

# Species Management Guide for *Triteleia hendersonii* var. *leachiae*

Jon Titus 1995 Oregon Natural Heritage Program, Portland, OR

## INTRODUCTION

Blue-striped Brodiaea or Leach's Brodiaea (*Triteleia hendersonii* Greene var. *leachiae* [Peck] Hoover, or *Brodiaea hendersonii* Wats. var. *leachiae*) Lily Family (Liliaceae) is found in the foothills of the Siskiyou Mountains of Curry, Coos and Josephine Counties of southwestern Oregon. It occurs in a variety of habitats including meadow edges, oak woodlands and road cuts.

The primary objective of this Management Guide is to outline a plan for managing *Triteleia hendersonii* var. *leachiae* on the Gold Beach and Power Ranger Districts of the Siskiyou National Forest, which will allow for the species' survival through time, and will reduce or eliminate the need for its placement on the U.S. Fish and Wildlife Service's list of endangered and threatened species under the Endangered Species Act. The taxon is a candidate for listing under This Management Guide may be used as the basis for a Cooperative Agreement with the U.S. Fish and Wildlife Service.

This guide is divided into two major sections. The first provides the most recent information on the range, distribution, population biology, and habitat requirements of *Triteleia hendersonii* var. *leachiae*. The second identifies management practices consistent with the species needs, including the identification of essential monitoring needs.

## BIOLOGICAL INFORMATION

### Plant Description

*Triteleia hendersonii* var. *leachiae* is a distinct and showy perennial forb in the lily family. It has white flowers with a bluish median stripe on each perianth segment. There are no line drawings of this taxon, but a drawing of *Triteleia hendersonii* var. *hendersonii* from Abrams (1940) is shown on Fig. 1, with a description of the species.

The genus *Triteleia* was separated from of *Brodiaea* by Greene (1886) and Hoover (1939, 1941). However, authors such as Peck (1961) have combined the groups into *Brodiaea*. *Triteleia* is treated as a distinct genus in the Jepson Manual (Hickman 1993). The species was originally described by Watson (1888). The variety was first identified by Peck (1940) as *Brodiaea leachiae*, and revised to variety status by Hoover (1941) which is the accepted status today. Due to the lack of a recent flora for southwestern Oregon the following technical description is from Peck's, *A Manual of the Higher Plants of Oregon*, p. 215 (1961).

Figure 1. Line drawing of *Triteleia hendersonii* from Abrams (1940)

9. *Triteleia hendersonii* (S. Wats.)  
Greene.

Henderson's *Triteleia*. Fig. 991.

*Brodiaea hendersonii* S. Wats. Proc. Am. Acad. 23:  
266. 1888.

*Triteleia hendersonii* Greene, Pittonia 1: 164. 1888.

Scape rather slender, 20-50 cm. long, minutely scabrous. Leaves shorter than or exceeding the scapes, 5-10 mm. wide, glabrous; umbels open, 6-15-flowered; pedicels slender, 2-3 cm. long; perianth salmon-color with broad dark purplish midveins, 15-20 mm. long; the tube turbinate, short-attenuate at base; segments a little longer than the tube, oblong-lanceolate; stamens in 1 row, inserted on the throat; filaments 4-5 mm. long, slender, slightly dilated at base; anthers blue, 1.5 mm. long; capsule broadly ovoid, abruptly beaked by the style, 6 mm. long, shorter than the stipe; seeds 4-5 in each cavity.

Cañon slopes, and rocky hillsides, Transition Zone; Siskiyou Mountains of southern Oregon and northern California. Type locality: near Ashland, Jackson County, Oregon.



Bulb ovoid, 1.5-2 cm high, the fibrous coat thick; scape very slender, slightly scabrous, 1.5-2.5 dm. high; leaves usually 2, equaling or surpassing the scape; scape 4-7 flowered, the filiform pedicels 12-25 mm long; perianth 1.5-2 cm. long, campanulate -funnelform or the lobes strongly spreading, parted a little more than half its length, gradually narrowed to the very slender base, white or bluish tinged, the lobes each with a broad median stripe of darker or purplish blue extending to the base of the tube; stamens all alike, the versatile anthers bluish, the filaments narrowly subulate, not strongly dilated at base; stipe twice as long as the ovary.-Along the lower Illinois R., Curry County.

The variety *leachiae* can be distinguished from the "species" by the color of the perianth. If the perianth is white or faintly bluish tinged and contains a darker or purplish blue median stripe on each perianth segment it is variety *leachiae*. If the perianth is pale yellow with a deep violet median stripe it is *T. hendersonii* var. *hendersonii* (Hoover 1941, Peck 1961).

Neither variety of *T. hendersonii* has been found in California and are not included in the Jepson Manual (Hickman 1993). However, a number of occurrences of var. *hendersonii* are quite close to the California border at the southern end of the Rogue Valley near Ashland, and it may eventually be found there.

#### Range and Distribution

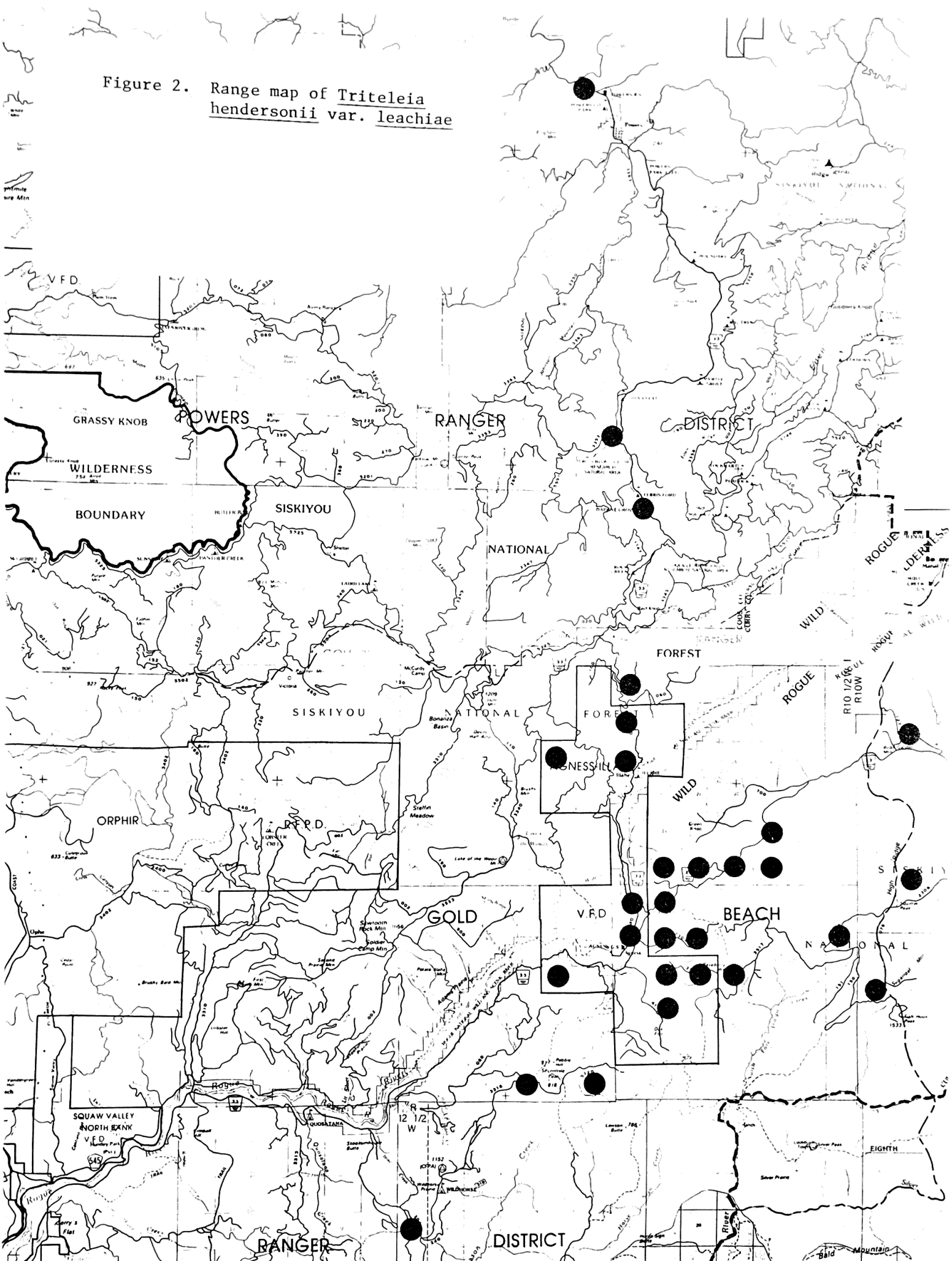
*Triteleia hendersonii* var. *leachiae* is restricted to the Shasta Costa, Rogue (Foster, Nail Keg, Quosatana, Snout and Billings Creeks), lower Illinois (Fall and Fox Creeks) and South Fork Coquille watersheds. The largest populations are located in the Shasta Costa watershed. All sites are located in the physiographic province of Klamath Mountains (Franklin and Dryness 1973). There are many populations identified at present and further surveys conducted in the flowering season will most likely elucidate more populations. Although quite plentiful in a few scattered locations in Curry County and to a lesser extent in Coos and Josephine Counties, the range of this species is quite restricted, and the habitat is not secure.

Details of the populations are included in the management section of the guide, and are to some extent summarized in the Element Occurrence Records (Appendix 1). A range map for *Triteleia hendersonii* var. *leachiae* is included as Fig. 2.

The most northerly population occurs north of Powers on private land near the South Fork Coquille River and is composed of two small subpopulations. Several populations have been found on the Powers Ranger District, the largest population is at the Daphne Campground adjacent to the South Fork Coquille River with >1100 individuals. A small population has also been found on BLM land to the east of the Powers District.

On the southside of Agness Pass, in the eastern Foster Creek drainage, several populations totaling more than 10,000 plants have been identified on roadcuts, cliffs, meadow edges and in open oak - Douglas-fir woodland. A population has been also identified on Billings Creek in a similar range of

Figure 2. Range map of *Triteleia hendersonii* var. *leachiae*



habitats. In addition, a large population of >400 plants exists at a recreational use site about 0.75 km up Foster Creek from the Rogue River.

At the western edge of the range of this taxa a small population of approximately 50 individuals was found in a roadcut of unstable talus (probably mudstone) on Road 33. Large and extensive populations were found near tributaries of Snout Creek with >10,000 plants in the largest population. Smaller populations were also identified in the Fall Creek watershed.

The largest populations were found in the lower Shasta Costa Creek. An extensive population of >50,000 plants was found along a small tributary of the Shasta Costa Creek. This population occurred mostly in open oak - Douglas-fir woodlands and to a lesser extent in meadow edges. Large populations were also found along nearby creek tributaries and further explorations will most likely yield more populations. Populations were also located on unstable talus roadcuts and on cliffs on both the north and south sides of the watershed.

Populations at the eastern and southeastern edges of the range of this taxa near Sevenmile Peak and southwest of Wildhorse Prairie were also censused.

### Habitat Description

*Triteleia hendersonii* var. *leachiae* is found in a number of habitats ranging from open oak - Douglas-fir woodlands, meadow edges, unstable mudstone talus roadcuts, and cliffs. It is found occasionally in brushy woodland areas but avoids dense coniferous woodlands and areas of dense litter. The open woodlands are often grass dominated and may or may not have extensive bryophyte cover and/or a diverse forb level component making up the understory. The woodland-meadow edges where the taxa occurs are generally thickly vegetated with herbaceous species. On roadcuts it is found with seeded exotic forbs and grasses or in highly eroded sedimentary rock areas with sparse vegetation, and on cliffs it is found on bryophyte and graminoid dominated outcrops.

Populations occur across all aspects in the open woodland and meadow edge habitats. On roadcuts and cliffs populations are usually found on north and west aspects although exceptions are common. Slopes range from 0° to 90°.

#### a) Soils

The taxon is not found in serpentine soils. It is usually found on older, non-metamorphic sedimentary soils, including mudstones, shales and clays. The Curry County Soil Survey (1970), which describes the adjacent private and state lands, characterizes these soils as largely belonging to the Orford Association, which are described as deep to moderately deep silty clay soils over siltstone, sandstone or mudstone. Also found as part of the habitat for this taxon (although somewhat closer to the coast) are soils belonging to the Winema series, which are also deep clay loams on siltstones and sandstones. The third soil group represents a small portion of the sites for *Triteleia hendersonii* var. *leachiae*, those along rivers and on river terraces. This is described as the

Riverwash-Nehalem-Gardner association, which are generally coarse textured alluvial loams found along the river floodplains.

## b) Habitats, Plant Associations and Associated Species

Information on habitats and plant associations is gleaned from my own observations and reports by Forest Service personnel. These observations were conducted on an ad hoc basis and therefore no statistical basis exists for habitat preference exists. *Triteleia hendersonii* var. *leachiae* occurs with a wide variety of associated species in species poor and species rich habitats. In the associated species listed below, an (E) following the taxon's name indicates that it is an exotic species, not native to southwestern Oregon.

1. **Road cuts** - *Triteleia hendersonii* var. *leachiae* occurs in mudstone roadcut communities. These communities commonly contain invasive exotic and native species including species used in seeding after road work. The substrate is often very unstable. The roadcuts containing *Triteleia hendersonii* var. *leachiae* are usually north or west facing. South aspects may be avoided due to moisture and/or to geological or road construction patterns. Common associates in these roadcuts include *Anaphalis margaritacea*, *Campanula prenanthoides*, *Iris innominata*, *Galium aparine* (E), *Rubus leucodermis*, *Ribes cruentum*, *Lonicera hispidula*, *Trientalis latifolia*, *Acer macrophyllum*, *Pseudotsuga menziesii*, *Festuca arundinacea* (E), *Quercus chrysolepis*, *Whipplea modesta*, Other *Festuca* spp., *Aira caryophylla* (E), *Bromus tectorum* (E), *Hieracium albiflorum*, *Hypochaeris radicata* (E), *Epilobium minutum*, *Erigeron foliosus*, *Polystichum minutum*, *Heuchera micrantha*, *Luina hypoleuca*, *Medicago lupulina* (E), *Cynuros echinatus* (E), *Oxali corniculata* (E), *Sedum spathulifolium*, *Pentagramma triangularis*, *Oxalis oregana*, *Toxicodendron diversilobum*, *Vicia* spp. (E), *Arbutus menziesii*, *Festuca californica*, *Rubus discolor* (E), *Calachortus tolmiei*, *Montia parviflora*, *Delphinium* spp., *Luzula comosa*, *Aster* species.

2. **Cliffs** - Cliffs are usually north or west facing, composed of non-metamorphic sedimentary rock. Populations usually occur on moss dominated outcrops and ledges on the cliff. The common associates found on roadcuts overlap with species found on cliffs -- especially for cliffs adjacent to roads.

3. **Open Woodlands and Meadow Edges** - The open woodland communities in which *Triteleia hendersonii* var. *leachiae* occurs are dominated by *Pseudotsuga menziesii* and various mixes of *Quercus garryana*, *Q. kelloggii*, *Q. chrysolepis* and *Lithocarpus densiflorus*, and sometimes *Arbutus menziesii*, *Umbellularia californica* and *Acer macrophyllum*. The woodlands may be free of shrubs or may contain saplings of the above species and scattered shrubs such as *Q. chrysolepis*, *Toxicodendron diversilobum*, *Vaccinium ovatum*, *Ceanothus integerrum* and less often *Ribes cruentum*, *Holodiscus discolor*, *Rhamnus purshiana*, *Gaultheria shallon*, *Rhododendron macrophylla*, *Acer circinatum*, *Symphoricarpos mollis*, and *Vaccinium parvifolium*. Dense *Vaccinium ovatum* thickets rarely contain *Triteleia hendersonii* var. *leachiae*.

The herbaceous cover may be moss, grass or forb dominated but representatives of all three groups are always present. Some of the species observed in association with *Triteleia hendersonii* var.

*leachiae* are *Lonicera hispidula*, *Festuca arundinacea* (E), *Cynosuros echinatus* (E), *Festuca californica* and *Calachortus tolmiei* as common dominants. Also occurring are species such as: *Prunella vulgaris*, *Whipplea modesta*, *Anthoxanthum odorata* (E), *Ligusticum* spp., *Dactylis glomerata* (E), *Daucus carota* (E), *Bellis perennis*, *Lathyrus delnorticus*, *Iris innominata*, *Iris* spp., *Trifolium repens* (E), *Galium muricatum*, *Sheridia arvense*, *Rumex acetosella* (E), *Aira caryophyllea* (E), *Bromus tectorum* (E), other *Bromus* spp., *Sanicula crassicaulis*, *Hypericum perforatum*, *Hypochaeris radicata* (E), *Lotus micrantha*, *Torilis* spp. (E), *Polystichum minutum*, *Allium bolanderi*, *Gnaphalium purpureum*, *Collomia heterophylla*, *Medicago polymorpha*, *Pentagramma triangularis*, *Vicia* spp. (E), *Vicia sativa* (E), *Chlorogalum* spp. *Osmorhiza chilensis*, *Rubus discolor* (E), *Luzula comosa*, *Aster* spp., *Synthesis reniformis*. These are diverse plant communities so a wide variety of other species also occur as associates.

Associated species in the higher elevation (2000-4000 feet) open woodlands are somewhat different. For example, *Xerophyllum tenax* and *Erythronium* spp. are common associates. However, many associated species occur in both the lower and higher elevation sites. These populations flower up to a month after the lower elevation populations.

*Triteleia hendersonii* var. *leachiae* occurs occasionally in areas of dense brushy understory (composed of the shrubs mentioned above) at low densities. In addition, the target species may occasionally occur in dense *Polystichum munitum* thickets.

## Population Biology

The leaves of *Triteleia hendersonii* var. *leachiae* emerge in spring. The plant blooms in mid-May to mid-June depending on elevation, exposure and severity of the winter.

Very little is known about the population biology of *Triteleia hendersonii* var. *leachiae*. It is assumed that the plant reproduces sexually through seeds. It is most likely insect pollinated by bees, flies and/or beetles. The bulb is probably long lived. Whether the plant leafs out and flowers annually or only at multi-year intervals is unknown. In addition, the relationship between frequency of above-ground emergence and climatic and disturbance regimes is unknown.

## Threats

### Natural Threats

While the majority of the significant threats to *Triteleia hendersonii* var. *leachiae* are human caused, several natural events and factors could impact its populations. For example, natural herbivory and succession may limit populations.

**Herbivory:** Apparent herbivory was observed at only one population, a road cut population (Road 33) in which many leaves appeared to be clipped off. It was not clear if this was caused by deer,

rabbits, or rodents. Thus herbivory is apparently not a major factor. However, below ground herbivory of bulbs had a major impact on plant mortality in a recent study of a rare *Calochortus* taxon (Kagan 1995), and may have a major impact on populations of *Triteleia hendersonii* var. *leachiae*. Herbivory of underground organs is difficult to assess without long-term observations.

**Succession:** It is possible that natural successional events may be impacting *Triteleia hendersonii* var. *leachiae* populations. It is more likely that successional events triggered by anthropogenic fire suppression may be impacting populations through an increase in understory brush and litter accumulation. This is addressed below.

### Human-Related Threats

**Forestry/Logging:** Numerous plant populations have been destroyed throughout the Siskiyou National Forest by logging practices and the associated road building which have resulted in major soil disturbance and the replanting of dense, closed canopy forests. Logging may also influence fire frequency, brush buildup and dramatically increase shade through canopy closure of planted conifers. At a few sites, *Triteleia hendersonii* var. *leachiae* populations were found prior to logging. After the logging and subsequent growth of planted conifers these populations could not be relocated and were assumed to have disappeared under the cover of dense conifer saplings. In some instances, *Triteleia hendersonii* var. *leachiae* plants have been observed growing up through logging slash (in areas which were not replanted or the replanting efforts failed). In addition, when the scattered Douglas-firs in meadows have been removed, the *Triteleia hendersonii* var. *leachiae* populations appear vigorous.

Future logging operations should avoid areas which contain *Triteleia hendersonii* var. *leachiae*, and the planting of conifers in open woodland habitats providing habitat for the taxon should not be conducted. Logging is a serious threat for this species if the timber harvest activities destroy plants or result in extensive soil disturbance; or if they are followed by replanting, which can rapidly lead to a closed canopy forest. On the other hand, selective logging, especially in meadow and open woodland habitats, may provide an effective management tool for this taxa.

**Fire Suppression:** *Triteleia hendersonii* var. *leachiae* occurs in areas with high fire frequency due to warm, dry summers and an abundance of lightning. In addition, it is possible that pre-Columbian peoples ignited fires to maintain more open habitats in this area. In any case, fire suppression over the past 75 years has drastically altered many of the habitats in the Siskiyou National Forest. Although the species now occurs in its highest densities in open Douglas-fir/oak woodlands these sites may have been much more common in pre-fire suppression days. It is possible that the range of *Triteleia hendersonii* var. *leachiae* may have decreased along with the range of these habitats. Fire suppression may create the conditions for increasing understory brush and litter accumulation which may crowd out the target species and/or create conditions for the accumulation of Douglas-fir stems and the creation of a closed canopy Douglas-fir forest. The depth of the bulb and the ephemeral nature of actively growing aboveground structures most likely give the plant an immunity to all but the hottest fires.



The research has not been done to show the effect of the fire suppression on this species. It may be that (at least some of) the open woodlands that harbor *Triteleia hendersonii* var. *leachiae* are edaphically or climatically controlled and do not depend upon fire for their maintenance. There is no doubt that meadow communities in the Siskiyou are being invaded by woody plants due to fire suppression, however, *Triteleia hendersonii* var. *leachiae* rarely occurs in open meadow habitats, rather it occurs at its greatest densities in open woodlands and meadow margins. Liliaceous species with large bulbs are often very long lived, thus the effects of land management practices on population dynamics is difficult to assess over the short term.

**Road Construction:** This plant often occurs on roadcuts. These populations are important in spite of the fact that they are over represented due to their ease of detection. The taxon appears to be very tolerant of road disturbance and is observed growing in loose roadside talus and in roadside ditches. Two possibilities exist for the prevalence of roadcut populations. The populations may have been present on and adjacent to the site before construction and invaded the roadcut from adjacent locations after construction. Another possibility is that roadcuts of loose mudstone talus may be a desirable habitat and the plants dispersed from further afield to take advantage of the favorable light/edaphic/moisture environment. On most roadcut populations, *Triteleia hendersonii* var. *leachiae* plants were not observed nearby, although occasionally plants were found adjacent to the cut. The dynamics of this taxon on roadcuts will require longterm observations to assess. Due to the uncertainties of our current knowledge, road building and widening should be avoided in *Triteleia hendersonii* var. *leachiae* habitat even if the plant may thrive on some roadcuts.

**Grazing:** There are only two grazing allotments on the Gold Beach Ranger District and none on the Powers District. Therefore, grazing is not a threat to this species. The effect of the more widespread grazing which occurred in the past is difficult to estimate.

**Recreation:** Meadows and open woodlands are popular habitats for off-road vehicle riding. These activities are detrimental to the successful flowering and fruiting of *Triteleia hendersonii* var. *leachiae* and its associates and very destructive to these fragile habitats. Off-road vehicles will also damage the bulbs since the soft substrate is torn up by these vehicles. This was observed in the locations where off-road vehicles use was evident. The Forest Service does appear to be discouraging off-road vehicle use in meadows and open woodlands and evidence of this type of damage was found in only a few sites. This discouragement should continue and be enforced through gating roads and appropriate signage.

**Meadow Management:** Meadow management is critical for the continued survival of meadow and open woodland habitats against the invasion of exotic herbaceous species and an increasing density of woody species. It is probable that open woodlands without management will suffer from an increasing density of Douglas-fir and/or shrubby species and the gradual disappearance of the target species.

Controlled burns, girdling of conifers and the removal of brush are all effective means of meadow enhancement. Care should be taken to not pile brush on *Triteleia hendersonii* var. *leachiae* sites. Meadow managers should stay abreast of the most recent findings in meadow management and

maintain monitoring plots. Meadow management practices were observed on the Gold Beach district - positive or negative effects of meadow management on the taxon will require longterm monitoring. However, the practices do not appear to be negatively impacting the taxon over the short term, *i.e.* there are vigorous populations in meadow management zones.

## MANAGEMENT PLAN

### Population Objectives

The goal of this management plan is to maintain and enhance populations of *Triteleia hendersonii* var. *leachiae*, to prevent it from becoming extinct and if possible to remove the need for including it on the U. S. Fish and Wildlife list of species needing the protection of the Endangered Species Act.

There are currently many populations, nearly all of which occur entirely on public land. The goal of this plan is to maintain the significant populations over time and to maintain or increase *Triteleia hendersonii* var. *leachiae* population sizes and stabilize its habitat throughout its range.

### Management of Roadside Populations

*Triteleia hendersonii* var. *leachiae* is apparently tolerant of the disturbance levels on road cuts. These roadside populations are apparently safe and do not require any management except for an avoidance of road widening or roadside spraying activities. Current roadside activities do not seem to be adversely affecting the populations, at least over the short term.

It is possible that timber management activities could impact roadcut populations. Logging operations which would cause erosion to road cut populations should be avoided. Buffers should be left between a logging operation and a road cut harboring a *Triteleia hendersonii* var. *leachiae* population.

### Management of Cliff Populations

Cliff populations do not require any specific management recommendations, except for those populations located on cliffs adjacent to roads in which case road widening activities should be avoided. In addition, logging activities should be avoided near cliffs which harbor *Triteleia hendersonii* var. *leachiae* populations.

## Management of Meadow Edge and Open Woodland Habitats

Effective management recommendations are dependent on specific research results which do not exist for this taxon. However, recommendations for open woodland and meadow maintenance would be applicable for this species. Removal of exotics, prescribed burns, brush removal and girdling of invading trees are all effective techniques for the maintenance of meadow and open woodland habitats, and are all currently being practiced and should be encouraged. These practices should occur after the *Triteleia hendersonii* var. *leachia* has flowered and fruited in the areas where it occurs. Care should be taken not to pile brush over areas where the plant occurs.

Off-road vehicle use should not be allowed but less obtrusive forms of recreation are fine, however, other associated species may be more sensitive to use by hikers, hunters or off-road bicyclists.

The relationship between *Triteleia hendersonii* var. *leachia* and exotic grasses versus native bunchgrasses is unknown. There is a possibility that the higher competitiveness of exotic grasses may detrimentally impact native species such as *Triteleia hendersonii* var. *leachia*. For example, *Bromus tectorum* negatively impacts native bunchgrasses through its early exploitation of soil moisture supplies (Mack 1981, 1984).

In conclusion, good meadow and open woodland management should be good *Triteleia hendersonii* var. *leachia* management.

## **Selected Populations:**

The ten top priority populations for conservation have been identified as selected populations below. Some of the best open woodland sites with intact oak canopies and very few exotic species in the understory should be considered as possible Research Natural Areas (RNA). These sites represent an unfilled, medium priority cell from the Oregon Natural Heritage Plan (1993), Coastal oak-conifer woodland and meadow mosaic. Sites with Research Natural Area potential are noted below. The meadows do contain exotic species in all of the following areas, but represent the most significant populations and habitat for this taxon. As such, these sites should be managed primarily for the maintenance of *Triteleia hendersonii* var. *leacheia* and its habitat.

- 1) Shasta Costa--T34S,R11W, Section 34 and 35 and other nearby sections. An extensive area of meadow and oak woodland with more than 50,000 *Triteleia hendersonii* var. *leachia* plants. This is the largest and best potential RNA on the Siskiyou National Forest.
- 2) Fall Creek--T34S,R11W, Section 17,SE4NW4. Meadow and oak woodland habitat with more than 1,000 *Triteleia hendersonii* var. *leachiae* plants. This site is also a potential RNA, although the unfilled habitats here are smaller than those in the Shasta Costa site..

- 3) Road 110 pop off of Road 3336 pop.--T34S,R11W, Section 14, NW4SE4. Meadow and oak woodland habitat with lichen beds and madrona thickets. Although the number of *Triteleia hendersonii* var. *leachiae* is limited the habitat is both very interesting, and different enough to represent an important genetic reservoir for the taxon. This area also contains a good representation of the RNA habitats.
- 4) Snout Creek--T35S,R11W, Section 8. Open woodland and meadow habitat with more than 10,000 *Triteleia hendersonii* var. *leachiae* plants.
- 5) Road 3318.300 population -- EO 024 -- T36S,R12.5W, Section 24. Oldgrowth forest edge at the southwest edge of the taxon's range.
- 6) Daphne Grove Campground -- EO 004 -- T33S,R11W, Section 7. Grassy area and dry meadow bordering riverbed. Unusual habitat near the northeastern edge of the species range.
- 7) South Fork Coquille River -- EO 005 -- T32S,R12W, Section 26. Cliffs at the extreme northwest edge of the taxon's range on USFS lands.
- 8) Bob's Garden Mountain -- EO 017 -- T34S,R10W, Section 5. Small occurrence in open mixed canopy forest at the east end of the species range. This site was the only one not relocated during this study. However, it is a small occurrence in a large area of potential habitat, recently located by a Forest Service botanist. Assuming it is still extant, it should be managed as a selected population.
- 9) Seven Mile Peak area -- EO 032 -- T35S,R12W, Section 36. A fairly local occurrence on unusual (apparently serpentine) substrates near the southern edge of the taxon's range.
- 10) South Fork Coquille River -- EO 025 -- T31S,R12W, Section 11. A small population on a rock outcrop at the extreme northwest edge of the taxon's range, on BLM land.

### Monitoring

Monitoring plots should be established in several of the populations in different habitats in different locations. The most significant locations would be the Selected Populations which occur in areas where fire suppression and canopy closure appears to be a threat. Monitoring plots would yield rough assessments of the status of the populations and the effect of management regimes, especially if prescribed fire can be reintroduced into *Triteleia hendersonii* var. *leacheia* habitat. Monitoring program should also be tied in with meadow management objectives. Long term monitoring is essential for any accurate assessment since flowering may be very sensitive to annual climatic conditions. For example, the year of this study was one of extremely high winter precipitation which may have resulted in the large numbers of plants being observed. Individual plants should be marked in order to determine emergence frequency. A long term annual census is required to

assess recruitment into the population from seed, asexual propagation through bulb-splitting, number of years until flowering, frequency of flowering and flower number, fruit set, and other important factors critical to the understanding of population dynamics of a taxon. However, at the bare minimum population size should be censused annually in a number of plots.

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