Darrach, M.E. and C.E. Hinchliff. 2014. *Lomatium tarantuloides* (Apiaceae), a new narrowly endemic species from northeast Oregon. Phytoneuron 2014-27: 1–8. Published 18 February 2014. ISSN 2153 733X

LOMATIUM TARANTULOIDES (APIACEAE), A NEW NARROWLY ENDEMIC SPECIES FROM NORTHEAST OREGON

MARK E. DARRACH*
Herbarium, Burke Museum of Natural History and Culture
University of Washington
Seattle, Washington 98195
corydalis_mark@earthlink.net
mdarrach@fs.fed.us
*present address:
Umatilla National Forest
72510 Coyote Road
Pendleton, Oregon 97801

CODY E. HINCHLIFF
Dept. of Ecology and Evolutionary Biology
University of Michigan
Ann Arbor, Michigan 48109
cody.hinchliff@gmail.com

ABSTRACT

Lomatium tarantuloides Darrach & Hinchliff, **sp. nov.**, is a narrow endemic of conservation concern growing primarily in shallow, gravelly, serpentine-derived soils in a small area of the Malheur, Umatilla, and Wallowa-Whitman National Forests in Grant County of northeastern Oregon. The species is distinguished from other members of the genus by leaf morphology, prostrate inflorescences and infructescences, fruit shape, and pedicel length. The presently recognized populations are primarily confined to small patches within a several km^2 area in the higher elevations of the Greenhorn Mountains in the Blue Mountain physiographic province. Populations are of densely clustered plants in sites often characterized by persistent rodent-perpetuated disturbance where the new species tends to display the highest biomass of any single vascular plant species present.

Lomatium is by far the largest genus in Apiaceae in North America. Several new species from the USA have been described over the last few years, including *L. ochocense* Helliwell (2010), *L. bentonitum* Carlson & Mansfield (Carlson et al. 2011), *L. pastoralis* D.H.Wagner ex Darrach & Wagner (2012), and *L. brunsfeldianum* McNeill (2012).

Collections of an unrecognized white-flowered *Lomatium* species were made by botanists Stuart Markow and Mark Darrach in the Greenhorn Mountains of northeastern Oregon in July 2002. The population at that site (type locality) is confined to shallow serpentine-derived gravelly lithosol soils at 2291 meters on a nearly flat aspect on the Umatilla National Forest. Subsequent morphological examination and comparison of specimens with reference material by Stuart Markow at the Rocky Mountain Herbarium (RM) and Mark Darrach at the Burke Museum Herbarium (WTU), Washington State University (WS), and Oregon State University (OSC, ORE, WILLU) suggested these collections represented a hitherto undescribed species with morphological similarities to the recently described *L. pastoralis*.

Recent molecular genetic work conducted in 2011 and 2012 as part of a broader investigation into the genetics of *Lomatium* by Emma George (College of Idaho), Jim Smith (Boise State University), and Donald Mansfield (College of Idaho) has confirmed the 2002 collections to be a genetically distinct entity, but in a separate clade relative to *L. pastoralis* (George et al., in press).

Since its initial discovery, new populations of the species have been found on similar serpentine substrates; all but two are within a few kilometers of the type locality. Two additional yellow-flowered populations on an acidic volcanic mudflow substrate are also now known from approximately 23 kilometers north-northeast of the type locality. Aside from the yellow flower color, plants from these two populations do not differ significantly from those at the type locality.

Measurements in the description below represent a combination of characters derived from both herbarium material and live plants.

Lomatium tarantuloides M.E. Darrach and C.E. Hinchliff, **sp. nov.** Figures 1, 2, 3. **TYPE**: **USA**. **Oregon**. Grant Co.: open lithosol area on serpentine adjacent to DuPratt Spring, ca. 3.5 km E of summit of Boulder Butte, T10S R34E NW ¼ of NE ¼ Sec.10, 44º 44' 0.773" N; 118º 36' 15.152" W, abundant in vernally moist open gravelly serpentine lithosol on flat or gentle southerly aspects, elev. 2291 m (7215 ft), 22 Jul 2010, *M.E. Darrach 794* (holotype: WTU; isotypes: OSC, WS, RENO, NY, UMA, US).

Lomatium tarantuloides combines character states distinct from its immediately associated and regionally contiguous congeners and all other recognized members of the genus. The following characters are particularly diagnostic: prostrate inflorescences and infructescences, usually white flowers, involucel bracts usually completely lacking or very poorly developed, fruits elliptical with narrow wings, and small (usually 5 mm in length), and pedicels short (usually about 2.5 mm in length).

Herbs: perennial, long-lived, non to faintly aromatic, glabrous, acaulescent (caulescent), 0.5–17.0 cm in height with typical plants approximately 5cm in height when in mature fruit. **Root:** a simple to rarely bifurcate taproot, terete, 3.4–12.4 cm long, 1.6–10.0 mm wide, surmounted by a simple subterranean root crown and a narrow prominent terete subterranean pseudoscape, 15.0–75mm long that is typically single, but can be as numerous as 7 in the oldest specimens. The point of attachment between root crown and pseudoscape typically is somewhat swollen. Root crown annual scars, when clearly discernable, 5–55 in number reflecting approximate plant age. **Leaves:** old sheathing leaf bases entirely absent, leaves 2–29, most typically 3, venation obscure, glabrous, compound, ternate to biternate-pinnate to irregularly pinnate or irregularly partially bipinnate, 1.5–9.1 cm wide, 1.1–9.5 cm in length. Petioles 0.4–5.0 cm long with variably developed winged basal portions, winged bases herbaceous with variably green to blackish-purple anthocyanic coloration at the base and bearing entire to occasionally weakly serrate scarious margins that become stramineous and chartaceous with age, prominent nerves on leaves with winged petioles 4–13. Reduced, usually once pinnate axillary leaves often present, petioles of these leaves enclosed within broad-winged bases of larger primary leaves, wings lacking or minimally developed, usually entirely lacking nerves. Pressed leaves usually about equally as broad as wide, the leaf outline quadrate, rhombic, axillary leaves narrowly rhombic. Leaflets spreading, not overlapping, entire, narrowly elliptical to very narrowly oblanceolate to spatulate to, occasionally, linear-filiform, ultimate segments 2–43 mm long, 0.4–3.8 mm wide. **Inflorescences:** compound, involucre none, numbering up to 19 in old, long-established plants, but typically 2 or 3, shorter axillary peduncles occasionally present. Peduncles prostrate to weakly ascending, terete and typically weakly ribbed, usually deep blackish-purple at the base, R:77 G:5 B:34 (Colorpicker 2014). Peduncle length 20–110 mm in flower with typical specimens 60–70 mm, greatly exceeding the leaves as the inflorescence matures with typical increases in peduncle length of approximately 70% at maturity relative to when plants are at anthesis. Rays 2–23, dimidiate and unequal in length in flower, grossly so in fruit. Minimum ray length per inflorescence 1.5–5.5 mm, maximum per inflorescence 8.5–29.5. Shortest rays usually bearing umbellets with entirely male flowers. These short, staminate umbellets are frequently somewhat contorted and are clustered at the umbel center, they are irregularly deciduous by maturity and tend to bear fewer flowers. The longer rays bear umbellets that are a mixture of male, female and, occasionally, perfect flowers. Male flower pedicels smooth, glabrous, 1.3–2.1 mm in length with typical values about 1.7 mm, female and perfect flower pedicels smooth, glabrous, 0.6–2.3 mm with typical values about 1.2 mm. **Involucel:** bracts green, herbaceous, narrow to linear, bract number 0–8 and, when present as 3 or more, irregularly dimidiate. Of 205 umbellets evaluated for this character approximately 60% had no involucel bracts at all and an additional 31% had only one or two. Involucel bracts 0.6–3.2 mm in length, 0.1–0.3 mm in width, glabrous, free to base, often with a well-developed mid-vein. **Flowers:** primarily polygamomonoecious on most plants, but some plants are andromonoecious, glabrous 7–34 per umbellet with values of 15–20 typically encountered, petals bright white to greenish-white with green mid-nerve and notably bright yellow petals in one population, 0.8–1.3 mm long, 0.6–1.0 mm wide, ovate with an adaxially strongly incurved short apiculus; anthers rose-purple to purple on plants with white flowers, pale yellow on plants with yellow flowers, stylopodia nectaries purple or green on plants with white flowers and green on plants with yellow flowers. Styles 0.8–1.1 mm, strongly curved, outwardly divergent; ovaries green and glabrous. **Fruit:** hemispherically arranged with 0–16 fruit per umbellet; 7 or 8 being the most commonly encountered numbers, the longer rays usually considerably more fecund, pedicels spreading-ascending to semi-erect, 0.4–7.4 mm with typical values of about 2.5 mm encountered on most specimens. Fruits glabrous, 3.7–6.9 mm long with typical material about 5.0–5.5 mm in length, 1.5–2.7 mm wide with typical values approximately 2.0 mm. Fruit wing width 0.2–0.35 mm, not obviously thickened, strongly dorsiventrally compressed with rounded base and distal obtuse margin. Fruit shape elliptical, elliptical-ovate to oblong, color greenish tan in the intervals. Dorsal fruit surfaces with 2–4 (usually 3) well-develop nerves flush with the fruit surface; vittae obscure, 1–3 in the intervals, 0–3 along the commisure, 1–3 on the wings. Carpophore cleft to the base, persistent. A composite illustration is provided in Figure 1 and specimen photographs are in Figures 2 and 3.

Etymology. The epithet “tarantuloides” alludes to the dense, web-like interweaving of the prostrate, early-senescent infructescence peduncles of the closely spaced plants. The name “spider biscuitroot” is suggested as a common name.

Habitat. *Lomatium tarantuloides* is known only from flat to gently sloping southerly to easterly aspects. The plants occupy ephemerally, moist to wet, shallow soils primarily on serpentine/peridotite-derived gravelly sites that become dry and largely barren by mid-late summer. The two known yellow-flowered populations occupy sites with similar characteristics and soils with analogous textures, but with substrates of acidic volcanic mudflow parentage. The known sites all show strong evidence of a persistent, fossorial rodent-induced soil bioturbation regime.

Range. The species is known from a total of 8 very restricted localities. Six of these are at higher elevations in the Greenhorn Mountains, ranging elevation from approximately 1616 meters to 2317 meters. The type locality and one other site are on the Umatilla National Forest, four sites are on contiguous adjacent lands of the Malheur National Forest, and two sites are on lands of the Wallowa-Whitman National Forest. Populations most distant from the Greenhorn Mountains are just east of Moon Meadows in Grant County on the Umatilla National Forest at approximately 1800 meters elevation. One other apparently small population in the Trout Meadows area (adjacent to the Moon Meadows population) is on the Wallowa-Whitman National Forest and needs to be relocated and properly characterized.

Paratypes. **Oregon**. Grant Co.: Princess Trail, ca 150 yards SW of Dupratt Spring, ca 7.5 air mi SW of Granite, OR, T10S R34E NE ¼ of NW ¼ Sec. 3, 2256 m (7,400 ft), 9 Jul 2002, *Markow 12358* (OSC, RM); Trout Meadows, 20 feet S of FS road 52, ca 100 yards SE of Umatilla National Forest boundary, ca 10 air mi NW of Granite, OR 1616 m (5300 ft), 8 Jun 2003, *Markow 12473* (OSC, RM); Trout Meadows, 20 feet S of FS road 52, ca 100 yards SE of Umatilla National Forest boundary, ca 10 air mi NW of Granite, OR, T7S R35E Sec. 13 SW, 1616 m (5300 ft), 26 Jun 2003, *J.Wood 7778* (OSC); along both sides of Blackeye Trail, ca 0.5 air mi E of intersection with FS Road 2010, Malheur National Forest, T10S R34E N ½ Sec. 24, 1951 m (6400 ft), 26 Jun 2003, *Markow 12491* (OSC, RM); 2 air mi S of Vinegar Hill near trailhead of Blackeye Trail on scabs and open areas both E and W of FS road 2010, T10S R34E SW ¼ of NE ¼ Sec. 24, 1977 m (6483 ft), 1 Jul 2003, *Markow 12494* (OSC, RM); 0.8 km S of Morning Mine site Greenhorn Mountains, 1919 m (6296 ft), 18 Jul 2011, *Darrach 683* (UMA); 1.3 km ESE of Moon Meadow along Packsaddle Trail, 1862 m (6110 ft), 25 Jul 2011, *Darrach 802* (UMA).

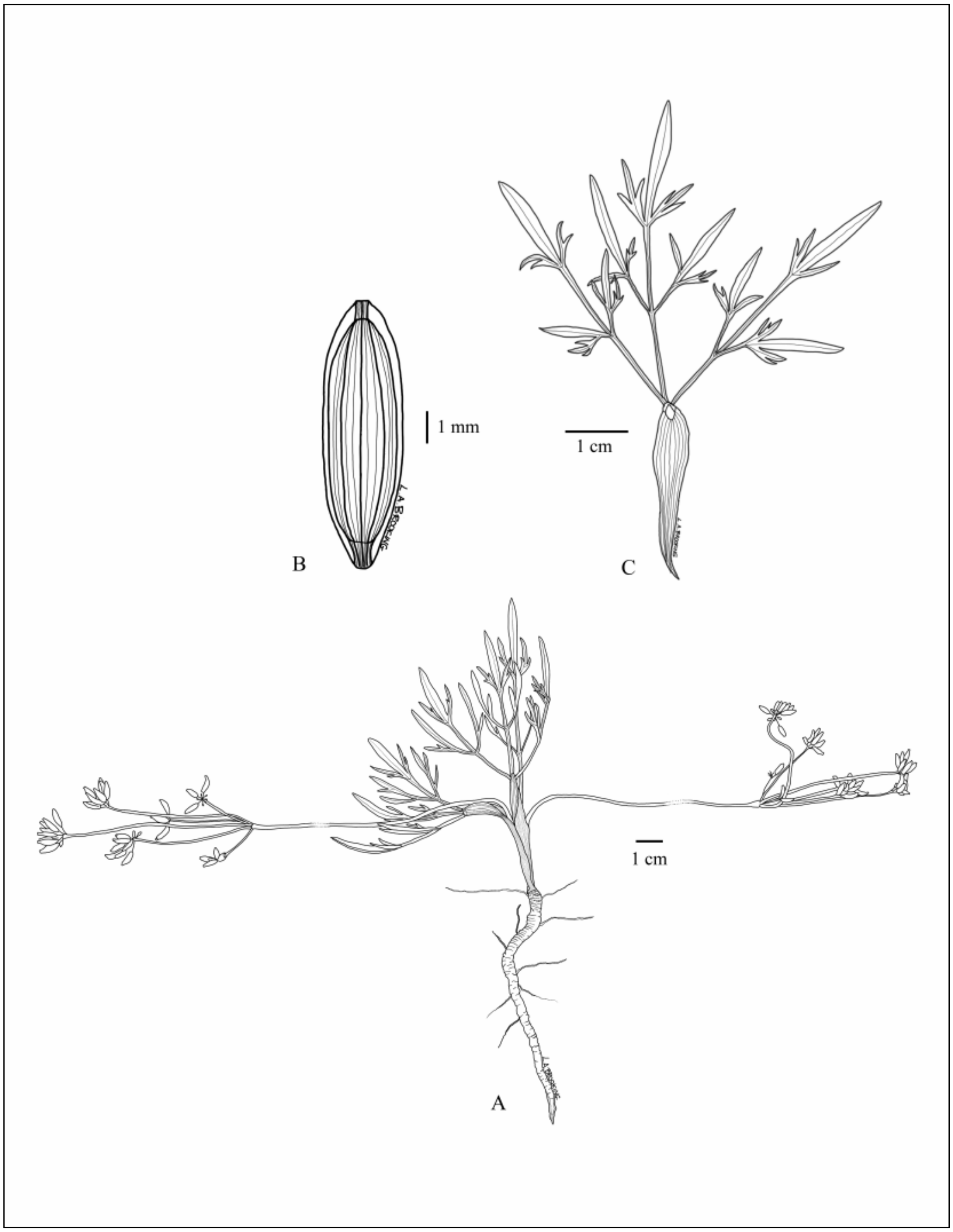

Figure 1. *Lomatium tarantuloides*. A. Habit of plant with grayed-out segment of infructescence peduncles representing missing segment necessary for illustrative purposes. B. Mature fruit. C. Typical leaf morphology.

Figure 2. *Lomatium tarantuloides.* Mature plant at anthesis in situ at type locality.

Figure 3. *Lomatium tarantuloides.* Mature plant at anthesis with typical taproot morphology.

Similarities and relationships

The species with which *Lomatium tarantuloides* is most likely to be confused are *L. leptocarpum* (Torr. & A. Gray) J.M. Coult. & Rose, the recently-described *L. pastoralis*, and *L. ultramaficum* D.W. Taylor & C. James (in press). *Lomatium leptocarpum* has bright yellow flowers, narrow nearly sessile fruits with a much higher aspect ratio, a well-developed involucel, more numerous leaflets, and ascending to upright inflorescences. The morphological similarities between *L. tarantuloides* and *L. pastoralis* are sufficient that it was initial thought that the two entities might be best treated as conspecific at infraspecific rank. Closer examination and recent molecular genetic evidence (George et al., in press) provide evidence that each should be recognized at the specific rank. *Lomatium pastoralis* always has bright yellow flowers, longer (on average) fruits, wider ultimate leaflets, and inflorescence peduncles that are strongly decumbent proximally, becoming ascendent to fully erect distally. *Lomatium ultramaficum*, recently discovered from Shasta County, California, also is confined to an ultramafic substrate. These plants are quite similar to *L. tarantuloides* but possess, on average, considerably longer and wider fruits, a light yellow flower color, and persistent leaf bases from previous growing seasons. The distance of many hundreds of air kilometers between the populations in a genus that is generally recognized as strongly limited in the scale of its areal seed distribution potential (Marisco & Hellman 2009) also provides a strong argument for *L. tarantuloides* and *L. ultramaficum* being of two distinct species.

Lomatium tarantuloides (under the designated placeholder "*Lomatium* sp. nov. F") is included in a molecular phylogenetic analysis addressing species-level relationships in *Lomatium* and related genera (George et al., in press). In that study, *L. tarantuloides* is placed with strong support in a small clade including another narrow endemic species known only from a small population in the Cascade Mountains of Washington state (*Lomatium* sp. nov., in prep.). Interestingly, *L. tarantuloides* is not indicated to share a close phylogenetic affinity with the recently described *L. pastoralis*, despite significant morphological similarity between them. As recognized by George et al. (in press) as well as preceding studies (Downie et al. 2002, 2010; Sun & Downie 2010a, 2010b), the phyletic placement of *L. tarantuloides* reflects an increasingly supported pattern in which apparent morphology-based taxonomic alliances within the clade including *Lomatium* and related genera do not translate accordingly when applying molecular phylogenetic analytical scrutiny.

Recognition that traditional morphological approaches to species circumscriptions may be of reduced reliability as an estimator of evolutionary relatedness in *Lomatium* and allied Apiaceae genera has significant taxonomic implications. Stronger consideration of the utility of genetic sequence data, ecological setting (e.g. substrate preferences), and biogeographic considerations may be critical for species delimitation and the recognition of lineages that merit conservation efforts. This has particular relevance for taxonomists as well as biodiversity managers in western North America, where Apiaceae constitutes a significant element of local floras. Indeed, the integration of non-morphological data has been an important avenue through which several distinct entities in this group have been recognized (George et al. in press; Carlson et al. 2011; Lesica & Kittelson 2013), and these approaches hold promise for the resolution of difficult groups such as *Lomatium triternatum* complex (George et al. in press; Lesica & Kittelson 2013).

Phenology, ecology, and conservation

Lomatium tarantuloides emerges each year primarily as a function of the timing of melt-back of the mountain snow pack. In low precipitation years this may occur as early as late May or the beginning of June, occasionally as late as mid-July. Flowers are at or near anthesis by mid-July in most years. The plants rapidly senesce thereafter, seed is fully dispersed by mid-August, and the plants become largely unrecognizable on the landscape by mid to late August.

The species typically occurs in dense populations on non-forested substrates, where it is usually the dominant vascular plant species. Associated vascular plant taxa documented to co-occur with *Lomatium tarantuloides* include these: *Abies lasiocarpa, Achillea millefolium, Achnatherum lemmonii* subsp. *lemmonii, Achnatherum nelsonii* subsp. *dorei, Aconogonon phytolaccifolium, Allium campanulatum, Dicentra uniflora, Fritillaria pudica, Gayophytum humile, Lewisia pygmaea, Ligusticum grayi, Nothocalais alpestris, Perideridia bolanderi, Polygonum majus, Polygonum minimum, Ranunculus alismifolius* subsp. *davisii*, and *Sanicula graveolens.*

Observations of *Lomatium tarantuloides* populations indicate that it is an early seral occupant of bioturbated, non-forested landscapes. As soil push mounds and under-snowpack winter season rodent trace soil casts indicate, the primary source of persistent disturbance at the type locality and other population sites appears to be provided by active robust populations of the fossorial northern pocket gopher *Thomomys talpoides*. As long as these rodent populations persist at the population sites, the bioturbation activities of these small mammals create an ideal, albeit temporally unstable, disturbance regime that supports promotion of reproductive *L. tarantuloides* populations. However, as climate change effects reduce both the amount and duration of mountain snow packs in the region (Barnett et al. 2005), the continuing ability of these burrowing rodents to provide a persistent source of disturbance comes into question.

While summer domestic sheep usage is now entirely absent from most of the region, the area from which *Lomatium tarantuloides* populations are known was subjected to intensive sheep grazing from approximately 1890 through to the early 1930's (Langford 1996). This history echoes strongly in the character of the vegetation in the area (Darrach pers. observ.; Johnson pers. comm.), with nearly all of the shallow soil non-forested areas strongly departed ecologically from what are considered to be pre-settlement vegetation patterns. This grazing history also apparently produced a persistent source of disturbance that likely benefitted the fecundity of the *L. tarantuloides* populations. *Lomatium* species are, as a generality, unpalatable to livestock, and this may well have been an additional factor in keeping the species viable under strong herbivore pressure (Darrach pers. obs.; Utah State University 2013). As snowpack and, presumably, associated rodent activity, decline, a management strategy employing targeted domestic sheep or goat grazing in the populations may be of value in keeping populations of *L. tarantuloides* viable.

ACKNOWLEDGEMENTS

We thank the Umatilla National Forest of the U.S. Forest Service and Corydalis Consulting for providing both funding and labor in support of this project. Mara Denny and other seasonal field assistants provided valuable data gathering support. Linda Brooking provided superb illustration work. Contributions by Jean Wood and the late and consummate botanist, teacher, and good friend Stuart Markow to the recognition of this species as new to science cannot be understated.

LITERATURE CITED

Barnett, T.P., J.C. Adam, and D.P. Lettenmaier. 2005. Potential impacts of a warming climate on water availability in snow-dominated regions. Nature 438: 303–309.

Carlson, K.M., D.H. Mansfield, and J.F. Smith. 2011. A new species in the *Lomatium foeniculaceum* (Apiaceae) clade revealed through combined morphometric and phylogenetic analyses. Syst. Bot. 36: 495–507.

Color Picker. 2014. Online Color Analysis Tool [web application]. <http://www.colorpicker.com> Accessed: 5 February 2014

Darrach, M.E. and D.H. Wagner. 2011. *Lomatium pastoralis* (Apiaceae) a new narrow endemic species from northeast Oregon. J. Bot. Res. Inst. Texas 5: 427–435.

Downie, S.R., R.L. Hartman, F-J. Sun, and D.S. Katz-Downie. 2002. Polyphyly of the spring-parsleys (*Cymopterus*): molecular and morphological evidence suggests complex relationships among the perennial endemic genera of western North American Apiaceae. Canad. J. Bot. 80: 1295–1324.

Downie, S.R., K. Spalik, D.S. Katz-Downie, and J.P. Reduron. 2010. Major clades within Apiaceae subfamily Apioideae as inferred by phylogenetic analysis of nrDNA ITS sequences. Pl. Divers. Evol. 128: 111–136.

George, E.E., D.H. Mansfield, J.F. Smith, R.L. Hartman, S.R. Downie, and C.E. Hinchliff. Phylogenetic analysis reveals multiple cases of morphological parallelism and taxonomic polyphyly in *Lomatium* (Apiaceae). Syst. Bot. (in press).

Helliwell, R. 2010. A new *Lomatium* (Apiaceae) from the Ochoco Mountains of central Oregon. J. Bot. Res. Inst. Texas 4: 7–11.

Johnson, C.G. 2001 (July). Personal communication on the Umatilla National Forest.

McNeill, R.P. 2012. *Lomatium brunsfeldianum*: a new species of *Lomatium* (Umbelliferae) from northern Idaho. J. Bot. Res. Inst. Texas 6: 29–36.

Langford, N. 1996. Forest Dreams, Forest Nightmares: The Paradox of Old-Growth in the Inland West. Univ. of Washington Press, Seattle.

Lesica, P. and P.M. Kittelson. 2013. Morphological and ecological segregation of two sympatric *Lomatium triternatum* (Apiaceae) varieties in Montana. Madroño 60: 211–216

Marsico, T.D. and J.J. Hellmann. 2009. Dispersal limitation inferred from an experimental translocation of *Lomatium* (Apiaceae) species outside their geographic ranges. Oikos 118: 1783–1792.

Sun, F.-J. and S.R. Downie. 2010a. Phylogenetic relationships among the perennial, endemic Apiaceae subfamily Apioideae of western North America: additional data from the cpDNA *trnF-trnL-trnT* region continue to support a highly polyphyletic *Cymopterus*. Pl. Diver. Evol. 128: 151–172.

Sun, F.-J. and S.R. Downie. 2010b. Phylogenetic analyses of morphological and molecular data reveal major clades within the perennial, endemic western North American Apiaceae subfamily Apioideae. J. Torrey Bot. Soc. 137: 133–156.

Utah State University Cooperative Extension. 2011. Range Plants of Utah [web application]. Utah State University, Logan. <http://extension.usu.edu/rangeplants/> Accessed: 28 Dec 2013.