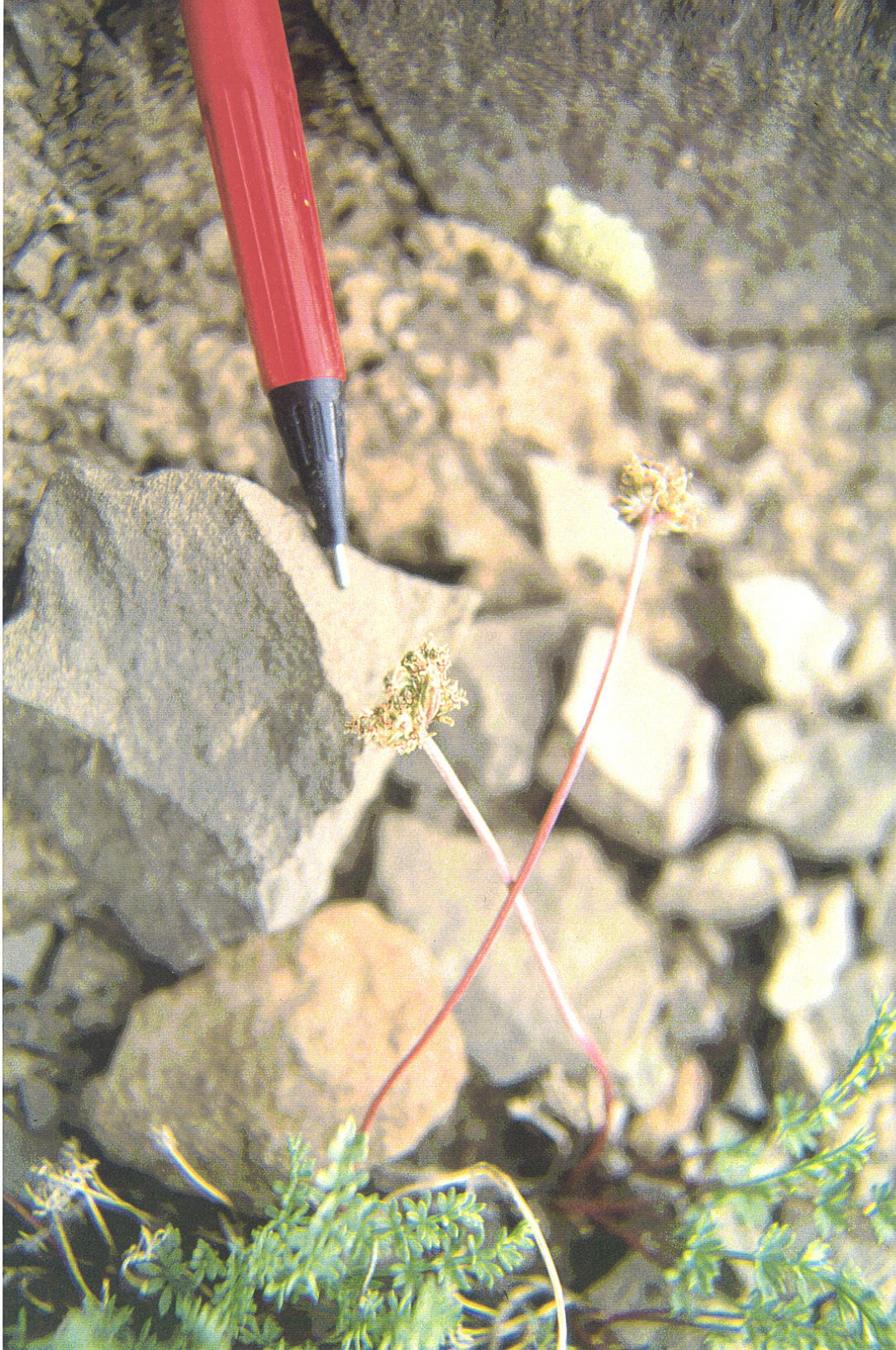


Figure 3. Wyoming Distribution of *Cymopterus evertii*

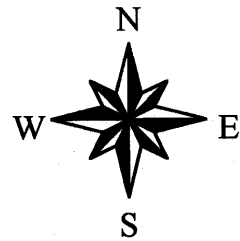
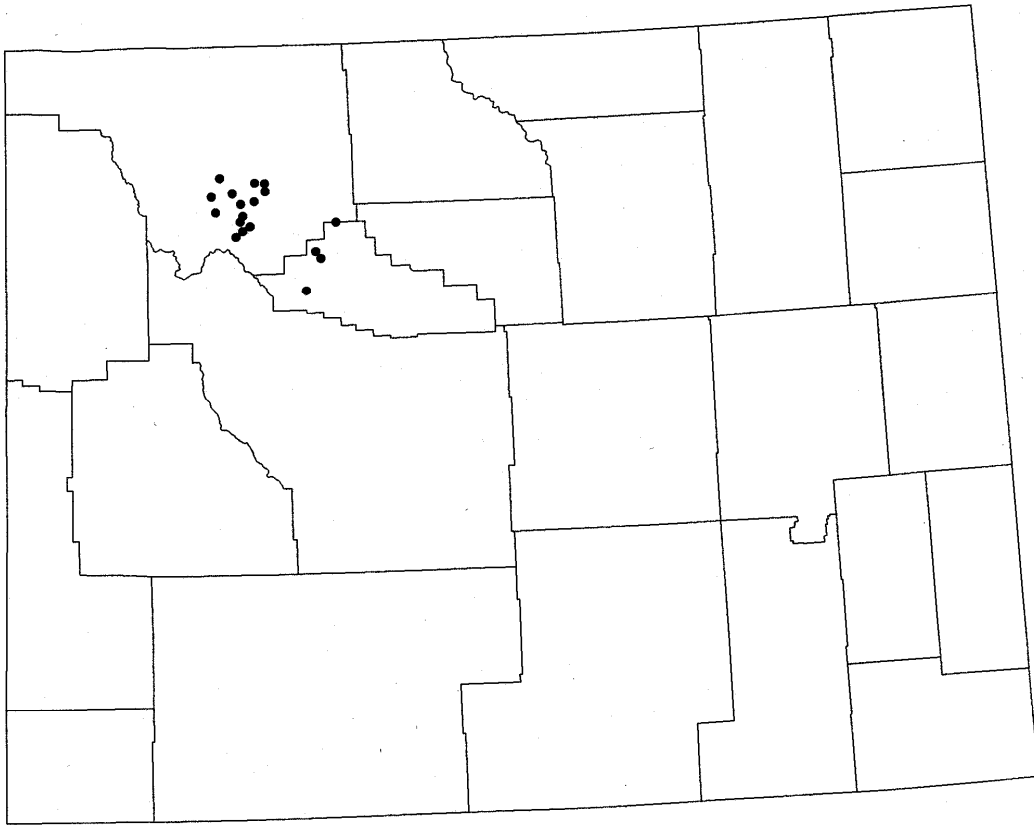


Table 1. Location Information for Known Populations of *Cymopterus evertii* in Northwestern Wyoming.

A. Bighorn Basin

Occurrence #: 001
 Counties: Hot Springs and Park.
 Legal Description: **T47N R99W S2** (NW4NW4); **S13** (center); **T48N R99W S26** (NW4 of SE4); **S28** (SE4); **S33** (NE4NE4); **S35** (NW4).
 Latitude: 44° 04' 38" N (centrum).
 North: 44° 05' 57" N.
 South: 44° 02' 24" N.
 Longitude: 108° 42' 28" W (centrum).
 East: 108 °40' 41" W.
 West: 108 °44' 14" W.
 Elevation: 5800-5900 ft (1760-1800 m).
 USGS 7.5' Quad: Hillberry Rim.
 Location: W side of Hillberry Rim from the S end of Wild Horse Heaven S ca 4 miles to Buffalo Creek. 5 sub-populations: 3 colonies along the Squaw Teats Road between the ridge SW of Wild Horse Heaven and Black Buttes, 1 colony in the vicinity of Wilson Reservoirs, and 1 colony along Buffalo Creek ca 2.25 miles south of Wilson Reservoirs.

B. Owl Creek Mountains

Occurrence # 020.
 County: Hot Springs.
 Legal Description: **T43N R101W S1-2;**
T44N R101 W S36.
 Latitude: 43° 43' 42" N.
 Longitude: 108° 55' 50" W.
 Elevation: 7400-8200 ft (2255-2500 m).
 USGS 7.5' Quad: Eagle Nest Ranch.
 Location: N of the North Fork of Owl Creek, ca 7 air miles NW of Anchor Reservoir and 37 air miles WNW of Thermopolis.

C. Absaroka Range

Occurrence # 002.
 County: Park.
 Legal Description: **T47N R104W S1** (S4), **S3** (SE4), **S4** (SE4).
 Latitude: 44° 04' 00" N (centrum).
 North: 44° 04' 03" N.
 South: 44° 03' 54" N.
 Longitude: 109° 19' 18" W (centrum).
 East: 109° 17' 15" W.
 West: 109° 20' 30" W.
 Elevation: 9200-9850 ft (2804-3000 m).
 USGS 7.5' Quad: Phelps Mountain.
 Location: E-W trending ridge system on the N side of Phelps Mountain, from the E side of Jack Creek ca 2.5 miles E to the vicinity of Point 10271, 21-23 air miles WSW of Meeteetse.

Occurrence # 004.
 County: Park.
 Legal Description: **T47N R105W S26.**
 Latitude: 44° 00' 55" N.
 Longitude: 109° 25' 27" W.
 Elevation: 8300 ft (2530 m).
 USGS 7.5' Quad: Irish Rock.
 Location: Upper Greybull River between Bonne Creek and Venus Creek, 9–12 air miles NW of Kirwin.

Occurrence # 005.
 County: Park.
 Legal Description: **T49N R103W S19** (SE4 of SW4), **S20** (SW4 of NE4 of SW4 & NE4 of SW4SW4), **S29** (NW4 of NE4), **S30** (SW4 of NW4 of NE4 & NE4NE4 of NW4).
 Latitude: 44° 11' 47" N (centrum).
 North: 44° 12' 11" N.
 South: 44° 11' 35" N.
 Longitude: 109° 17' 15" W (centrum).

East: 109° 15' 50" W.
West: 109° 17' 25" W.
Elevation: 9800-10,400 ft (2990-3170 m).
USGS 7.5' Quad: North Fork Pickett Creek.
Location: SE slope of Carter Mountain along the Carter Mountain Road on the E and W slopes of the upper Little Rose Creek valley, ca 19 air miles W of Meeteetse.

Occurrence # 006.
County: Park.
Legal Description: **T48N R104W S17** (SE4SW4).
Latitude: 44° 07' 22" N.
Longitude: 109° 22' 15" N.
Elevation: 9200-9850 ft (2804-3000 m).
USGS 7.5' Quad: Phelps Mountain.
Location: Drainage immediately NW of the confluence of Jack Creek and the Greybull River.

Occurrence # 007.
County: Park.
Legal Description: **T48N R106W S10** (SE4), **S11** (SW4 of NW4), **S15** (NW4 of NE4), **S21**.
Latitude: 44° 08' 35" N (centrum).
North: 44° 08' 47" N.
South: 44° 07' 05" N.
Longitude: 109° 33' 55" W (centrum).
East: 109° 33' 35" W.
West: 109° 35' 07" W.
Elevation: 9000-10,300 ft (2745-3140 m).
USGS 7.5' Quads: Needle Mountain and Valley.
Location: South Fork Shoshone River drainage, summit of Boulder Ridge NE and SW of trail crossing, ca 44 miles SW of Cody.
Occurrence # 008.
County: Park.

Legal Description: **T49N R103W S2**.
Latitude: 44° 14' 42" N.
Longitude: 109° 12' 22" W.
Elevation: 10,400 ft (3170m).
USGS 7.5' Quad: Thomas Reservoir.
Location: Ca 1 mile S of Meeteetse Creek and ca 2 miles S of Foster Reservoir, ca 19 air miles SSW of Cody.

Occurrence # 010.
County: Park.
Legal Description: **T49N R104W S29**.
Latitude: 44° 11' 03" N.
Longitude: 109° 23' 10" W.
Elevation: 10,800 ft (3290 m).
USGS 7.5' Quad: Aldrich Basin.
Location: Carter Mountain, ca 1.5 miles NNW of Piney Pass, ca 28 air miles W of Meeteetse in the vicinity of the Carter Triangulation Station.

Occurrence # 011
County: Park.
Legal Description: **T49N R105W S1** (SW4SE4).
Latitude: 44° 14' 22" N (centrum).
North: 44° 14' 23" N.
South: 44° 14' 21" N.
Longitude: 109° 26' 29" N (centrum).
East: 109° 26' 23" N.
West: 109° 26' 36" N.
Elevation: 7200-9200 ft. (2195-2800 m).
USGS 7.5' Quad: Aldrich Basin
Location: NW slope of Carter Mountain, on S side of small, unnamed tributary of Corral Creek, ca 1 mile N of the main stem of Aldrich Creek, ca 2 miles SE of the South Fork Road.

Occurrence # 012.
County: Park.
Legal Description: **T50N R103W S19**

(NW4), **S20** (S2).
Latitude: 44° 17' 25" N (centrum).
North: 44° 17' 40" N.
South: 44° 17' 17" N.
Longitude: 109° 16' 47" W (centrum).
East: 109° 15' 50" W.
West: 109° 17' 25" W.
Elevation: 8900-9400 ft (2715-2865 m).
USGS 7.5' Quad: Belknap Creek.
Location: NE end of Carter Mountain on ridge between Belknap Creek drainage and Carter Mountain Road in the vicinity of Peak "8981", ca 19 air miles SW of Cody.

Occurrence # 013.
County: Park.
Legal Description: **T50N R103W S23-26**.

Latitude: 44° 17' 07" N (centrum).
North: 44° 17' 07" N.
South: 44° 17' 05" N.
Longitude: 109° 12' 35" W (centrum).
East: 109° 11' 20" W.
West: 109° 12' 35" W.
Elevation: 8700-8800 ft (2650-2680 m).
USGS 7.5' Quad: Devils Tooth.
Location: NE end of Carter Mountain, vicinity of Foster Reservoir and ca 1 mile W of Foster Reservoir near the head of Foster Draw.

Occurrence # 016.
County: Park.
Legal Description: **T49N R106W S10** (SE4SE4SE4); **S11** (SW4SW4, NE4 of SW4, SE4 of NW4, NE4NE4); **S12** (SW4); **S15** (N2).
Latitude: 44° 13' 23" N (centrum).
North: 44° 14' 10" N.
South: 44° 13' 05" N.
Longitude: 109° 35' 33" W (centrum).
East: 109° 34' 10" W.
West: 109° 36' 26" W.
Elevation: 9800-10,300 ft (2987-3139

m).
USGS 7.5' Quad: Valley.
Location: South Fork Shoshone River drainage, on summit ridge along Ishawooa Mesa Trail, ca 1.5 air miles S of Ishawooa Creek and ca 28 air miles SW of Cody.

Occurrence # 017.
County: Park.
Legal Description: **T48N R104W S30** (NW4 of SW4 of SE4).
Latitude: 44° 05' 36" N.
Longitude: 109° 23' 25" W.
Elevation: 8700 ft (2650 m).
USGS 7.5' Quad: Irish Rock.
Location: Along the Greybull River Trail just upstream from confluence with Warehouse Creek.

Occurrence # 019.
County: Park.
Legal Description: **T47N R104W S7** (SE4); **S8** (SW4); **S17** (W2) **S20** (NE4).
Latitude: 44° 02' 43" N (centrum).
North: 44° 03' 17" N.
South: 44° 01' 30" N.
Longitude: 109° 22' 25" W (centrum).
East: 109° 21' 35" W.
West: 109° 23' 02" W.
Elevation: 10,200-10,900 ft (3110-3320 m).
USGS 7.5' Quad: Irish Rock and Phelps Mountain
Location: Irish Rock and ridge to the SSE, N and SSE of Haymaker Timber Creek Trail (ca 2 miles W of Phelps Mountain and 3 miles S of the Greybull River).
Occurrence # 022.
County: Hot Springs.
Legal Description: **T45N R100W S2** (E4 of SW4, W4 of SE4, & SE4 of NW4), **S11** (NE4 of NW4 & NE4 of

NW4 of NE4).
Latitude: 43° 53' 42" N (centrum).
North: 43° 53' 54" N.
South: 43° 53' 12" N.
Longitude: 108° 49' 22" W (centrum).
East: 108° 49' 03" W.
West: 108° 49' 27" W.
Elevation: 6600-7400 ft (2010-2255 m).
USGS 7.5' Quad: Adam Weiss Peak.
Location: Ridge ca 1 mile NNW of the
summits of Twin Buttes, ca 35 air
miles W of Thermopolis.

Occurrence # 023.
County: Park.
Legal Description: **T50N R105W S7**
(NE4); **S8** (S2).
Latitude: 44° 19' 00" N.
Longitude: 109° 31' 50" W.
Elevation: 8000-9000 ft (2440-2745 m).
USGS 7.5' Quad: Ptarmigan Mountain.
Location: South Fork Shoshone River

Drainage, Houlihan Creek and ridge to
the southwest on the south side of
Wapiti Ridge.

Occurrence # 024.
County: Hot Springs.
Legal Description: **T46N R100W S27**
(SW4SW4); **S28** (NE4NE4).
Latitude: 43° 55' 51" N (centrum).
North: 43° 55' 53" N.
South: 43° 55' 15" N.
Longitude: 108° 51' 29" W (centrum).
East: 108° 51' 00" W.
West: 108° 51' 29" W.
Elevation: 6800-7100 ft (2075-2165 m).
USGS 7.5' Quad: Adam Weiss Peak.
Location: Ridge N of Enos Creek, ca 1.3
air miles E of Bill Dickie Draw & ca 3-
4 air miles N of Twin Buttes, ca 35 air
miles W of Thermopolis.

E. HABITAT

1. ASSOCIATED VEGETATION: In the Absaroka Range, *Cymopterus evertii* occurs primarily on sparsely vegetated ridges and slopes of coarse, volcanic soils dominated by cushion plants or in openings within forests of Engelmann spruce (*Picea engelmannii*), Douglas-fir (*Pseudotsuga menziesii*), and limber pine (*Pinus flexilis*) (Marriott 1988; Mills and Fertig 1996; Scott 1997). Occasional populations are also found in alpine meadows or alluvial river bottoms. Lower elevation populations in the western Bighorn Basin and foothills of the Owl Creek Mountains occur mostly on sandstone or clay-derived soils in openings in big sagebrush (*Artemisia tridentata*)-Idaho fescue (*Festuca idahoensis*) grasslands or limber pine-Rocky Mountain juniper (*Juniperus scopulorum*) woodlands (Figures 4-5). Colonies may occur in full sun or partial shade, but are usually restricted to rock outcrops with thin soils and low vegetative cover (usually 10-30%) (Fertig 1992).

2. FREQUENTLY ASSOCIATED SPECIES:

Arenaria nuttallii (Nuttall's sandwort)
Artemisia frigida (Fringed sagebrush)
Cymopterus longilobus (Mountain spring-parsley)
Cymopterus terebinthinus (Turpentine spring-parsley)
Elymus elymoides (Bottlebrush squirreltail)
Elymus spicatus (Bluebunch wheatgrass)
Erigeron compositus (Cut-leaved fleabane)
Juniperus scopulorum (Rocky Mountain juniper)
Koeleria macrantha (Prairie junegrass)
Leucopoa kingii (Spikefescue)
Penstemon laricifolius (Larch-leaved beardtongue)
Phlox muscoides (Moss phlox)
Sedum lanceolatum (Lanceleaved stonecrop)

Cymopterus evertii may also co-occur with several rare species, including *Penstemon absarokensis* (Absaroka beardtongue, G2/S2), *Physaria saximontana* var. *saximontana* (Rocky Mountain twinpod, G3T2/S2), and *Haplopappus macronema* var. *linearis* (Narrowleaf goldenweed, G4G5T3/S2).

3. TOPOGRAPHY: *Cymopterus evertii* is typically found on gentle to steep slopes of fellfields, low hills, and ridges on all aspects. Known occurrences range in elevation from 5800-10,900 feet (1760-3320 meters).
4. SOIL RELATIONSHIPS: Occurrences of *Cymopterus evertii* in the Absaroka and Owl Creek mountains are found on coarse, sandy-clay

andesite soils derived from the Eocene-age Absaroka Volcanics Supergroup. Representative formations include the Wiggins, Tepee Trail, Aycross, Sunlight, Trout Peak, and Wapiti. In the Bighorn Basin, populations are found on brown to gray sandstone outcrops of the Paleocene Fort Union and late Cretaceous Lewis Shale formations or reddish-white clays derived from the Aycross Formation (Love and Christiansen 1985). *C. evertii* populations are found mostly on weakly developed inceptisols.

5. REGIONAL CLIMATE: Average annual precipitation ranges from 10 inches (25 cm) in the western Bighorn Basin to 40 inches (100 cm) in the central Absaroka Range (Martner 1986). Mean annual temperature within the range of *Cymopterus evertii* varies from 36-44° F (2.2-4.4° C), with mean maximum and minimum temperatures in January of 28-34 ° F and 4-8° F (- 2.2 to 1° C and – 15.5 to – 13.3° C) and mean maximum and minimum temperatures in July of 74-88°F and 40-54° F (23.3-31.1°C and 4.4-12.2° C) (Martner 1986).
6. LOCAL MICROCLIMATE: Populations of *Cymopterus evertii* are found mostly on semi-barren, wind-exposed rocky ridges and slopes that are locally drier and less vegetated than adjacent slopes.

F. POPULATION BIOLOGY AND DEMOGRAPHY

1. PHENOLOGY: Flowering occurs from May through July, while fruits are present from June through August (Mills and Fertig 1996).
2. POPULATION SIZE AND CONDITION: There are currently 18 known occurrences of *Cymopterus evertii* in Wyoming (consisting of at least 36 subpopulations). Individual populations range in size from less than 10 individuals to “tens of thousands” (Marriott 1988) covering areas of 1 square meter to approximately 50 acres. Based on census data from 1988 and 1998 surveys, the total Wyoming population is conservatively estimated at over 30,000 individuals occupying an area of more than 300 acres. The largest known occurrences are found in the Absaroka Range. The Bighorn Basin population contains only 4800-5600 plants in 120 acres of known habitat.

Populations may consist of widely scattered individuals, or locally dense clusters (especially in shadier sites). Average density on volcanic slopes is 3

Figure 4 (page 19). Habitat of *Cymopterus evertii* on sparsely vegetated sandstone outcrops with scattered *Pinus flexilis* and *Juniperus scopulorum* on the west side of Hillberry Rim (Occurrence # 001), Park County, Wyoming. WYNDD photograph by Laura Welp, 2 July 1998.



plants per square meter, although densities as high as 25 plants per square meter may occur in favorable microsites. Basin populations consist mostly of medium to large plants (with diameters over 3 cm), with relatively few smaller plants or seedlings. This demographic structure suggests that recruitment may be episodic, but individuals are long-lived.

Demographic monitoring plots (Appendix B) were established at two sites in the basin and one site in the foothills in 1998. Preliminary findings suggest that total density ranges from 3.2 to 11.6 plants per square meter, with medium sized (3.1-10 cm diameter) and large (over 10 cm diameter) plants contributing the highest cover and density. Density appeared to increase in sparsely vegetated sites and in areas with shade. No long-term trend data are yet available from these transects, but observations at other sites suggest that many populations have been stable over the last two decades.

Demographic data from currently known Wyoming populations are summarized in Table 2.

3. REPRODUCTIVE BIOLOGY:

- a. TYPE OF REPRODUCTION: *Cymopterus evertii* reproduces sexually by seed.
- b. POLLINATION BIOLOGY: The specific pollinators of *Cymopterus evertii* are not known, although the plant's small white flowers probably attract flies or other small insects.
- c. SEED DISPERSAL AND BIOLOGY: The fruits of *Cymopterus evertii* split into flattened, short-winged mericarps at maturity (Hartman and Kirkpatrick 1986). These fruit segments can be dispersed short distances by the wind, although most fruits probably land in the vicinity of their parents. No information is known about the germination requirements or biology of seedlings, although it is likely that seedling establishment is favored in sparsely vegetated microsites.

Figure 5 (page 21). Habitat of *Cymopterus evertii* in semi-barren openings of reddish-white clays derived from Eocene volcanic deposits within a savanna of *Pinus flexilis*, *Juniperus scopulorum*, and *Artemisia tridentata* on a ridge ca 1 mile north of Twin Buttes (Occurrence # 022), Hot Springs County, Wyoming. WYNDD photograph by Laura Welp, 28 June 1998.



Table 2. Demographic Information for Known Populations of *Cymopterus evertii* in Northwestern Wyoming.

A. Bighorn Basin

Occurrence # 001.
 Area: ca 120 acres (5 subpopulations).
 Number and Age of Plants: 4800-5660 plants estimated by L. Welp in 1998.
 Density: Plants in scattered clumps, locally abundant and patchy.
 Evidence of Reproduction: Ca 10% of population observed in fruit in 1998 and ca 90% vegetative.
 Evidence of Expansion/Contraction: Population has been known since 1981 and is thought to be stable.

Evidence of Expansion/Contraction: Population has not been relocated since 1986.

Occurrence # 004.
 Area: Not reported.
 Number and Age of Plants: Not reported.
 Density: Not reported.
 Evidence of Reproduction: Plants were past fruiting when observed in 1983.
 Evidence of Expansion/Contraction: Not known. Population has not been relocated since 1983.

B. Owl Creek Mountains

Occurrence # 020.
 Area: Not reported.
 Number and Age of Plants: Not known.
 Density: Not reported.
 Evidence of Reproduction: Plants observed in flower and fruit in 1991.
 Evidence of Expansion/Contraction: Population was first discovered in 1991 (Jones and Fertig 1992), but could not be relocated in 1998.

Occurrence # 005.
 Area: 40 + acres (3 subpopulations).
 Number and Age of Plants: Population estimated at 200-300 fruiting and vegetative plants at 2 colonies by Jones (1991).
 Density: Not reported.
 Evidence of Reproduction: Plants observed in fruit in 1982, 1984, and 1990.
 Evidence of Expansion/Contraction: Population has been known since 1982 and is presumed to be stable.

C. Absaroka Range

Occurrence # 002.
 Area: 3+ acres (3 subpopulations).
 Number and Age of Plants: “Hundreds of plants” reported from Jack Creek colony (Sec 4) by Marriott (1988).
 Census data not available for other 2 colonies.
 Density: Not reported.
 Evidence of Reproduction: Plants observed in flower and fruit in 1983.

Occurrence # 006.
 Area: Not reported.
 Density: Not reported.
 Evidence of Reproduction: Plants reported to be in fruit.
 Evidence of Expansion/Contraction: Not known. Population has not been relocated since 1983.

Occurrence # 007
 Area: 10 acres.
 Number and Age of Plants: “Tens of

thousands” of plants reported in 1988 survey by H. Marriott.
Density: Marriott (1988) observed densities ranging from 3 plants per square meter on typical sites to 25 plants per square meter in sandier sites.
Evidence of Reproduction: Plants observed in flower or fruit in 1984, 1988, and 1989.
Evidence of Expansion/Contraction: Population has been known since 1984.

Occurrence # 008
Area: 1 + acres.
Number and Age of Plants: Not reported.
Density: Not reported.
Evidence of Reproduction: Plants observed in fruit in 1983 by R. Kirkpatrick.
Evidence of Expansion/Contraction: Population has not been relocated since 1983.

Occurrence # 010
Area: Not reported.
Number and Age of Plants: Not reported.
Density: Not reported.
Evidence of Reproduction: Plants observed in fruit in 1983.
Evidence of Expansion/Contraction: Population has not been relocated since 1983.

Occurrence # 011.
Area: 5 acres.
Number and Age of Plants: Mix of size and age classes observed in locally abundant population in 1997 (Fertig 1998).
Density: Not reported.
Evidence of Reproduction: Plants observed in flower in 1983 and in fruit

in 1997.
Evidence of Expansion/Contraction: Population has been known since 1983.
Occurrence # 012.
Area: Less than 1 acre.
Number and Age of Plants: “Thousands of plants” reported by Marriott in 1988.
Density: Not known.
Evidence of Reproduction: Plants observed in flower and fruit in 1984 and 1988.
Evidence of Expansion/Contraction: Population has been known since 1984.

Occurrence # 013.
Area: Not reported.
Number and Age of Plants: Number of plants not reported.
Density: Not reported.
Evidence of Reproduction: Plants observed in flower and fruit in 1983.
Evidence of Expansion/Contraction: Population has not been relocated since 1983.

Occurrence # 016.
Area: Not reported.
Number and Age of Plants: Thousands of plants reported by Marriott in 1988.
Density: Not reported.
Evidence of Reproduction: Plants observed in fruit by Rosenthal in 1997.
Evidence of Expansion/Contraction: Population has been known since 1988.

Occurrence # 017.
Area: 1 acre.
Number and Age of Plants: 100-200 plants reported by Marriott in 1988.
Density: Not reported.
Evidence of Reproduction: Not known.

Evidence of Expansion/Contraction:
Population has been known since 1988.

Occurrence # 019.

Area: Not reported.

Number and Age of Plants: Tens of thousands of plants reported by Marriott in 1988.

Density: Not reported.

Evidence of Reproduction: Not reported.

Evidence of Expansion/Contraction:
Population has been known since 1988.

Occurrence # 021.

Area: Not reported.

Number and Age of Plants: Not known.

Density: Not reported.

Evidence of Reproduction: Not reported.

Evidence of Expansion/Contraction:
Population has been known since 1989.

Occurrence # 022.

Area: 30 acres (4 subpopulations).

Number and Age of Plants: 610 reproductive and vegetative plants observed in 1992, total population estimated at 1000 (Fertig 1992). Population estimated at 1200-1500 by Welp in 1998.

Density: ca 500 per ¼ acre.

Evidence of Reproduction: Observed in flower, fruit, and vegetative condition in 1992.

Evidence of Expansion/Contraction:

Population has been known since 1992 and is thought to be stable to increasing.

Occurrence # 023.

Area: Not reported.

Number and Age of Plants: Not known.

Density: Not reported.

Evidence of Reproduction: Some plants observed in flower and fruit in 1996.

Evidence of Expansion/Contraction:
Population was discovered in 1996 (Rosenthal 1998).

Occurrence # 024.

Area: 5 acres (3 subpopulations).

Number and Age of Plants: 564 plants observed by Welp.

Density: Plants clumped in areas ranging from 1 square meter to 1500 square meters.

Evidence of Reproduction: 20% of the population observed in fruit and 80% vegetative in 1998.

Evidence of Expansion/Contraction:

Population first discovered in 1992 and resurveyed in 1998. Probably stable.

G. POPULATION ECOLOGY

1. GENERAL SUMMARY: Populations of *Cymopterus evertii* typically consist of locally clustered to widely scattered individuals restricted to semi-barren rocky slopes or openings within conifer woodlands, alpine meadows, or sagebrush grasslands. Individual populations may range in size from 10 to tens of thousands of plants in areas of 1 square meter to 50 acres. Densities vary from 3 to 11 plants per square meter, depending on surrounding vegetation cover and habitat suitability. Colonies studied in 1998 most often contained medium to large sized plants (over 3 cm in diameter), with few smaller plants, suggesting that reproduction may be sporadic and that plants are long-lived once established.
2. COMPETITION: Many large populations of *Cymopterus evertii* are found on open ridgecrests and slopes where competing vegetation is short and sparse. Demographic plot data indicate that densities are highest on less vegetated sites. This species may be better adapted to colonize or persist in rocky, barren sites than other species or is a poor competitor in more favorable habitats.
3. HERBIVORY: No evidence of herbivory by livestock or other large grazers was observed during surveys in 1998.
4. HYBRIDIZATION: No hybrids involving *Cymopterus evertii* and its close relative, *C. nivalis*, have been documented in Wyoming. Occasional *evertii* specimens in the Bighorn Basin may appear to have glabrate fruits (like *nivalis*), but this is thought to be the result of abrasion by wind-blown grit rather than hybridization (Hartman and Kirkpatrick 1986).

H. LAND OWNERSHIP

1. BLM: Six occurrences of *Cymopterus evertii* are found on BLM lands in the Worland District (Bighorn Basin and Cody resource areas). Two of these populations (# 005 and 008) occur within the Carter Mountain Area of Critical Environmental Concern (Jones 1991; Fertig 1998). All other BLM populations are on lands managed for multiple use (# 001, 020, 022, and 024).
2. US Forest Service: Twelve occurrences are on lands managed by Shoshone National Forest in the Greybull (# 002, 004, 006, 010, 013, and 017) and Wapiti (# 007, 011, 012, 016, 021, and 023) Ranger Districts. Six of these populations are protected within the Washakie Wilderness (Fertig 1998). The remaining Forest Service populations are on lands managed for multiple use.

IV. ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

A. POTENTIAL THREATS TO CURRENTLY KNOWN POPULATIONS:

The restricted geographic range and habitat specificity of this species makes it vulnerable to large scale natural and human induced disturbances. The following potential threats were observed during 1998 surveys or have been reported in the literature:

1. **MINERAL DEVELOPMENT:** The western rim of the Bighorn Basin and adjacent foothills of the Absaroka and Owl Creek ranges is a major oil and natural gas field. All BLM lands within the range of *Cymopterus evertii* are open to exploration and development of leaseable minerals, with some mitigation requirements and seasonal restrictions for big game winter range and calving in the Carter Mountain ACEC (USDI Bureau of Land Management 1990, 1996). Most populations are on rocky outcrops that are unlikely locations for well pads and roads, but colonies on semi-barren openings on sagebrush slopes could be potentially impacted by development.
2. **GRAZING:** BLM lands occupied by *C. evertii* (including the Carter Mountain ACEC) are managed for grazing by livestock. No evidence of direct herbivory has been observed on these plants, although populations could potentially be affected by trampling or competition from invading weeds in disturbed areas. Livestock usage of *C. evertii* habitat appears to be low, however, due to the lack of available water and sparse forage.
3. **RECREATION:** Impacts from off-road vehicle (ORV) recreation is a potential threat to low elevation populations on BLM lands and to some colonies on Carter Mountain. ORV use is technically restricted to existing roads in the Carter Mountain area and on BLM lands in the foothills of the Owl Creek and Absaroka mountains (Occurrences 020, 022, & 024), although formation of new roads is always a potential problem. Impacts from hikers and pack horses is also a potential threat to some populations found near trails on Shoshone National Forest. Overall, these impacts are probably low due to the rugged, and poorly accessible habitats occupied by most populations of this species.

B. **MANAGEMENT PRACTICES AND RESPONSE:** No experimental data exist on the response of this taxon to management actions.

C. CONSERVATION RECOMMENDATIONS:

1. **RECOMMENDATIONS REGARDING PRESENT OR ANTICIPATED ACTIVITIES:** Most populations of *Cymopterus evertii* are relatively secure at present due to their location in rugged, inaccessible habitats.

Lower elevation populations near existing oil and gas fields are probably the most vulnerable to surface disturbances. These populations are found mostly in sandstone outcrops and sparsely vegetated openings in sagebrush grasslands that can be avoided if populations are detected early enough during the planning process. Development of new roads or recreation areas should be avoided in habitats directly occupied by this species.

2. AREAS RECOMMENDED FOR PROTECTION: At least eight occurrences of *Cymopterus evertii* are currently protected within the Washakie Wilderness and the Carter Mountain Area of Critical Environmental Concern (Fertig 1998). The population on BLM lands north of Twin Buttes (Occurrence # 022) has good potential for special management status due to the presence of this species and *Physaria saximontana* var. *saximontana*, another locally endemic plant species (Fertig 1992).

D. STATUS RECOMMENDATIONS: Due to its local abundance and low threats in the Absaroka Range, *Cymopterus evertii* was dropped as a candidate for federal listing under the Endangered Species Act in 1990 and for Sensitive status on Shoshone National Forest (Marriott 1988). Fertig (1992) also recommended against BLM Sensitive status, although periodic monitoring of populations on BLM lands was suggested. More recent surveys suggest that populations continue to be stable and that sensitive designation is not necessary at the present time. Due to the plants limited range, however, monitoring should continue so that possible future downward trends can be detected early and appropriate management responses can be formulated.

V. SUMMARY: *Cymopterus evertii* is a regional endemic of northwestern Wyoming and northeastern Utah. Rangewide, the species is known from approximately 20 occurrences, 18 of which are currently recognized in the Absaroka and Owl Creek mountains and western Bighorn Basin in Hot Springs and Park counties, Wyoming. Based on surveys in 1988 and 1996-98, the current Wyoming population is conservatively estimated at over 30,000 individuals in over 300 acres of habitat. *C. evertii* typically occurs on sparsely vegetated, montane or alpine rocky slopes and ridgetops of volcanic andesitic soils in the Absaroka and Owl Creek ranges or in openings in sandstone ridges or knolls within limber pine/Rocky Mountain juniper or big sagebrush/Idaho fescue communities in the Bighorn Basin. Populations at higher elevations are largely protected by their ruggedness and inaccessibility, while those in the Bighorn Basin are potentially threatened by development associated with oil and gas development and recreation. At least 8 populations are currently protected in the Washakie Wilderness on Shoshone National Forest or in the BLM Carter Mountain ACEC. This species was formerly a candidate for listing under the Endangered Species Act, but was dropped from consideration due to its low threats and local

abundance in the Shoshone National Forest. Although it does not warrant Sensitive designation on BLM lands at present, the plant's small range and specialized habitat makes it sufficiently vulnerable that it should continue to be monitored for potential downward trends in the future.

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Appendix A.

Element Occurrence Records and Population Maps
for *Cymopterus evertii*

Appendix B.

Demographic Monitoring Data for *Cymopterus evertii*

Transect Locations:

Transect # 1

County: Hot Springs.

Occurrence: # 001.

Legal Description: T48N R99W S34 SE4 of SW4 of NE4.

Orientation: 307° WNW.

USGS Quad: Hillberry Rim.

Directions: Drive about 1.5 miles along Squaw Teats Road to the beginning of the second large bend in the road (Slide 1; also see map). Walk north along the bottom of the ridge to a small forked tree on top of a white boulder (Slide 2). From the tree, walk upslope at 29° NW to a small bent limber pine on the horizon (Slide 3, middle tree). The origin of the transect is located at the base of the west side of the tree. The transect runs upslope parallel to the top of the ridge for 50 meters. Both the origin (Slide 4) and the end point (Slide 5) are marked by orange-tipped re-bar and a small pile of stones.

Habitat: Open rocky sandstone ridge with coarse sandy soil. Community of scattered *Juniperus scopulorum*, *Pinus flexilis*, and *Artemisia tridentata* var. *vaseyana* with a sparse understory of scattered *Penstemon laricifolius*, *Phlox muscoides*, and *Elymus spicatus*. Total vegetative cover is low.

Comments: Transect represents typical population density for the area. Plants seemed to be more abundant under trees, where it was shady and vegetation cover was low. Part of the transect was set among trees and part in the open to document differences in species density between shaded and unshaded plots.

Transect # 2

County: Hot Springs.

Occurrence: # 001.

Legal Description: T47N R99W S13 SW4 of SW4 of NE4.

Orientation:. About 360° N.

USGS Quad: Hillberry Rim.

Directions: In same general location as Transect # 1, but located farther south. Drive east from State Hwy 120 down unmaintained BLM road (see map for Occ. # 001, T47N R99W S24). Road crosses stream and may be impassable from this point on. Cross stream and walk ca. 0.5 miles down road to junction of two-tracks. Walk east about 0.3 miles toward Hillberry Rim (Slides 6 and 7; also see map). Walk to the base of the sandstone outcrop, visible from base of rim (Slide 8). Follow small drainage up to first plateau (Slide 9) and stand on flat rock on north side of large juniper tree (Slide 10). Walk upslope 68 paces at 100° to the largest dead tree on the horizon (Slide 10). From this dead tree, walk about 15 feet southeast to smaller dead tree (Slide 11). Walk 31 paces at 110° across rim to *Pinus flexilis* (Slide 12). Origin is on north side of tree (Slide 13, middle of photo) and transect roughly parallels ridge (dips slightly downslope toward

end of transect). Both the origin (Slide 13) and the end point (Slide 14) are marked by orange-tipped re-bar and a small pile of stones.

Habitat: Open gentle slightly north-facing slope near top of ridge on coarse sandy soil with sandstone outcrops and boulders. Soil is light-gray to white and light orange.

Sparsely vegetated cushion plant community of *Cymopterus evertii*, *Elymus spicatus*, *Phlox muscoides*, *Penstemon laricifolius*, and *Eriogonum*. Overstory of scattered *Pinus flexilis* and *Juniperus scopulorum*. In some places, *Cymopterus evertii* dominates the forb layer. The population here seems to be confined to the steeper, drier, west-facing part of the slope rather than the gentler, more vegetated areas to the east. Species density seems to diminish from north to south along the rim.

Comments: Exact compass orientation of transect was inadvertently not noted and should be recorded on a subsequent visit. The transect was located here due to relative ease of access.

Transect # 3

County: Hot Springs.

Occurrence: # 022.

Legal Description: T46N R100W S28 SW4 of NE4 of NE4.

Orientation: 29° NNE.

USGS Quad: Adam Weiss Peak.

Directions: Drive west on BLM road 1303 along Enos Creek to two-track on north side of road (see map (T46N R100W S27)). Follow two-track up to ridgetop and turn west (Slide 15). Follow faint two-track along ridge ca. 0.5 mile. Path will pass through a stand of trees and then open out to a dip in the ridge. There is a large dead tree near fence where the ridge begins to rise again (Slide 16). Walk to the west side of this tree. The end of the transect is 7 paces away at 328° near a fence post. From the endpoint, walk 30 meters at 219° to the origin. Both the origin (Slide 17) and the end point (Slide 18) are marked by orange-tipped re-bar and a small pile of stones.

Habitat: Crest of rocky sandstone ridge in coarse sandy soil in open *Pinus flexilis*/*Artemisia tridentata* var. *vaseyana* savanna with *Juniperus scopulorum*. Common forbs include *Sedum lanceolatum*, *Potentilla*, *Antennaria rosea*, *Erigeron compositus*, and *Koeleria macrantha*. Soil is very red.

Comments: This population was chosen because it was higher in the foothills so it provided a contrast with the lower elevation plots. It also had more reproducing plants than the other two plots, and it was fairly accessible compared to other locations in the foothills. After the plot was established and read, a faint two-track was noticed running through the middle of the population.

Sampling Method

Two 50 x 0.5 meter and one 30 x 0.5 meter permanent belt transects were established following the general protocol of Lesica (1987). *Cymopterus evertii* is so small that the 1 x 1 square meter plots used by Lesica would be too impractical, so they were modified to 0.5 x 1 meter plots, with the long side parallel to the tape. The transect was read from the origin to the endpoint in 1 meter increments on the left side of the tape. Origins and

endpoints were photographed and marked by orange re-bar and low rock piles. Directions to the transects were written and photos were taken of the route to each transect.

In each plot, data were collected on percent vegetative cover and number of individual plants in each of three age/size classes: Small (1-3 cm. in diameter); Medium (3.1-10 cm. diameter); and Large (>10 cm in diameter). Diameters were measured across the top of the largest part of the canopy. Size apparently does not always correspond to reproductive capacity in this species, since some plants in the Small range bore evidence of past fruiting/flowering. Therefore, categories could not be based on life stage, although it is assumed that the smaller plants are younger. The number of Reproductive plants was recorded, along with the number of fruiting heads on each plant. Dead plants of any size class were noted.

It was suspected that shading might influence *Cymopterus evertii* populations in some way, so a coarse, subjective evaluation of the amount of shade falling on each plot during the midpoint of the day was estimated by judging how much overstory canopy was directly above the plot. S = plot is shaded during midpoint of day; P = plot is partially shaded during midpoint of day; U = plot unshaded during midpoint of day.

Clusters of individuals were recorded as one plant on the data sheets, since individual plants could not be distinguished without digging up the cluster. The diameter of each cluster was recorded on the data sheet approximately where it occurred spatially in the plot. The number of fruiting heads on reproductive individuals was recorded as a subscript under the diameter and the two numbers were circled. The percent vegetative cover and the level of shade was recorded in a box within each plot.

Summary of Results:

	Plot 1	Plot 2	Plot 3
Total density/m ²	3.2	5.84	11.6
Density of Small/m ²	0.76	2.16	1.92
Density of Medium m ²	1.4	1.96	5.6
Density of Large/m ²	1.04	1.72	4.0
Density of Reproductive/m ²	0.24	0.04	1.26
Reproductive plants by class size (Small, Medium, Large)	0 Sm; 3 Med; 3 Lg	0 Sm; 0 Med; 1 Lg	0 Sm; 5 Med; 17 Lg.
# plants in Shaded, Partially shaded, and Unshaded plots	no data	S54; P52; U40	S27; P112; U36

Total density ranges from 3.2-11.6 plants per square meter, with higher densities observed at higher elevation sites.

Density of Small clusters varies from 0.76-2.16 plants per square meter.

Density of Medium clusters range from 1.4-5.6 plants per square meter.

Density of Large clusters range from 1.04-4.0 plants per square meter.

Reproductive plants, which are mostly in the Large size category, range from 0.04-1.26 plants per square meter.

Because this is the first year of sampling, no estimates of population trends can be made.

Discussion/Recommendations

All three transects have a mix of size classes, suggesting that reproduction is taking place. Although one transect only had one fruiting plant this year, there was evidence of past fruiting and flowering in all plots. Total density is highest in the mountain plot, with nearly twice as many plants per square meter as the lower elevation plots. Densities of Small and Large clusters and Reproductive plants were highest here as well, with 16 times more reproductive plants than in the lower elevation plots. Although these results are not significant, they may be a preliminary indication that the higher elevation mountain habitat, which constitutes most of the species range, is more favorable than the lower elevation habitat on the periphery of the range. Moisture level or substrate may be key variables determining species distribution, but this must be studied more intensively to move beyond the level of conjecture.

Two microhabitat variables that influence local distribution of plants are shade and vegetation cover. It was subjectively observed in all populations that plants were more abundant in areas with less vegetative cover. Another, less consistent observation was that plants (especially the smaller, younger individuals) were more abundant under trees than out in the open. Larger plants would be found both under shade and in less shaded areas. This was often true for low elevation populations on the periphery of the range; however, in other areas at higher elevations in the mountains, population density was more correlated with low vegetation cover than amount of shade. For example, Occ. # 022 had many clusters of plants in bare spots in meadows in full sun. This may indicate that the higher elevation sites are more mesic, and plants can tolerate more sun than those in the lower, more xeric sites.

Plots of 0.5 square meter are an appropriate size to quickly estimate density of *C. evertii* populations. Most plots took from 1-2 hours to read. An effort was made to place plots in accessible areas within a mile or two of a road. These plots should be re-measured annually or biennially until a trend is established, at which time monitoring could be less frequent. Establishment of additional transects would be desirable, perhaps with an effort to distribute plots along the range of the species habitat.

Cymopterus evertii
Transect # 1 Census Data

Date: 30 June 1998
Surveyor: Laura Welp
Length: 50 meters

Plot #	Total # individ.	# Small (1-3 cm dia.)	# Medium (3.1-10 cm dia.)	# Large (> 10.1 cm dia.)	# Reprod	Cm. dia. / # fruiting heads of reprod. plants	# Dead	%Veg Cov	Shaded*
1	4	0	1	3	0		0	15	S
2	7	1	3	3	0		0	25	S
3	10	2	8	0	0		0	25	P
4	0	0	0	0	0		0	nd	nd
5	1	0	0	1	0		0	15	U
6	0	0	0	0	0		0	nd	nd
7	0	0	0	0	0		0	nd	nd
8	0	0	0	0	0		0	nd	nd
9	0	0	0	0	0		0	nd	nd
10	0	0	0	0	0		0	nd	nd
11	0	0	0	0	0		0	nd	nd
12	0	0	0	0	0		0	nd	nd
13	0	0	0	0	0		0	nd	nd
14	0	0	0	0	0		0	nd	nd
15	0	0	0	0	0		0	nd	nd
16	2	0	0	2	0		0	15	U
17	2	0	1	1	1	19/1	0	25	P
18	7	2	5	0	1	9/1	0	15	S
19	6	0	4	2	3	8/1; 25/3; 19/1	0	35	S
20	1	0	1	0	0		0	15	P
21	0	0	0	0	0		0	0	U
22	6	0	5	1	1	8/2	0	20	U
23	0	0	0	0	0		0	nd	nd
24	0	0	0	0	0		0	nd	nd
25	0	0	0	0	0		0	nd	nd
26	0	0	0	0	0		0	nd	nd
27	0	0	0	0	0		0	nd	nd
28	3	0	3	0	0		0	10	U
29	0	0	0	0	0		0	0	U
30	3	1	1	1	0		0	15	U
31	8	5	2	1	0		0	25	U
32	0	0	0	0	0		0	nd	nd
33	0	0	0	0	0		0	nd	nd
34	0	0	0	0	0		0	nd	nd
35	0	0	0	0	0		0	nd	nd
36	1	0	1	0	0		0	25	U
37	4	3	1	0	0		0	35	U
38	8	4	4	0	0		0	20	U
39	4	2	1	0	0		0	25	U

Plot #	Total # individ.	# Small (1-3 cm dia.)	# Medium (3.1-10 cm dia.)	# Large (> 10.1 cm dia.)	# Reprod	Cm. dia. / # fruiting heads of reprod. plants	# Dead	%Veg Cov	Shaded*
40	3	1	1	1	0		0	20	U
41	0	0	0	0	0		0	nd	nd
42	0	0	0	0	0		0	nd	nd
43	0	0	0	0	0		0	0	U
44	0	0	0	0	0		0	10	U
45	0	0	0	0	0		0	nd	nd
46	0	0	0	0	0		0	nd	nd
47	0	0	0	0	0		0	nd	nd
48	0	0	0	0	0		0	nd	nd
49	0	0	0	0	0		0	nd	nd
50	0	0	0	0	0		0	nd	nd
TOT	80	19	35	26	6		0	x = 21%	

Total # of plants per 0.5 meter:

Small (1-3 cm dia) per 0.5 meter: 0.38

Medium (3.1-10 cm dia) per 0.5 meter: 0.70

Large (10.1-24 cm dia) per 0.5 meter: 0.52

Reproductive plants per 0.5 meter: 0.12;

Reproductive plants by size class: 0 Small, 3 Medium, and 3 Large

Total # plants per square meter: 3.2

Small (1-3 cm dia) per square meter: 0.76

Medium (3.1-10 cm dia) per square meter: 1.4

Large (10.1-24 cm dia) per square meter: 1.04

Reproductive plants per square meter: 0.24

Reproductive plants by size class: 0 Small, 3 Medium, and 3 Large

Comments:

1) One individual seen flowering off of plot.

2) A small caterpillar seen on leaves of one plant in plot.

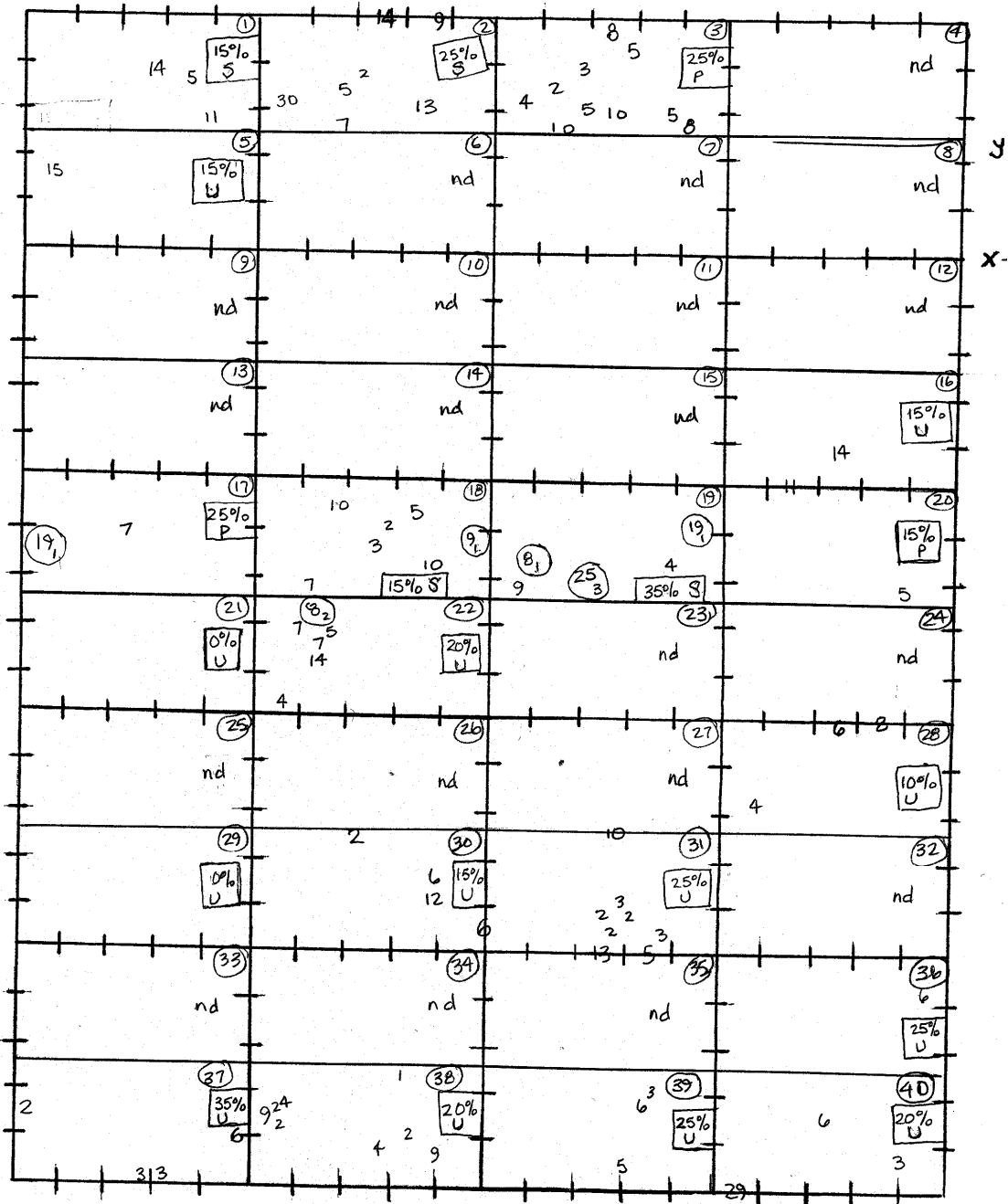
3) Many plants had fruiting stalks from previous year.

4) The vegetation cover and shade status for plots with no *Cymopterus evertii* was not recorded, and should be on subsequent readings. No inferences can be drawn about vegetative cover or shade from this plot.

* S = plot is shaded during midpoint of day; P = plot is partially shaded during midpoint of day; U = plot unshaded during midpoint of day.

S = 24 plants in 4 plots; P = 13 plants in 3 plots; U = 43 plants in 15 plots.

Transect # 1

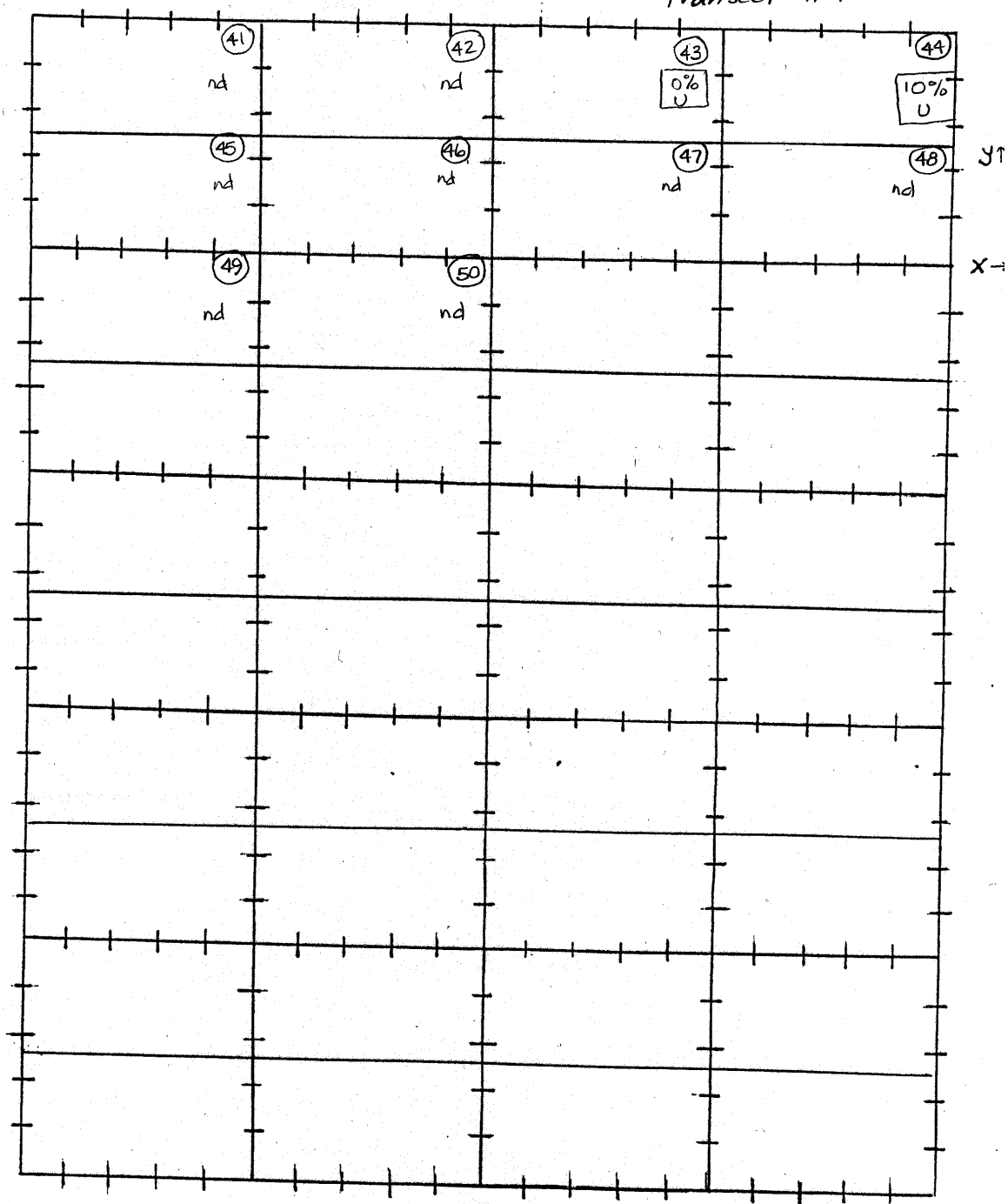


Target Species: *Cymopterus evertii*
 Surveyor: Laura Welp
 Legal Desc.: T48N R99W S34 SE4 of SW4 of NE4
 Orientation: 307°

Date: 6/30/98
 Quad: Hillberry Rim
 - one plant in flr off plot

Notes:
 - small caterpillar on lvs of one Cy ev
 - Many plants had frt stalks from previous years.

Transect #1



Target Species: *Cymopterus everfi*
Surveyor: Laura Welp
Legal Desc.:
Orientation: 307°
Notes:

Date: 6/30/98
Quad: Hill berry Rim

Cymopterus evertii

Transect # 2 Census Data

Date: 2 July 1998

Surveyor: Laura Welp

Length: 50 meters

Plot #	Total # plants	# Small (1-3 cm dia.)	# Medium (3.1-10 cm dia.)	# Large (> 10.1 cm dia.)	# Reprod.	Cm. dia / # fruiting heads of reprod. plants	# Dead	%Veg Cov	Shaded*
1	11	7	1	3	1	19 / 1	0	35	S
2	3	1	1	1	0		0	25	P
3	4	0	3	0	0		0	25	U
4	0	0	0	0	0		0	10	U
5	0	0	0	0	0		0	20	U
6	0	0	0	0	0		0	15	U
7	1	0	0	1	0		0	15	U
8	0	0	0	0	0		0	20	U
9	0	0	0	0	0		0	15	U
10	0	0	0	0	0		0	15	U
11	0	0	0	0	0		0	20	U
12	0	0	0	0	0		0	20	0
13	0	0	0	0	0		0	10	U
14	0	0	0	0	0		0	10	U
15	0	0	0	0	0		0	15	U
16	0	0	0	0	0		0	15	U
17	4	1	2	1	0		0	25	P
18	5	1	2	2	0		0	25	P
19	8	1	5	2	0		0	25	P
20	4	3	0	1	0		0	10	U
21	2	1	1	0	0		0	5	P
22	0	0	0	0	0		0	0	S
23	1	0	1	0	0		0	5	S
24	3	2	1	0	0		0	10	P
25	1	0	0	1	0		0	15	U
26	2	0	1	1	0		0	15	U
27	0	0	0	0	0		0	10	U
28	1	0	0	1	0		0	15	U
29	0	0	0	0	0		0	20	U
30	0	0	0	0	0		0	5	U
31	0	0	0	0	0		0	10	U
32	0	0	0	0	0		0	20	U
33	0	0	0	0	0		0	15	U
34	1	0	1	0	0		0	10	U
35	0	0	0	0	0		0	15	U
36	3	0	2	1	0		0	15	U
37	4	0	3	1	0		0	20	P
38	4	0	3	1	0		0	15	S
39	7	4	1	2	0		0	25	P
Plot #	Total # plants	# Small (1-3 cm dia.)	# Medium (3.1-10 cm dia.)	# Large (> 10.1 cm dia.)	# Reprod.	Cm. dia / # fruiting heads of reprod. plants	# Dead	%Veg Cov	Shaded*

		dia.)	cm dia.)	cm dia.)		reprod. plants			
40	2	0	0	2	0		0	35	U
41	4	0	3	1	0		0	25	U
42	3	0	1	2	0		0	25	U
43	2	0	1	1	0		0	20	U
44	8	2	4	2	0		0	25	P
45	6	3	2	1	0		0	20	P
46	2	0	2	0	0		0	10	P
47	12	4	5	3	0		0	0	
48	2	1	0	1	0		0	10	S
49	12	4	8	0	0		0	30	S
50	24	21	2	1	0		0	35	S
TOT	146	54	49	43	1		0	x = 17%	

Total # of plants per 0.5 meter: 2.92

Small (1-3 cm dia) per 0.5 meter: 1.08

Medium (3.1-10 cm dia) per 0.5 meter: 0.98

Large (10.1-24 cm dia) per 0.5 meter: 0.86

Reproductive plants per 0.5 meter: 0.02

Reproductive plants by size class: 0 Small, 0 Medium, 1 Large

Total # of plants per square meter: 5.84

Small (1-3 cm dia) per square meter: 2.16

Medium (3.1-10 cm dia) per square meter: 1.96

Large (10.1-24 cm dia) per square meter: 1.72

Reproductive plants per square meter: 0.04

Reproductive plants by size class: 0 Small, 0 Medium, 1 Large

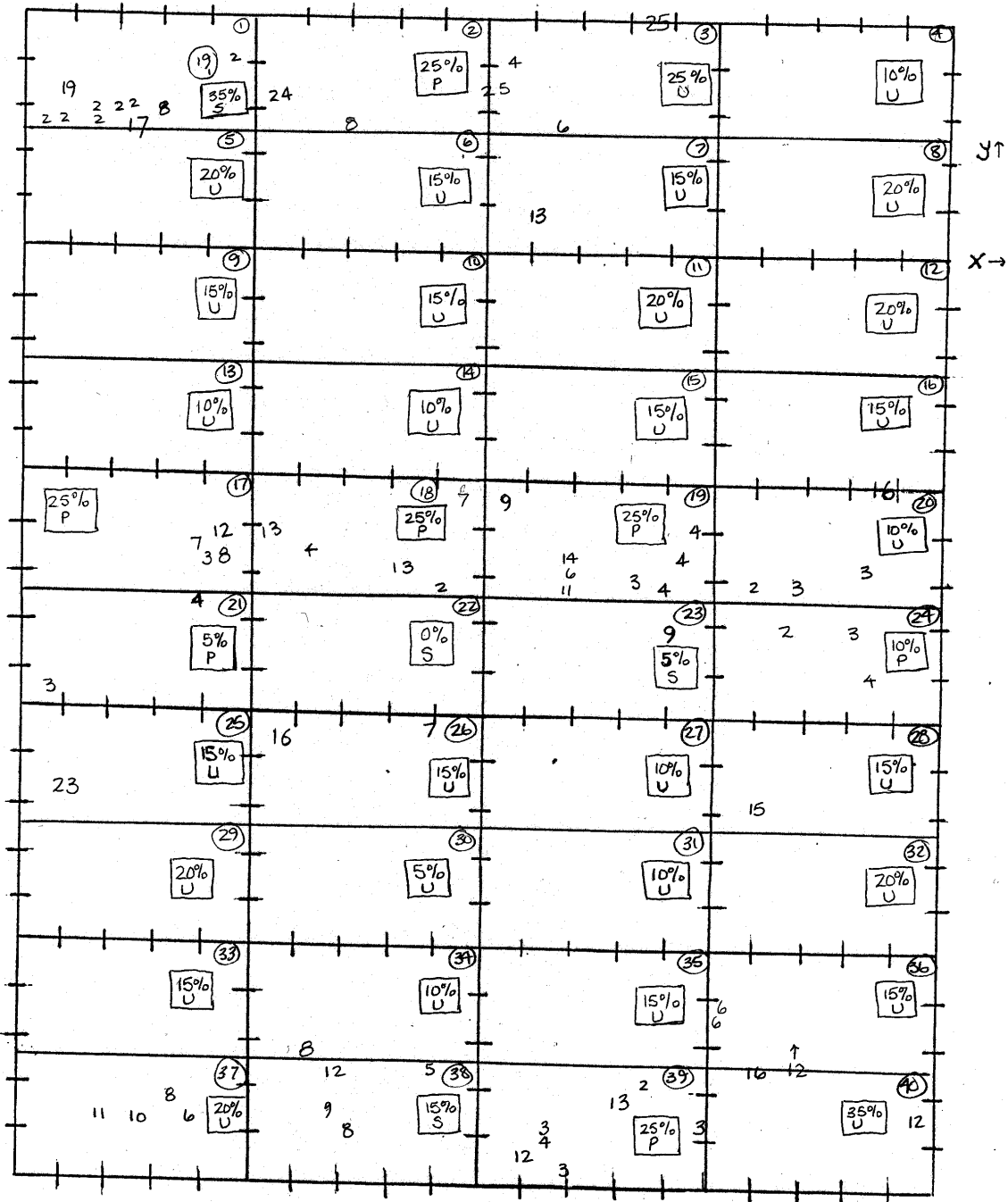
Comments:

The results of the 0.5 x 1 meter plots were multiplied by 2 to report results by square meter.

* S = plot is shaded during midpoint of day; P = plot is partially shaded during midpoint of day; U = plot unshaded during midpoint of day.

S = 18 plants in 5 plots; P = 64 plants in 12 plots; U = 64 plants in 33 plots

Transect #2



Target Species: *Cymopterus evertii*

Surveyor: Laura Welp

Legal Desc.: T47N R99W S13 SW4 of SW4 of NE4

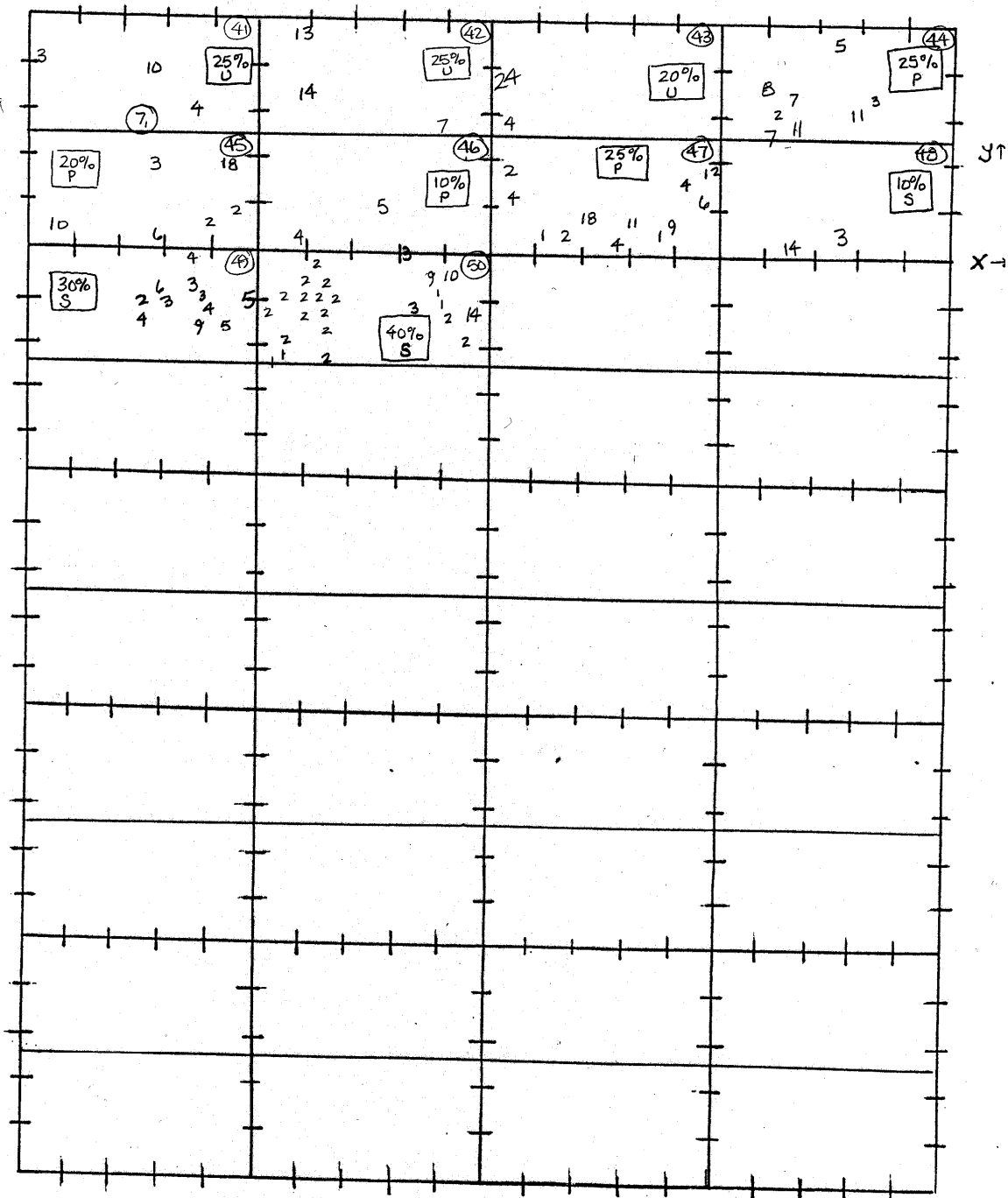
Orientation: ~ 360°N

Notes:

Date: 7/2/98

Quad: Hillberry Rim

Transect #2



Target Species: *Cymopterus evertii*
 Surveyor: Laura Welp
 Legal Desc.:
 Orientation: ~ 360°N
 Notes:

Date: 7/2/98
 Quad: Hilberry Rim

Cymopterus evertii
Transect # 3 Census Data

Date: 4 July 1998
Surveyor: Laura Welp
Length: 30 meters

Plot #	Total # plants	# Small (1-3 cm dia.)	# Medium (3.1-10 cm dia.)	# Large (> 10.1 cm dia.)	# Reprod./ (cm. dia-# friting heads)	Cm. dia / # fruiting heads of reprod. plants	# Dead	%Veg Cov	Shaded? *
1	0	0	0	0	0		0	0	S
2	2	0	0	2	1	12/4	0	25	S
3	9	0	4	5	1	20/11	0	25	S
4	4	0	0	4	1	93/6	0	50	S
5	1	0	0	1	1	13/1	0	60	P
6	3	0	1	2	0	0	0	60	P
7	0	0	0	0	0	0	0	15	S
8	1	1	0	0	0	0	0	<1	S
9	4	1	1	2	0	0	0	30	S
10	4	0	1	2	2	15/2; 12/5	0	20	S
11	3	0	1	2	0	0	0	65	S
12	1	0	0	1	1	16/1	0	30	P
13	2	0	1	1	1	13/1	0	25	P
14	0	0	0	0	0	0	0	15	U
15	0	0	0	0	0	0	0	35	U
16	0	0	0	0	0	0	0	20	U
17	1	0	1	0	0	0	0	35	U
18	0	0	0	0	0	0	0	25	U
19	0	0	0	0	0	0	0	20	U
20	2	0	1	1	1	11/2	0	55	U
21	0	0	0	0	0	0	0	70	U
22	3	0	2	1	1	15/1	0	75	U
23	2	0	1	0	1	10/3	0	75	U
24	2	0	2	0	0	0	0	40	P
25	7	0	1	6	3	11/4;11/1; 15/1	0	20	U
26	21	4	11	6	3	5/2; 20/7; 21/3	0	45	U
27	19	4	11	4	0	0	0	30	P
28	31	7	20	4	2	9/1; 22/5	0	45	P
29	31	8	22	1	2	10/1; 8/1	0	25	P
30	22	4	12	6	1	13/1	0	30	P
TOT	175	27	86	61	19		0	x = 28%	

Total # of plants per 0.5 meter: 5.8
 # Small (1-3 cm dia) per 0.5 meter: 0.96
 # Medium (3.1-10 cm dia) per 0.5 meter: 2.8
 # Large (10.1-24 cm dia) per 0.5 meter: 2.0
 # Reproductive plants per 0.5 meter: 0.63
 # Reproductive plants by size class: 0 Small, 5 Medium, 17 Large

* Y = plot is shaded during midpoint of day; P = plot is partially shaded during midpoint of day; N = plot unshaded during midpoint of day.

Total # of plants per square meter: 11.6

Small (1-3 cm dia) per square meter: 1.92

Medium (3.1-10 cm dia) per square meter: 5.6

Large (10.1-24 cm dia) per square meter: 4.0

Reproductive plants per square meter: 1.26

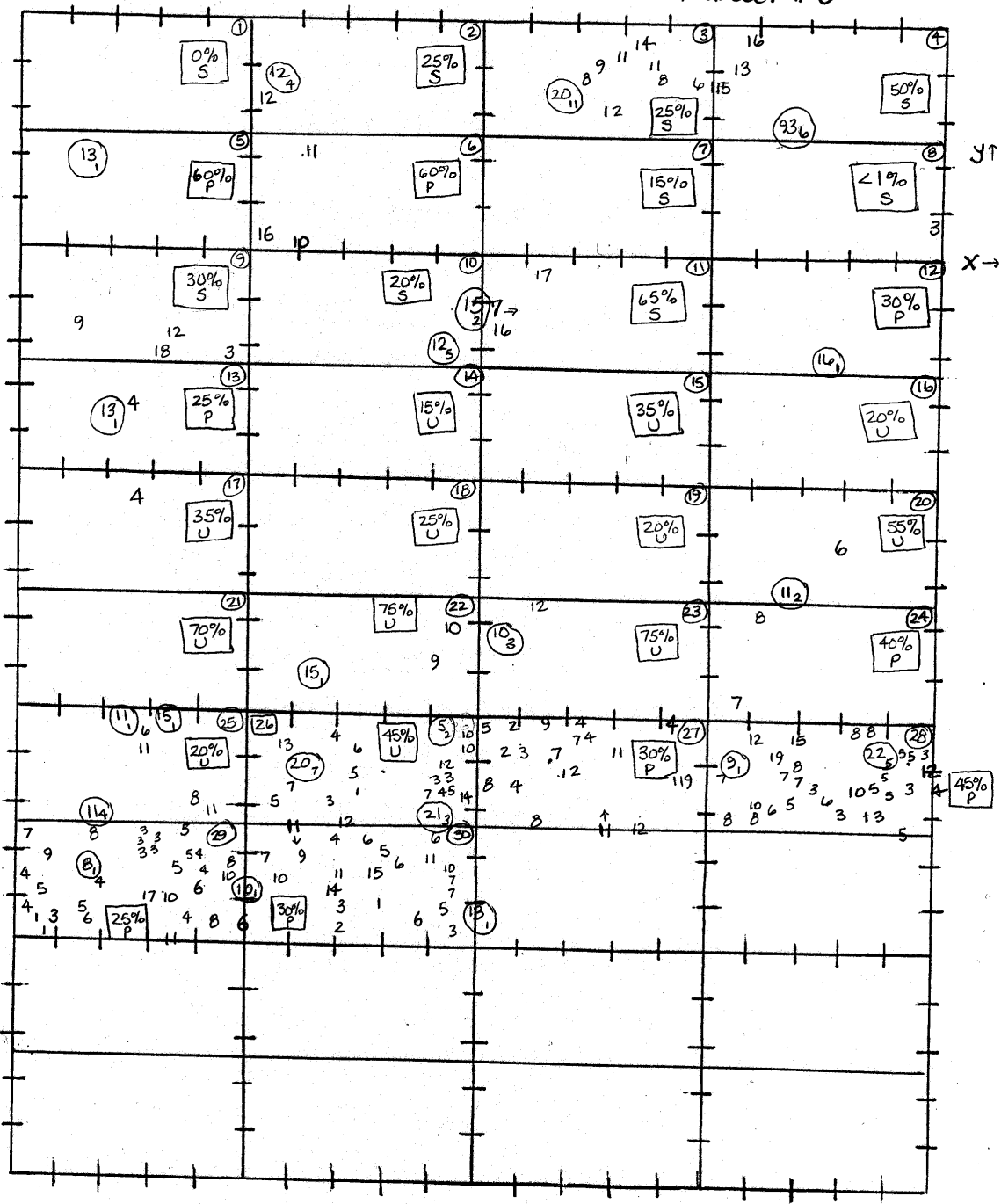
Comments:

The results of the 0.5 x 1 meter plots were multiplied by 2 to report results by square meter.

* S = plot is shaded during midpoint of day; P = plot is partially shaded during midpoint of day; U = plot unshaded during midpoint of day.

S = 27 plants in 9 plots; P = 112 plants in 9 plots; U = 36 plants in 12 plots

Transect #3



Target Species: *Cymopterus evertii*
 Surveyor: Laura Welp Date: 7/4/98
 Legal Desc.: T46N R100W S28 SW4 of NE4 of NE4 Quad: Adam Weiss Peak
 Orientation: 29° NNE
 Notes:

