

POA MANSFIELDII (POACEAE),  
A NEW SPECIES ENDEMIC TO STEENS MOUNTAIN, OREGON, U.S.A.

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ABSTRACT

A short, rhizomatous, gynodioecious *Poa* occurs on alpine slopes below melting snowbanks on Steens Mountain, an isolated, fault-block mountain in southeast Oregon. It was included in *P. chambersii*, a dioecious species of Oregon's Cascade Range with cobwebby hairs on at least the lower calluses, although the Steens Mountain form is gynodioecious and its calluses are glabrous. These differences between the Cascadian and Steens Mountain forms were recognized (Soreng 1998, 2007). The Steens Mountain bluegrass is here described as a narrowly endemic species, ***Poa mansfieldii***.

RESUMEN

Una pequeña *Poa* rizomatosa y ginodioica vive en laderas alpinas por debajo de los bancos de nieve en fusión en Steens Mountain, una montaña aislada, del sureste de Oregón. Fue incluida en *P. chambersii*, una especie dioica de la cordillera de las Cascadas de Oregón con pelos aracnoideos al menos en los callos inferiores, aunque la forma de la Steens Mountain es ginodioica y sus callos son glabros. Estas diferencias entre las formas de las Cascadas y Steens Mountain estaban reconocidas (Soreng 1998, 2007). La *Poa* de Steens Mountain se describe aquí como una especie endémica, ***Poa mansfieldii***.

INTRODUCTION

A small *Poa* on Steens Mountain differs morphologically from other known *Poa* species. It is an endemic taxon described here as *P. mansfieldii*.

Steens Mountain is an isolated "sky island" (Brown 1978; Heald 1951) where an unusual mix of species occur together. It is a fault-block mountain at the northern edge of the Great Basin, reaching 2950 m in elevation and isolated from other high mountains by broad basins at 1200 m in elevation (Mansfield 2000). Subalpine and alpine plants there include species typical of the Great Basin ranges and taxa more common in the Rocky Mountains, the Cascade/Sierra axis, and higher latitudes. The isolation, with the unusual mix of species growing there, make Steens Mountain an incubator of endemic taxa. Other named taxa that are restricted to Steens Mountain are *Calamagrostis utsuensis* Otting and B.L. Wilson, *Castilleja pilosa* (S. Watson) Rydb. var. *steenensis* (Pennell) N.H. Holmgren, *Cirsium peckii* L.F. Henderson, *Draba cusickii* B.L. Rob. ex O.E. Schulz var. *cusickii*, and *Eriogonum ovalifolium* Nutt. var. *rubidum* (Gand.) Reveal & Mansfield.

***Poa mansfieldii*** Otting & B.L. Wilson, **sp. nov.** (Figs. 1–4). TYPE: U.S.A. OREGON: HARNEY CO.: Steens Mountain; between Little Blitzen Gorge and the Steens Loop Road, S of the head of the Gorge, 42.66865° north, 118. 58791° west, UTM zone 11T, 369877 east, 4725244 north (WGS84), elev. 2725 m, shallow, moist soil layer in an alpine meadow, with *Trifolium wormskioldii*, 6 Aug 2014, Wilson & Otting 18270, (HOLOTYPE: OSC; ISOTYPES: CIC, ID, NY, RENO, UC, UTC, US, WTU).

**Plants** gynodioecious, perennial, rhizomatous, basal branching mainly extravaginal, prophylls rudimentary; **culms** arising singly or in sparse tufts along rhizomes, erect or decumbent at base, terete to somewhat compressed, smooth, 8–33 cm tall, with 0–1 nodes exposed, old sheaths persisting at base. **Leaves:** **sheaths**

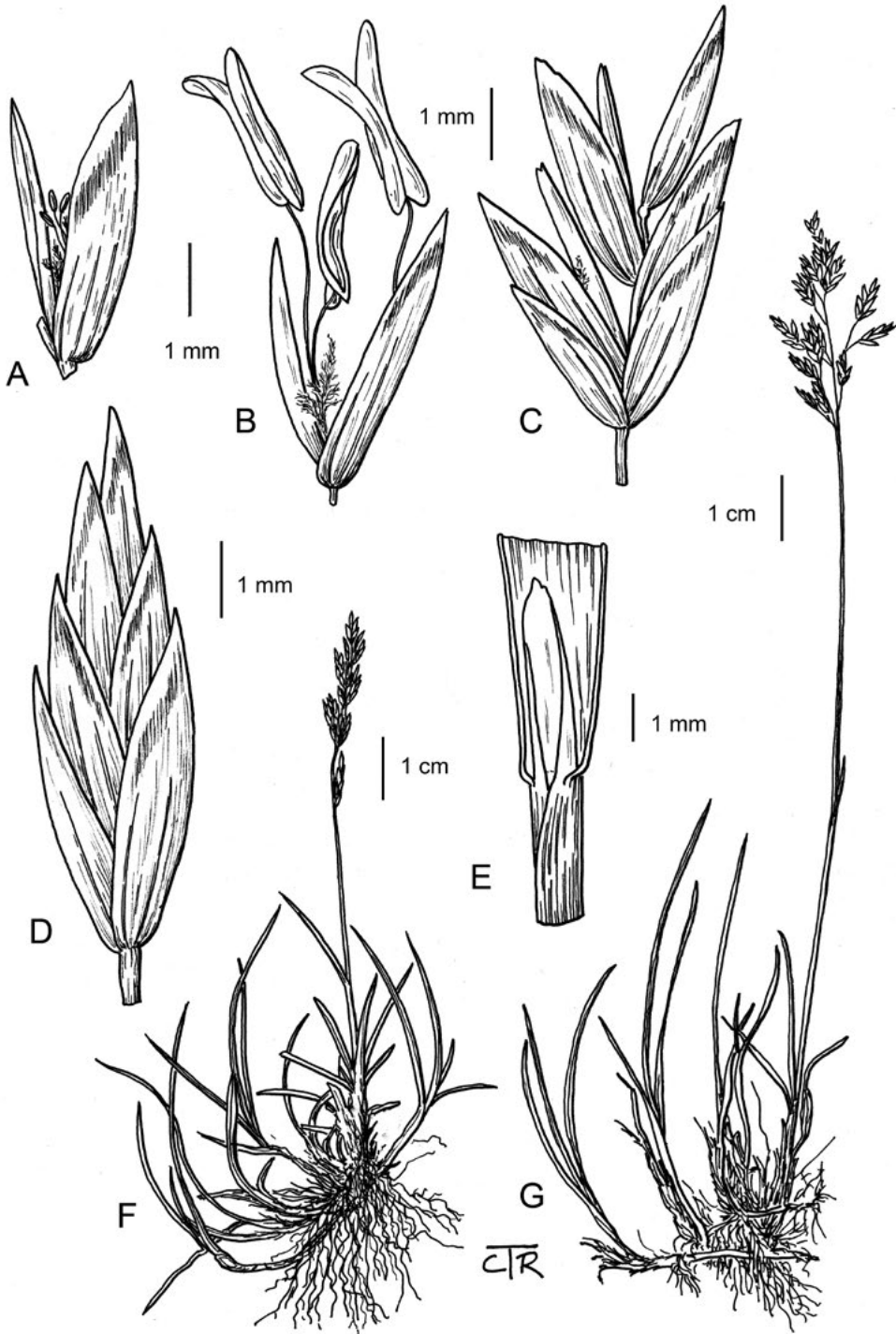


FIG. 1. *Poa mansfieldii*. A: pistillate floret with stigmas and vestigial anthers. B: bisexual floret with stigmas and well-developed anthers. C: pistillate spikelet, florets at anthesis. D: spikelet, florets closed. E: ligule. F: plant habit, not at anthesis. G: plant habit, pistillate plant at anthesis. CTR: illustrator initials.



FIG. 2. *Poa mansfieldii* habitat; basins where snow lies relatively late (top). In the bottom picture, *P. mansfieldii* is in the foreground among the gravel; the densely mound-forming plants behind are *Carex vernacula*.





FIG. 3. *Poa mansfieldii* forming a tuft in rock crevices, and growing as a turf in a meadow below a snowbank.



FIG. 4. *Poa mansfieldii* at anthesis. **Left:** Pistillate plant in flower. **Right:** Bisexual plant in early flower, showing anthers.

glabrous, weakly keeled, those of uppermost culm leaves closed 35–60% their length, longer than the uppermost leaf blade, lowermost cataphyllous; **ligules** hyaline, acute to truncate, smooth and glabrous abaxially, those of uppermost culm leaves 2.5–4.5(6.4) mm, those of vegetative shoots 1.7–4.5 mm, margins smooth; **blades:** moderately firm, flat or folded, smooth and glabrous on both surfaces or very sparsely scaberulous over veins; uppermost culm leaf blades (7.5)15–31(47) × (0.8)2–3(3.4) mm, apices acute to broadly acute, slightly to distinctly prow-shaped; basal blades vestigial, old sheaths persisting at base. **Panicles** (20)35–64(85) mm, erect, tightly to loosely contracted, lanceolate to narrowly elliptic, with (6)10–40(66) spikelets; branches 1–3(5) per node, 7–47 mm, longest branches (8)14–45(47) mm, ascending to erect, ± terete, smooth. **Spikelets** 3–8.4(10.5) mm, length/width ratio 3.2–4.7, laterally compressed, usually mostly purple, occasionally mostly green, with (1)2–5(6) florets; rachilla internodes (0.3)0.8–1.6 mm; smooth and glabrous; glumes 3–5(5.6) mm, 55–85% as long as adjacent lemma, distinctly keeled, margins smooth; lower glumes 1.4–2(2.8) mm wide



Fig. 5. *Poa mansfieldii* bisexual spikelet in flower.

(margin to margin), 1(3)-veined; upper glumes 1.8–2.8 mm wide (margin to margin), with 3(5) veins; calluses smooth, glabrous, blunt, slightly pinched in abaxial view. **Lemmas** 3.8–5.1(6.7) mm, lanceolate, distinctly keeled, with 5 veins (lateral ones less prominent than the others), keel glabrous and smooth or sparsely scaberulous distally, occasionally sparsely scaberulous throughout; marginal veins glabrous and smooth, occasionally scaberulous; intercostal regions glabrous, scaberulous in the lower 2/3, the scabers 0.025–0.5(0.75) mm; margins hyaline; apex acute. **Paleas**: keels smooth to scabrous; intercostal regions smooth, glabrous. **Flowers** bisexual or unisexual. **Anthers**: functional anthers 2–3 mm (when dry), anthers aborted late in development 0.9–2.8 mm, vestigial anthers 0.3–0.4(0.6) mm. **Lodicules** 0.5 mm, broadly lanceolate, with a lateral lobe, acute to obtuse. **Caryopses** 2–2.4 mm, slightly

laterally compressed to almost triangular in cross section, rounded on keel side, elliptical to lanceolate in side view, glabrous, dark honey-colored, with hint of translucence, hilum nearly round, to 0.3 mm,  $\frac{1}{16}$  to  $\frac{1}{8}$  as long as the caryopsis; sulcus shallow, broad; styles 2, apical, approximate, white, stigmatic area plumose. (Figs. 1–5)

**Habitat, Range.**—Flat to gently sloping, seasonally saturated soil in alpine meadows below persistent snowbanks, growing intermingled with *Carex scopulorum* var. *bracteosa*, *Juncus mertensianus*, *Luzula spicata*, *Ranunculus eschscholtzii* var. *trisectus*, *Trifolium longipes*, and *T. wormskioldii* in dark organic soil, or more isolated in bare, moist, brown mineral soil. Elevation 2500–2800 m on Steens Mountain, southeast Oregon. Populations are known from the heads of Little Blitzen and Big Indian Gorges, the east rim of Kiger Gorge, Big Alvord Cirque and above Whitehorse Lake. Potentially suitable habitat has not been searched in other parts of Steens Mountain.

**Phenology.**—Flowering in July and August; mature caryopses observed in late September.

**Etymology.**—The species is named in honor of Donald H. Mansfield, author of the *Field Guide to the Flora of Steens Mountain* (Mansfield 2000). He and his students at College of Idaho have made intensive studies of the plants of this isolated “sky island.”

**Conservation concerns.**—*Poa mansfieldii* is vulnerable to extinction due to its small population size, although it may be secure at this time. It is a narrow endemic, occupying less than 2000 hectares, probably less than 1000 hectares, on a single mountain. Five populations are known. We are aware of only 26 herbarium collections of the species (Appendix), the first made by Mansfield in 1992. Its alpine meadow habitat is not currently grazed by cattle and other usage is slight. However, *P. mansfieldii* habitat is dependent on meltwater from snowbanks that persist well into summer. Global warming will alter snowfall and snowmelt patterns (Mote et al. 2016, 2018) potentially placing this grass at risk.

#### DISCUSSION

*Poa mansfieldii* has a gynodioecious breeding system, meaning that some plants are pistillate and others are bisexual (Giussani et al. 2016). In gynodioecious species, the ratio of pistillate and bisexual plants can vary among populations, or in single populations among years. The ratio may vary depending on the genetic basis of male sterility, but may depend on ecological factors (Delph et al. 2001). However, limited evidence suggests it may be stable for *P. mansfieldii*; we found that 26 (79%) of the plants examined had bisexual flowers and 7 (21%) had pistillate flowers, nearly identical to the ratio found in a previous, unpublished study (Soreng, pers. comm.) In *Poa mansfieldii*, each genetic individual (each set of shoots connected to each other by rhizomes) appears to produce only bisexual or pistillate florets, not both, though the matter needs more study. This contrasts with sequentially adjusted gynomonocious *Poa* in which some 50% of plants shift from producing



TABLE 1. Comparison of *Poa mansfieldii* of Steens Mountain and *P. chambersii* of the Cascade Range, two Oregon bluegrasses.

Trait	<i>Poa mansfieldii</i>	<i>Poa chambersii</i>
Range	Steens Mountain, Oregon	Cascade Range, Oregon
Culm height	8–33 cm	20–48 cm
Culm nodes exposed	0–1	1–2
Leaf sheath closure	35–60%	42–82%
Ligule length	1.7–4.5(6.4) mm	(0.9)2–3.3 mm
Ligule surface	smooth	smooth or minutely scabrous
Flag leaf length	(7.5)15–31(47) mm	32–66(73) mm
Flag leaf width	(0.8)2–3(3.4) mm	(1.7)2.2–3.6(4.2) mm
Panicle length	(20)35–64(85) mm	(40)47–84(102) mm
Panicle, spikelets per	(6)10–40(66)	18–48(54)
Spikelet length	3–8.4(10.5) mm	(3)5.4–11 mm
Spikelet floret number	(1)2–5(6)	(1)2–7
Callus hair length	0	0.4–1.9 mm
Callus surface	glabrous	sparsely webbed on at least some florets
Lemma length	3.8–5.1(6.7) mm	(4)4.7–7.6 mm
Lemma intercostal vestiture	glabrous or scaberulous	sparsely to densely scabrous
Lemma keel vestiture	smooth except sparsely scaberulous distally, occasionally scaberulous throughout	scabrous or with short cobwebby hairs on proximal 5–30%
Lemma vein vestiture	usually smooth, rarely scaberulous	usually scabrous, rarely smooth
Breeding system	gynodioecious	dioecious
Elevation	2000–2800 m	1700–2000 m

perfect or mostly perfect inflorescences to predominantly pistillate inflorescences as the season progresses (Soreng & Keil 2003).

*Poa mansfieldii* populations have been treated as conspecific with *P. chambersii* (Soreng 1998, 2007). Differences between the two forms were recognized when *P. chambersii* was described (Soreng 1998), but time constraints prevented assessing any taxonomic implications of the differences (Soreng, pers. comm.). Both species are rhizomatous bluegrasses of montane to alpine habitats, with many entirely pistillate plants, but they differ in several ways (Table 1). *Poa mansfieldii* has smooth to scaberulous lemma bodies, keels, and veins, and glabrous calluses; *P. chambersii* has scabrous lemmas with keels and marginal veins with short, soft hairs on the proximal one-fourth, and at least a few calluses in each spikelet have cobwebby hairs. The node where the uppermost leaf sheath originates is usually hidden in leaf sheaths near the base of the plant in *P. mansfieldii*; it is exposed in *P. chambersii*. The two taxa also have different breeding systems; *P. mansfieldii* is gynodioecious, with individual plants producing either bisexual or pistillate florets, whereas *P. chambersii* is dioecious, with individual plants producing either pistillate or staminate florets.

Gynodioecy is relatively rare in *Poa*, previously known from only 12 of the approximately 530 species in the genus (Giussani et al. 2016). One of the gynodioecious species is the similar *P. stebbinsii* Soreng of the Sierra Nevada of California, 375 km south-southeast of Steens Mountain. Both species are small alpine grasses with extravaginal basal branching, glabrous calluses, and glabrous to scabrous lemmas. Although both have extravaginal branching (new shoots with rudimentary prophylls and initial cataphylls), *P. stebbinsii* is densely caespitose and *P. mansfieldii* is rhizomatous with shoots arising singly or in tufts. There are also differences in glume widths and ligule lengths, and the leaf sheaths of *P. mansfieldii* are closed further than those of *P. stebbinsii* (Table 2).

Because the grass now called *P. stebbinsii* was at one time treated as *P. hansenii* Scribn. (Munz 1965, p. 1787), the identity of *P. hansenii* must be considered when describing *P. mansfieldii*. The *P. hansenii* type specimen (Hansen 603, US!) is a specimen of *Poa cusickii* Vasey ssp. *cusickii* with staminate florets (pers. obs., Soreng pers. comm.). The forms of *P. cusickii* occurring on Steens Mountain differ from *P. mansfieldii* in being densely caespitose, with branching strictly intravaginal. If a small tuft of *P. mansfieldii* is collected without its rhizomes, this difference in habit may be overlooked. *Poa cusickii* is also a taller plant with shorter ligules, those on culms

TABLE 2. Comparison of *Poa mansfieldii* and *P. stebbinsii*, gynodioecious alpine grasses with extravaginal shoots and glabrous calluses and lemmas. (Note: glume width = width from margin to margin)

Trait	<i>Poa mansfieldii</i>	<i>Poa stebbinsii</i>
Habit	rhizomatous	densely tufted, not rhizomatous
Flag leaf width	(0.8)2–3(3.4) mm	1–2(3) mm
Leaf sheath closure	35–60%	20–40(50)%
Ligule length, cauline leaves	2.4–4.5(6.4) mm	3–8 mm
Panicle branches per node	1–3(5)	1–2
Panicle branches, length	5–47 mm	5–15(25) mm
Panicle branches, orientation	ascending to erect	erect
Panicle branch surface	smooth	sparsely to moderately scabrous
Spikelet length	3–8.4(10.5) mm	4–6.5 mm
Spikelet floret no.	(1)2–5(6)	2–4
Glume length	3.5–5(5.6) mm	2.5–4 mm
Lower glume width	1.4–2(2.8) mm	0.7–1 mm
Upper glume width)	1.8–2.8 mm	1.3–1.7 mm
Lemma surface vestiture	smooth or scaberulous	scaberulous to scabrous
Lemma keel	sparsely scaberulous distally (rarely throughout)	scabrous for most of length
Range	Steens Mountain, Oregon	central Sierra Nevada, California

1–3(6) mm and those on innovations 0.2–0.5(2.5) mm, and its lower glumes are 3-veined. All alpine plants of *P. cusickii* are pistillate (Soreng 2007); the majority of *P. mansfieldii* plants have bisexual spikelets. *Poa cusickii* grows in mesic meadows and dry rocky slopes, in drier locations than *P. mansfieldii*, though the two may grow near each other.

A specimen reported as *P. hansenii* was collected in the Pine Forest Mountains of Nevada, south of Steens Mountain (Griffiths & Morris 248, US!). This specimen is not *P. cusickii* but the equally caespitose *P. secunda* J. Presl ssp. *juncifolia* (Scribn.) Soreng (N. Otting & R. E. Brainerd, pers. obs.).

The Steens Mountain *Poa* taxa with which *P. mansfieldii* is most likely to be confused are *P. cusickii* (discussed above) and *P. pratensis* L. ssp. *alpigena* (Fr. ex Blytt) Hiitonen. *Poa mansfieldii* and *P. pratensis* are both rhizomatous, but their spikelets differ. In *P. mansfieldii*, calluses and lemmas are glabrous and smooth to scaberulous. In *P. pratensis*, the callus has cobwebby hairs and the lemmas are more or less hairy on main veins.

An identification key to perennial *Poa* taxa of eastern Oregon, the northern Great Basin, and the Owyhee Uplands is provided. It is based on Soreng et al. (2015, 2019), Soreng & Simmons (2018), and Roché et al. (2019).

KEY TO PERENNIAL POA, BLUEGRASSES, OF EASTERN OREGON,  
THE NORTHERN GREAT BASIN, AND THE OWYHEE UPLANDS

(Underlined = known to be present on Steens Mountain. Subspecies and varieties of species are not keyed if more than one occurs in our area. Consult Soreng (2007) or Soreng et al. (2015) to identify them.)

1. Culms and vegetative shoots with bulbous bases; florets usually producing tiny bulblets rather than seeds, rarely some florets producing normal flowers and seeds.
  2. Lower ligules to 1 mm long; some lower sheaths and sometimes their blades near the collars retrorsely scabrous to strigulose, or hispidulous; panicles looser with finer and longer bladelets in the bulblets \_\_\_\_\_ ***P. iconia***
  2. Lower ligules longer than 1 mm; lower leaf sheaths glabrous and usually smooth; panicles more contracted \_\_\_\_\_ ***P. bulbosa***
1. Culms and vegetative shoots lacking bulbous bases; florets producing normal flowers and seeds, not producing bulblets.
  3. Culms and nodes strongly flattened, not rolling between the fingers; plants with long, stout rhizomes; calluses cobwebby, rarely glabrous \_\_\_\_\_ ***P. compressa***
  3. Culms and nodes round in cross section or indistinctly flattened, generally rolling easily between the fingers; rhizomatous or not; calluses cobwebby or not.
    4. Spikelets broadly ovoid, 1.5–2.5× as long as wide; lemmas strongly keeled, with prominent silky hairs on keel and marginal veins and sparse silky hairs between veins; leaf blades mostly basal, flat, comparatively short and broad, usually 30–50 mm long and 2–4.5 mm wide, upper culm leaves much reduced in length; plants caespitose \_\_\_\_\_ ***P. alpina* var. *alpina***



4. Plants without the above combination of characters; spikelets ovoid to lanceoloid; lemmas rounded or laterally compressed, glabrous or pubescent; leaf blades various; plants caespitose, rhizomatous, or stoloniferous.
5. Sheaths of upper culm leaves closed  $\leq$  25% their length (on average); plants with flowers all bisexual; plants caespitose or occasionally stoloniferous, not rhizomatous \_\_\_\_\_ **Subkey 1**
5. Sheaths of upper culm leaves closed  $>$  25% their length; plants dioecious, gynodioecious, or with flowers all bisexual; plants rhizomatous or caespitose, occasionally weakly stoloniferous \_\_\_\_\_ **Subkey 2**

### Subkey 1: Sheaths of uppermost culm leaf closed $\leq$ 25% (on average); plants mostly caespitose, sometimes stoloniferous.

1. Spikelets subterete, (3.8)4–5 $\times$  as long as wide; lemmas rounded to weakly keeled abaxially, glabrous or short-hairy at base, or sparsely short-hairy on keel and marginal veins near base; calluses usually glabrous, sometimes with hairs  $<$  0.2 mm; panicle branches generally ascending to appressed in fruit; anthers usually 1.5–3.5 mm; plants densely caespitose \_\_\_\_\_ **P. secunda** (2 ssp.)
1. Spikelets laterally compressed, generally 1–3.6 $\times$  as long as wide; lemmas distinctly keeled abaxially; calluses glabrous or variously hairy; anthers usually 0.2–2 mm; plants densely to loosely caespitose, occasionally stoloniferous.
  2. Calluses with cobwebby hairs arising in a dorsal tuft.
    3. Cobwebby hairs  $<$  50% as long as lemmas when stretched; plants densely caespitose, not stoloniferous; culms smooth and glabrous below nodes, rarely with a minute antrorse prickle or two; ligules 0.2–0.8(1) mm \_\_\_\_\_ **P. nemoralis**
    3. Cobwebby hairs  $\geq$  50% as long as lemmas when stretched; culms smooth or not below nodes; ligules (1)1.5–6 mm.
      4. Ligules of culm leaves (2)3–6 mm; panicles open, longest branches 20–120 mm; culms retrorsely scabrous to strigulose below nodes; plants loosely caespitose, often stoloniferous \_\_\_\_\_ **P. palustris**
      4. Ligules of culm leaves 1.25–2 mm; panicles narrowly contracted, longest branches 8–15(30) mm; culms smooth and glabrous below nodes; plants densely caespitose \_\_\_\_\_ **P. wallowensis**
  2. Calluses lacking cobwebby hairs, glabrous or with crown of hairs 0.2–2 mm.
    5. Nearly all shoots of the current season fertile at flowering time (some plants may have a late-season flush of new vegetative shoots); culms 1–15 cm; upper two-thirds of culm lacking nodes; lemmas evenly but sometimes sparsely pubescent across the lower back between keel and lateral veins \_\_\_\_\_ **P. glauca** var. **rupicola**
  5. Less than 50% of shoots of the current season fertile at flowering time; culms 1–60(100) cm; upper two-thirds of culm with or without nodes; lemma vestiture various.
    6. Culms 20–60(100) cm, panicles loosely contracted to open; anthers usually 1.2–2 mm; calluses usually with a crown of hairs 0.2–2 mm; (some forms similar to *P. secunda* ssp. *secunda*) \_\_\_\_\_ **P. stanantha** var. **stanantha**
    6. Culms 1–20(25) cm; panicles contracted; anthers usually 0.2–1.2(1.7) mm; calluses glabrous.
      7. Culms 1–12 cm; lemmas 2.5–3 mm; glumes often  $\geq$  upper florets; anthers usually 0.2–0.8 mm \_\_\_\_\_ **P. lettermanii**
      7. Culms 7–20(25) cm; lemmas 4–5(6) mm; glumes  $<$  upper florets; anthers usually 0.6–1.2(1.7) mm \_\_\_\_\_ **P. suksdorfii**

### Subkey 2 Sheaths of uppermost culm leaf closed $>$ 25% their length; plants rhizomatous or caespitose

1. Sheaths densely scabrous; ligules of upper culm leaves 3–10 mm; calluses with cobwebby hairs; lemmas usually hairy only on keel; culms (30)50–120 cm, usually erect; lower glumes usually sickle-shaped; plants caespitose \_\_\_\_\_ **P. trivialis** ssp. **trivialis**
1. Sheaths smooth or nearly so; ligules of upper culm leaves 0.5–4(6.4) mm; calluses glabrous or with cobwebby hairs; lemmas glabrous or if hairy on keel then also hairy elsewhere; culms 8–75(100) cm, erect or nodding; lower glumes not obviously sickle-shaped (except occasionally in rhizomatous *P. pratensis*); plants caespitose or rhizomatous.
  2. Calluses with cobwebby hairs usually  $\geq$  2 mm when stretched; flowers perfect, anthers well developed (rarely with late abortive stamens in *P. pratensis*).
    3. Plants rhizomatous, shoots arising singly or in tufts along rhizomes; panicles loosely contracted to pyramidal, branches (1)3–5(7) per node; anthers (1.2)1.4–1.7(2.0) mm \_\_\_\_\_ **P. pratensis** (3 ssp.)
    3. Plants loosely to densely caespitose; panicles narrowly contracted to open, branches 1–2(4) per node; anthers 0.2–1.1 mm.
      4. Panicles narrowly contracted, branches 8–15(30) mm; culms 8–14 cm \_\_\_\_\_ **P. wallowensis**
      4. Panicles open, branches (20)30–80 mm, widely spreading to reflexed; culms 10–60 cm.
        5. Plants loosely caespitose, occasionally with short rhizomes; glume keels usually scabrous; lower panicle branches more or less scabrous, erect to spreading, rarely reflexed \_\_\_\_\_ **P. leptocoma**
        5. Plants densely caespitose; glume keels smooth or nearly so; lower panicle branches smooth, usually reflexed \_\_\_\_\_ **P. reflexa**
  2. Calluses glabrous, infrequently with cobwebby hairs  $<$  2 mm when stretched; flowers all perfect, or mixtures of bisexual and unisexual, or all pistillate, anthers often aborted.
    6. Flowers bisexual with anthers well-developed, 0.6–1 mm \_\_\_\_\_ **P. wallowensis**
    6. Flowers pistillate, staminate, or bisexual, anthers often aborted, if well-developed then 1.3–3.7 mm.
      7. Blades of upper culm leaves absent or vestigial, usually much  $<$  1 cm, moderately thick and firm; vegetative shoot blades involute; lemma keels and marginal veins silky-hairy proximally; ligules (1.5)1.8–18 mm; florets all pistillate. \_\_\_\_\_ **P. fendleriana** ssp. **longiligula**
      7. Blades of upper culm leaves well-developed, usually  $>$  1 cm, or if shorter, then soft and withering; vegetative shoot blades flat, folded, or involute; lemma keels and marginal veins sparsely pubescent proximally, sometimes glabrous; ligules 0.5–4(6.4) mm; florets various.

8. Plants caespitose, not rhizomatous.
9. Panicles open to loosely contracted, usually nodding, sparse, spikelets (1)6–17(22); culms 5–35 cm \_\_\_\_\_ **P. leibergii**
9. Panicles narrowly to loosely contracted, erect, sparse to dense; spikelets 10–100+; culms 8–60 (70) cm \_\_\_\_\_ **P. cusickii** (4 spp.)
8. Plants rhizomatous, shoots arising singly or in tufts along rhizomes.
10. Leaf sheaths retrorsely hairy or retrorsely scabrous at least on lower leaves on or near collar, sometimes obscurely so; calluses glabrous; culms 35–80 cm; plants usually pistillate (rarely some florets bisexual or staminate) \_\_\_\_\_ **P. wheeleri**
10. Leaf sheaths and blades smooth and glabrous (rarely minutely scabrous over veins); calluses glabrous or with sparse cobwebby hairs; culms 8–40(50) cm; plants dioecious or gynodioecious.
11. Upper culm blades 32–66(73) mm; calluses with sparse cobwebby hairs 0.4–1.9 mm (rarely glabrous); lemma keels and marginal veins scabrous to soft-hairy on lower 30%; plants dioecious; habitat openings in montane conifer forests; range crest and w side of Cascade Mts., Oregon \_\_\_\_\_ **P. chambersii**
11. Upper culm blades (7.5)15–31(47) mm; calluses glabrous; lemma keel and marginal veins glabrous or minutely scaberulous; plants gynodioecious; habitat alpine slopes and meadows where snowbanks persist; range Steens Mt., se Oregon \_\_\_\_\_ **P. mansfieldii**

## APPENDIX: SPECIMENS EXAMINED

Herbarium codes from Thiers, B. [continuously updated].

**Poa chambersii**

**OREGON: Clackamas Co.:** timberline above Govt. Camp, 4 Jul 1926, *Peck 14677* (WILLU). **Linn Co.:** 2 mi S of Breitenbush L, 2200 m, 8 Aug 1936, *Peck 18743* (US). **Lane Co.:** Bohemia Dist, Fairview Mountain, 14 Jul 1940, *Baker 1898* (ID); Fairview Mt, N slope, 14 Jul 1940, *Baker 1934* (ID); Calapooya Range, Fairview Mountain, E slope, 4 Jul 1948, *Baker 5545* (US, WILLU); Fairview Mt, NW side of the summit peak, ca 100 ft below the fire tower, T235 R1E S11, 1800 m, 9 Jul 1993, *Chambers 5746* (OSC); Horse Pasture [sic] Mountain, 10 mi SW of McKenzie Bridge, 1830 m, 1 Jul 1914, *Peck 4765* (US); summit of Horsepasture Mt, 10 mi S of McKenzie Bridge, 2000 m, 1 Jul 1914, *Peck 6175* (WILLU); summit of Horse Pasture [sic] Mt, 10 mi S of McKenzie Bridge, 2000 m, 30 Aug 1916, *Peck 6509* (WILLU); near McKenzie Pass 7 mi W of summit of Cascade Mts, 7 Aug 1920, *Peck 9823* (WILLU); along McKenzie Pass 8 mi W of summit of Cascade Mts, 7 Aug 1920, *Peck 9823* (US). **Marion Co.:** 2 mi S of Breitenbush L, 8 Aug 1925, *Peck 18743* (WILLU).

**Poa mansfieldii**

**OREGON: Harney Co.:** Steens Mountain, S side of Little Blitzen Gorge near the road between Little Blitzen and Big Indian Gorge, 42.66932°N, 118.58681°W, 2730 m, 3 Aug 2005, *Brainerd & Newhouse 679* (OSC, US); Steens Mountain, S side of Little Blitzen Gorge, 42.66932°N, 118.58681°W, 2730 m, 3 Aug 2005, *Brainerd & Newhouse 694* (US); Steens Mountain, S side of Little Blitzen Gorge, 42.66932°N, 118.58681°W, 2730 m, 3 Aug 2005, *Brainerd & Newhouse 696* (WTU, US); Kiger Gorge, T335 R33E S1, 2600 m, 23 Sep 1995, *Lynn & Smith 34* (CIC); lower S rim of Little Blitzen Cirque, T335 R33E S14 SE ¼, 2730 m, 28 Jul 1992, *Mansfield 92-126* (CIC); far N end of E. Kiger Rim RNA above Aspen Camp, T325 R34E S7 SE ¼, 2440 m, 3 Aug 1992, *Mansfield 92-254* (CIC); far SW end of Little Blitzen Cirque, T335 R33E S14 SW ¼, 2600 m, 17 Aug 1992, *Mansfield 92-666* (CIC); lower Little Blitzen Cirque just above lip at SE end of L. Blitzen Gorge, T335 R33E S14 NE ¼, 2660 m, 18 Aug 1992, *Mansfield 92-807* (CIC); upper W Fork Big Pasture Creek just below rimrock of E Kiger Rim in RNA, T325 R34E S7 SE ¼, 2440 m, 3 Aug 1992, *Mansfield & Crocker 92-269* (CIC); N of Steens Loop Road, in W half of section 14, upper Little Blitzen Cirque, 42.6784°N, 118.5858°W, 2660 m, 23 Sep 1995, *Mansfield 95-75* (CIC unmounted); N of Steens Loop Road, in west half of section 14, upper Little Blitzen Cirque, just above the drop-off, 42.674°N, 118.584°W, 2740 m, 23 Sep 1995, *Mansfield 95-76* (CIC unmounted); Steens Mountain, Kiger Gorge, just above the drop-off, 42.70508°N, 118.56909°W, 2620 m, 23 Sep 1995, *Mansfield 95-78* (CIC unmounted); Great Basin, Steens Mountain, ridge NW of Wildhorse Lake, 21 air mi SE of Frenchglen, 42.63555°N, 118.59778°W, 2770 m, 21 Jul 2017, *Otting 3428* (UC); Great Basin, Steens Mountain, ridge NW of Wildhorse Lake, 21 air mi SE of Frenchglen, 42.63555°N, 118.59778°W, 2770 m, 21 Jul 2012, *Otting 3428a* (US); Great Basin, Steens Mountain, ridge NW of Wildhorse Lake, 21 air mil SE of Frenchglen, 42.63555°N, 118.59778°W, 2770 m, 21 Jul 2012, *Otting 3431* (CIC, US); Great Basin, Steens Mountain, ridge NW of Wildhorse Lake, 21 air mil SE of Frenchglen, 42.63602°N, 118.59826°W, 2750 m, 21 Jul 2012, *Otting 3432* (MO); Great Basin, Steens Mountain, ridge NW of Wildhorse Lake, 21 air mi SE of Frenchglen, 42.63625°N, 118.59835°W, 2740 m, 21 Jul 2012, *Otting 3434* (RSA); Great Basin, Steens Mountain, ridge NW of Wildhorse Lake, 21 air mi SE of Frenchglen, 42.63635°N, 118.59835°W, 2740 m, 21 Jul 2012, *Otting 3437* (US, UTC, WTU); Steens Mountain; below junction of Steens Mountain Loop Road and road to trail to White Horse Lake, 42.66984°N, 118.57737°W, 21 July 2012, *Wilson 17236* (ID, US); Steens Mountain; below junction of Steens Mountain Loop Road and road to trail to White Horse Lake, 42.67007°N, 118.57727°W, 21 Jul 2012, *Wilson 17237* (US, WS); Steens Mountain; below junction of Steens Mountain Loop Road and road to trail to White Horse Lake, 42.67017°N, 118.57805°W, 21 Jul 2012, *Wilson 17239* (OSC); Steens Mountain; below junction of Steens Mountain Loop Road and road to trail to White Horse Lake, 42.6701°N, 118.57805°W, 21 Jul 2012, *Wilson 17240* (UTC, WTU); Steens Mountain; below junction of Steens Mountain Loop Road and road to trail to White Horse Lake, 42.67028°N, 118.57808°W, 21 Jul 2012, *Wilson 17241* (NY, OSC, US); Steens Mountain; below junction of Steens Mountain Loop Road and road to trail to White Horse Lake, 42.67034°N, 118.57818°W, 21 Jul 2017, *Wilson 17242* (SRP, US); Steens Mountain; near headwaters of Big Indian Creek, W of Three Gorges Trail near trailhead, 2740 m, 7 Aug 2014, *Wilson 18293* (RENO); Steens Mountain; between Little Blitzen Gorge and the south Steens Loop Road, S of the head of the gorge, UTM zone 11, 369859e, 4725473n, 6 Aug 2014, *Wilson & Otting 18271* (MO).

**Poa stebbinsi**

**California: Eldorado Co.:** Susy Lake, 2 Aug 1906, *Eastwood 1203* (US). **Fresno Co.:** Mt. Goddard, 3350 m, 24–26 Jul 1900, *Chandler 691* (US); Mono Rock, 3200–3350 m, 20 Jul 1946, *Howell 22536* (US); Pioneer Basin, 2300 m, 22 Jul 1946, *Howell 22646* (US); Pioneer Basin, 2300 m, 22 Jul 1946, *Howell 22666* (US); just below Kaiser Peak, 23 Jul 1927, *Swallen 846* (US); just below Kaiser Peak, 23 Jul 1927, *Swallen 850*

(US); **Inyo Co.:** Rock Creek Lake basin, 15 Jul 1946, *Howell 22410* (US); Mono Mesa, 3400 m, 26 Jul 1946, *Howell 22734* (US); Seventh Lake, Big Pine Lakes, 3400 m, 9 Aug 1947, *Howell 23953* (US); Rock Creek Lake basin, 3260 m, 6 Aug 1933, *Peirson 10816* (US); Rock Creek Lake basin, 2300 m, 9 Aug 1933, *Peirson 10821* (US); Rock Creek Lake basin, Mono Pass, 15 Aug 1903, *Peirson s.n.* (US). **Mariposa Co.:** Yosemite National Park; vicinity of Tuolumne Meadow, 2600–2900 m, Jul 1902, *Babcock 3627* (US); Yosemite National Park; Ireland Creek Trail, 3200 m, 17–25 Aug 1908, *Hitckcock 3314* (US); High gap S of Elizabeth Lake, 8 Aug 1944, *Howell 20153* (US). **Mono Co.:** N slope of Mt Dana, 10 Aug 1044, *Howell 20228* (US); Harvey Monroe Hall Natural Area, Slate Creek Basin Alpine Terrace, N flank of White Mt, 3200 m, 16 Aug 1936, *Keck 4366* (US); Harvey Monroe Hall Natural Area, Slate Creek Basin Alpine Terrace, north flank of White Mt, 3200 m, 16 Aug 1936, *Keck 4366* (US); in saddle between Mt. Conness and East Plateau, 3350 m, 27 Aug 1937, *Keck 4634* (US); upper large Conness Glacier Lake, 3350 m, 29 Aug 1938, *Keck 4994* (US); Toiyabe National Forest, Masonic Mt, 2286 m, 24 Jun 1948, *Streshly LS-31* (US). **Tulare Co.:** along Whitney Creek, Crabtree Meadow to Mt Whitney, 30 Aug. to 9 Sep 1908, *Hitckcock 3436* (US); Siberian Outpost, Crabtree Meadow to Whitney Meadow, 30 Aug. to 9 Sep 1908, *Hitckcock 3452* (US); Little Five Lakes Basin, 29 Jul 1942, *Howell 17381* (US); Little Five Lakes Basin, 2 Aug 1942, *Howell 17587* (US); Little Five Lakes Basin, 2 Aug 1942, *Howell 17588* (US); Kaweah Gap, 3 Aug 1942, *Howell 17622* (US); Columbine Lake, 7 Aug 1942, *Howell 17810* (US); Columbine Lake, 7 Aug 1942, *Howell 17813* (US); Columbine Lake, 7 Aug 1942, *Howell 17813* (US); Bubbs Creek Canyon, ca 10300 ft., Sierra Nevada, 3140 m, 26 July 1938, *Howell 25020* (US); Pear Lake, Sequoia National Park, Sierra Nevada, 2900 m, 27 Jul 1934, *Long 234a* (US). **Tuolumne Co.:** Yosemite National Park; ascent of Mt. Lyall [sic], 3500 m, 17–25 Aug 1908, *Hitckcock 3300* (US); ascent of Mt. Lyall [sic], 3500 m, 17–25 Aug 1908, *Hitckcock 3302* (US); Gaylor Lakes, 2300 m, 12 Aug 1944, *Howell 20379* (US); near Pinecrest, 1680 m, 26 Jul 1946, *Springer s.n.*(US). **No county specified:** Rush Creek Divide, 22 Aug 1879, *Congdon s.n.* (US); Stanislaus & Mono Nat. For., 2830 m, 4 Aug 1912, *Maule s.n.* (US).

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