GREAT CAMAS

Camassia leichtlinii (Baker) S. Watson ssp. *suksdorfii* (Greenm.) Gould

Plant Symbol = CALES2

Photo by Kathy Pendergrass, Oregon NRCS, 2008

Common Names: Leichtlin's camas, large camas, Suksdorf's large camas
Scientific Names: *Camassia leichtlinii* (Baker) S. Watson var. *suksdorfii* (Greenm.) C.L. Hitchc., *Camassia suksdorfii* Greenm. Note: *Camassia quamash* ssp. *quamash* was previously misapplied as a synonym of this taxa.

Warning: Deathcamas (*Zigadenus venenosus*) can be confused with edible camas bulbs and is toxic. Be sure of your identification of camas bulbs before eating them!

Description
General: Lily Family (Liliaceae). Great camas is a perennial herb that grows from an edible bulb. The plant can grow from 24-48 inches (60-120 cm) tall. Leaves are long and narrow, grass-like, and emerge from the base. Great camas blooms in late April to late June. The inflorescence is a spike-like cluster borne on a leafless stem that is held above the leaves. Camas flowers are creamy-white to deep blue-violet; they have 6 tepals, 6 stamens, and 3 stigmas. The white form is considered to be native only to the Umpqua Valley of Oregon. Great camas differs from common camas (*Camassia quamash* ssp. *breviflora*) in the following ways: the flowers are regular, with tepals that twist together after anthesis and remain over the ovary; anthers are dull yellow to violet; the plant is larger, with longer flower stalks and bigger bulbs; and there is a fine, waxy powder on the leaves. The seeds are usually larger as well. The fruits are barrel-shaped to three-angled capsules, splitting into three parts to release many black, angled seeds.

Distribution: Great camas grows from south Vancouver Island, British Columbia to northern California, from the coast to the Cascade and Sierra Nevada Mountains at elevations below 10,800 feet (3300 m). This sub-species does not extend east of the Cascades. For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

Habitat: Great camas grows in wet meadows, woods, prairies, moist hillsides, and streamside areas. Camas habitat is often ephemeral, and dries up by late spring. In western Oregon, its preferred habitat includes shady environments, such as those that occur along riparian zones or under moderately dense deciduous forest canopies. However, it can be found in more open habitats elsewhere within its natural range. In British Columbia, great camas is restricted to wet flats, ditches, and moist rocky areas on southern Vancouver Island and the adjacent Gulf Islands. Common and great camas often grow in the same environments. The bulbs of great camas can be substantially larger in size and deeper in the soil than common camas, and sometimes grow 16 inches or more below the surface.

Adaptation
Great camas is frequently found in areas with soil moisture persisting throughout most of the growing season. Bulb depth appears limited by shallow water tables, anoxic conditions, or restrictive layers.

Uses
Ornamental: Horticulturally, this plant is used for cut flowers, beds, borders, ground cover, rock gardens, and prairie restoration.

Wildlife: Elk, deer, and moose reportedly graze camas early in the spring (Craighead et al., 1963). Gophers eat camas and move the bulbs to another area where they sprout and grow the next year (Watson, 1988). Indian women in Oregon's Umpqua Valley robbed camas bulbs from gopher caches (Piper, 1916). Herbivorous insects also eat camas leaves. Camas attracts a wide variety of pollinators including European honeybees, bumble bees, mason bees, hover flies, beetles, and lady beetles (Bartow, 2015; Pendergrass et al., 2008).

Great camas in its native wetland habitat in the Willamette Valley of western Oregon. Photo by Kathy Pendergass, Oregon NRCS, 2008.

Ethnobotany

Camas was and continues to be one of the most important "root" foods of western North American indigenous peoples, from southwestern British Columbia to Montana, and south to California (Kuhnlein and Turner, 1991). The part of the plant that was relished is actually a bulb. Camas was used by Northwest Coast peoples, the Coast Salish of Vancouver Island, western Washington groups, Squamish, Sechelt, Comox, and Kwak-waka'wakw of the British Columbia coast. Camas was considered to be one of the most important bulbs to local California natives. The Maidu particularly valued great camas.

Except for choice varieties of dried salmon, no other food item was more widely traded (Gunther, 1973). People traveled great distances to harvest the bulbs and there is some suggestion that plants were dispersed beyond their range by transplanting (Turner and Efrat, 1982; Turner et al., 1983). To the Nez Perce people, camas is still the most important root in trade, and trading is traditionally impossible without camas bulbs (Harbinger, 1964). Dried camas is the most expensive form of camas, with baked and then raw camas being less expensive. At marriage trades, the girl's family gives roots in corn husk bags. At funeral trades, camas roots are given to friends and relatives by the widow. The Nez Perce traded camas roots with the Warm Springs, Umatilla, Cayuse, Walla Walla, Nespelem, Yakama, Crows, and Flatheads.

The bulbs were usually dug after flowering, in summer, although some peoples dug them in spring. Harvesting the bulbs traditionally took weeks or months among the Nez Perce. Each family group "owned" its own camping spot and harvesting spot. These were passed down in families from generation to generation. Turf was lifted out systematically in small sections and then replaced after only larger bulbs had been removed. The bulbs were dug with a pointed digging stick. Annual controlled burning was used to maintain an open prairie-like habitat for optimum camas production. Areas were harvested only every few years.

Traditionally, camas bulbs were almost always pit-cooked. Within the past 100 years, camas bulbs have also been cooked by stovetop methods (Turner and Kuhnlein, 1983). The bulbs are allowed to cook for 24-36 hours when pit-cooked (Turner and Bell, 1971). It is probable that lengthy cooking is necessary for maximum conversion of the inulin in *Camassia* to fructose. The sweetness of cooked camas gave it utility as a sweetener and enhancer of other foods. Before sugar, European traders introduced molasses and honey. Sweetening agents were in short supply among native peoples, and camas was highly valued in this capacity. Sometimes other foods, such as the rhizomes of springbank clover (*Trifolium wormskioldii*) and the roots of Pacific silverweed (*Potentilla anserina* ssp. *pacifica*) were cooked with the camas bulbs. The Kalapuyan of the Willamette Valley in Oregon used to flavor camas with tarweed (*Madia elegans*). Bulbs don't keep well fresh. They were cooked or sun-dried and stored for later use. Sometimes camas bulbs were pressed flat and made into camas cakes the size of biscuits before being dried (Turner et al., 1983). Dried bulbs were re-constituted by soaking in water, usually overnight.

Many of the traditional camas gathering sites, such as Weippe Prairie and Camas Prairie in Idaho and the Willamette Valley in Oregon, have been converted to agriculture. The average size of a camas patch needed to feed a five person family was 2.7 ha (Thoms, 1989). Camas roots are hard to find now. Restoration of camas prairies and access to camas bulbs are priorities of many Indian people. At one time, "When camas was in bloom in wet meadows, the flowers grow so thickly that they look like a blue lake" (Murphey, 1959).

Camas stalks and leaves were used for making mattresses. It was sometimes used in place of grass when baking camas in pits. Camas is used by the Nez Perce as a cough medicine. It is boiled, and the juice is strained and mixed with honey.

Traditional Resource Management (TRM) was often intensive, to the point of being considered "semi-agricultural" by some. According to Dr. Nancy Turner, TRM included the following:

- Ownership, demarcation, and inheritance of beds or patches,
- Clearing of rock, brush, and weedy vegetation,
- Harvesting bulbs after seeds were produced, during specific times of the year,
- Periodic field burning in summer after digging,
- In some cases, sod removal then bulb removal followed by sod replacement,
- Digging or "cultivation" to keep the soil loose,
- "Selective breeding" by transplanting "better" bulbs to the beds,
- Sustainable harvest techniques, including partial, selective harvests and incidental or planned promotion of camas colonization and reproduction, and
- Death camas bulbs (*Zigadenus venenosus*) were removed, so they wouldn't accidentally be mistaken for the edible camas bulbs.

Status

Wetland Indicator: Great camas is classified as a facultative wetland plant (FACW), meaning it usually occurs in wetlands, but also may occur in non-wetlands. Please consult the PLANTS Web site (http://plants.usda.gov/) and your state's Department of Natural Resources for this plant's current status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

Planting Guidelines

Great camas can be propagated from seeds or bulbs; shade tolerance, moisture requirements, and preferred planting depth may differ among specific phenotypes. Plants require irrigation or moist soil conditions to become established. Great camas can be difficult to establish in California.

Great camas is readily established by transplanting wild or commercially grown bulbs. Wild harvests should be restricted to salvage sites with appropriate approvals or permits. Due to loss of wetland habitat throughout the United States, harvesting plants from the wild is rarely appropriate or legal except under salvage situations. Use of bulbs or seeds from local nurseries or greenhouses is strongly recommended.

Given that camas commonly occupies sites high in silt and clay that dry out in summer, windows for digging are often narrow. The best time to excavate bulbs is from early summer through mid-fall. Store the bulbs in a dry, dark, cool, well ventilated place in a potting medium such as dry peat moss, similar to recommendations for fall planted/spring flowering bulbs (such as daffodils and tulips).

Plant camas outdoors in the fall or early winter, when soils are moist enough to dig and prevailing soil temperatures are cool. This is generally below 60°F. Fall planting allows for better root development and fulfillment of any chilling requirement for flowering (De Hertogh et al., 1993). The larger the bulb, the greater the planting depth can be. As a general rule, bulbs can be planted three times as deep of the diameter of the bulb. Keep the camas bed damp until it gets warm. Once plants senesce after flowering, stop watering so seeds form and bulbs cure. Suggested spacing for flower beds and naturalized landscapes vary from 3-4 inches apart (8-10 per sq. ft.) to 6-8 inches apart.

For prairie restoration, seed great camas at a single species rate of about 27 pounds per acre (50 seeds per square foot), or if included as part of a pollinator or prairie seed mix, at a rate of 1.5 to 6.5 lb/ac (or about 5-10% of the mix, calculated on a seeds-per-square-foot basis).

Management

Consistent soil moisture is required every spring, but the soil can be allowed to dry out soon after the pods mature or the leaves senesce (dry up and turn brown). Moderate soil nutrient levels are beneficial. In natural settings, minor soil disturbance (loosening, surface scarification) adjacent to existing specimens may enhance natural regeneration by seed; seedling recruitment is highest in areas that are bare when the seeds germinate in February. Late summer field burning (where and when permitted) may improve stand vigor, reduce competition from brush and certain weeds, and aid in regeneration. For optimal bulb development, avoid mowing or grazing more than lightly, if at all, even during foliar senescence. Individual plants may live 15 to 20 years or more.

Pests and Potential Problems

Camas is favored as forage by deer, so fencing or repellents may be useful, particularly during the first growing season. Bulb predation by pocket gophers can be a substantial threat to stands if left unchecked. It may be necessary to bury bulbs with a protective wire mesh to prevent herbivory. The mesh needs to be coarse enough to allow shoots to grow through (De Hertogh et al., 1993). Voles (field mice) forage on young leaves in early spring and also consume bulbs. It may also be necessary to protect young seedlings from slugs the first year.

Environmental Concerns
There are no known environmental concerns related to great camas.

Seeds and Plant Production
Great camas propagates easily from seed. It can be collected as soon as the pods mature (turn light brown) or split open to reveal the mature black seeds. Pods ripen from late May to July. Dry seeds can be stored in a cool, dry place prior to planting. Camas seed is dormant and typically requires 60-100 days of cold moist stratification (moist chilling at 34-40°F) for maximum germination (Bartow, 2015; Emery, 1988; Guerrant and Raven, 1995; Deno, 1993; Northway pers. comm. 1998; Thoms, 1989).

To establish seed production fields, sow seed in the fall at a rate of 6 to 10 pounds per acre in 6- to 14-inch wide rows at a depth of ⅛ to ¼ inch (Bartow, 2015). Fall sown fields can be sprayed with a non-specific herbicide to eliminate the first flush of weeds, since seedlings do not typically germinate until late winter. One-leafed, grass-like seedlings will emerge in February or March under suitable conditions. Seedlings require moisture through the spring growing period to survive. Warm temperatures during seedling development can be lethal.

If started from seed, great camas will not flower and set seed until the third or fourth growing season. Once the bulbs are large enough to flower, seed yields are likely to increase substantially for several years thereafter, eventually plateauing and then starting to decline as bulbs become more crowded. As stands age, an abundance of foliage with few flowers is an indication that the bulbs have become over-crowded; on a small scale, they can be lifted, separated, and replanted at the proper spacing in the fall.

Seed can be harvested by conventional direct combining followed by seed drying (Bartow, 2015). Harvest should occur when the large majority of capsules have turned from green to tan and only a small percentage have split open to reveal the black seeds. If substantial healthy green foliage is still present at harvest time, plants should be cut high to leave as much of the leaves intact to benefit further bulb development. Optionally, mature stalks and seed heads can be windrowed onto tarps and then dried for a week or two. The dry capsules should split and release the seed, thus negating the need for threshing, but some shaking is required. Average seed yields at the Corvallis Plant Materials Center are 300 to 750 pounds per acre.

Great camas has approximately 70,000 to 90,000 seeds per pound.

Uncommon white (alba) form of great camas in the Umpqua Valley of Oregon. Photo by Kathy Pendergrass, Oregon NRCS, 2007.

Cultivars, Improved, and Selected Materials (and area of origin)
Cultivars of Leichtlin's camas are widely available in the flower bulb industry. One cultivar, 'Alba', is white (or bluish-white), while 'Caerulea' has light blue flowers, and 'Plena' has double greenish yellow blooms (Brenzel, 1995). 'Blauwe Donau' is described as having sea-lavender-violet flowers and lilac anthers. 'Lady Eve Price' has campanula-violet flowers with each segment having a darker colored methyl-violet central stripe (Royal General Bulbgrower's Association, 1991). 'Semiplena' has large, semi-double, creamy-white flowers.

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