

## bigleaf lupine

### *Lupinus polyphyllus* ssp. *polyphyllus* Lindl.

Synonyms: *Lupinus arcticus* S. Watson var. *humicola* (A. Nelson) C. P. Sm., *L. matanusensis* C. P. Sm., *L. polyphyllus* ssp. *polyphyllus* var. *polyphyllus* Lindl., *L. pseudopolyphyllus* C. P. Sm., *L. stationis* C. P. Sm., *L. wyethii* ssp. *wyethii* S. Watson

Other common names: garden lupine, largeleaf lupine, large-leaved lupine, lupin, marsh lupine, Washington lupin,

Family: Fabaceae

**Invasiveness Rank:** 71 The invasiveness rank is calculated based on a species' ecological impacts, biological attributes, distribution, and response to control measures. The ranks are scaled from 0 to 100, with 0 representing a plant that poses no threat to native ecosystems and 100 representing a plant that poses a major threat to native ecosystems.

*Note on nativity:* The native status of bigleaf lupine in Alaska is disputed. Hultén (1968) lists it as being introduced to Alaska, while Douglas et al. (1999) and Pojar and MacKinnon (1994) indicate that it is native to southeast Alaska. Bigleaf lupine is considered native to British Columbia, where its range extends to the northern edge of the province adjacent to southeast Alaska (Douglas et al. 1999, Pojar and MacKinnon 1994, Klinkenberg 2010). Further research using collection records, molecular and morphological markers, and paleoecological methods is necessary to confirm the origin of this species in Alaska.

#### Description

Bigleaf lupine is a perennial plant that grows 40 to 100 cm tall from creeping rhizomes. Stems are erect or ascending, glabrous or hairy, and usually unbranched. Several stems grow from the caudex. Leaves are alternate, petiolated, and palmately compound with 9 to 18 leaflets each. Petioles of basal leaves are 10 to 30 cm long. Leaflets are oblanceolate to elliptic, sparsely hairy below, glabrous above, 3 to 12 cm long, and 6 to 27 mm wide with pointed tips and entire margins. Racemes are dense, terminal, and 6 to 40 cm long. Pedicels are 5 to 10 mm long. Calyxes are hairy, two-lipped, and 4 to 6 mm long with entire or minutely toothed margins. Corollas are blue to pink, glabrous, and 11 to 16 mm long. Pods are hairy, curved, and 2.5 to 5 cm long. Each pod contains five to ten seeds (Hultén 1968, Welsh 1974, Douglas et al. 1999, NatureGate 2011).



Leaf of *Lupinus polyphyllus* ssp. *polyphyllus* Lindl.

*Similar species:* Four *Lupinus* species are native to Alaska and can be confused with bigleaf lupine: arctic lupine (*L. arcticus*), Yukon lupine (*L. kuschei*), prairie lupine (*L. lepidus*), and Nootka lupine (*L. nootkatensis*). Bigleaf lupine can be distinguished from all other *Lupinus* species in Alaska because it usually possesses more than 10 leaflets per leaf, whereas the four native *Lupinus* species possess 10 or fewer leaflets per leaf (Hultén 1968, Douglas et al. 1999).



*Lupinus polyphyllus* Lindl.

### Ecological Impact

**Impact on community composition, structure, and interactions:** Bigleaf lupine can form a new mid-forb layer that outshades and reduces the density of underlying layers (NatureGate 2011). In Alaska, 11% of infestations have occurred at or above 50% ground cover (AKEPIC 2011). Infestations reduce the diversity of native plant species along roadsides and in meadows in Europe (Valtonen et al. 2006, NatureGate 2011, Fremstad 2010). This species grows at high densities in Glacier Bay National Preserve, where it outcompetes and excludes native plants in meadows and shaded forest understories. It can form persistent populations in Alaska; the population in a natural area in Dry Bay, Glacier Bay National Preserve, has been prevalent for at least 15 years (Rapp 2009). Bigleaf lupine hybridizes freely with the native Nootka lupine (*Lupinus nootkatensis*) (Welsh 1974). Hybrid plants have been found in natural areas, such as subalpine meadows, in Alaska (UAM 2011). Bigleaf lupine is an important floral resource for bumblebees (Jennersten et al. 1988); the presence of this species may therefore alter native plant-pollinator interactions. Infestations can reduce the local abundance of butterflies (Valtonen et al. 2006). Many *Lupinus* species, including bigleaf lupine, contain alkaloids that are toxic to animals (DiTomaso and Healy 2007, Fremstad 2010).

**Impact on ecosystem processes:** Bigleaf lupine likely

delays the establishment of native species in disturbed sites (Densmore et al. 2001). Roots are associated with bacteria that fix atmospheric nitrogen, and infestations significantly increase the availability of nitrogen in the soil (Valtonen et al. 2006, Fremstad 2010, NatureGate 2011). The addition of nitrogen to the soil favors the establishment or increase of other non-native species. Removal of bigleaf lupine may not immediately return nutrient cycling patterns to their pre-invasion states (Valtonen et al. 2006). Rhizome growth binds and stabilizes soil (Rapp 2009).

### Biology and Invasive Potential

**Reproductive potential:** Bigleaf lupine reproduces sexually by seeds and vegetatively from rhizomes (Densmore et al. 2001). Plants produce an average of 2,654 seeds each (Aniszewski et al. 2001). Seeds can remain viable for many years (Gisler pers. comm.), possibly more than 50 years (Fremstad 2010). However, some populations appear to expand more by rhizomes than by seeds (Rapp 2009).

**Role of disturbance in establishment:** Bigleaf lupine establishes in anthropogenically disturbed sites and along roadways in Alaska (Hultén 1968, AKEPIC 2011). It also establishes in areas that are naturally disturbed by river action, stream action, and fire (AKEPIC 2011, UAM 2011, Carlson pers. obs., Lapina pers. obs.). Bigleaf lupine has established in vegetated meadows and forest understories in Glacier Bay National Preserve (Rapp 2009). It grows in open to dense forests (Welsh 1974) and was found growing in a wetland amongst bluejoint reedgrass (*Calamagrostis canadensis*) and marsh pea (*Lathyrus palustris*) in the Malaspina coastal plain (UAM 2011). Bigleaf lupine has been documented in the riverbeds of Canterbury, New Zealand where it has formed dense stands on bare gravel bars, stabilizing the previously unstable braided riverways (New Zealand DOC 2007). This species invades vegetated areas in Finland, Germany, and Russia (Valtonen et al. 2006, Fremstad 2010, NatureGate 2011).

**Potential for long-distance dispersal:** Pods open explosively, scattering seeds a few meters from the parent plant (Densmore et al. 2001, Fremstad 2010). Seeds have been transported from river banks by changing water levels, forming colonies in new areas (Rapp 2009).

**Potential to be spread by human activity:** Bigleaf lupine is cultivated as an ornamental plant in Alaska (Welsh 1974, Rapp 2009). It often escapes and becomes locally well-established (Welsh 1974). Seeds can be dispersed on vehicles or in contaminated soil (Fremstad 2010), and this species is spreading along roads in Alaska (Hultén 1968, AKEPIC 2011).

**Germination requirement:** Seeds have hard seed coats and can remain dormant for large amounts of time

(Densmore et al. 2001).

**Growth requirements:** Bigleaf lupine grows best in moderately dry to moist, well-drained sand or loam (Fremstad 2010). It can grow in open areas or in shaded understories (Rapp 2009). Seeds mature in late summer or early fall (Fremstad 2010). In British Columbia, this species grows in river bars, riverbanks, coasts, meadows, clearings, glades, open forests, and roadsides (Douglas et al. 1999).

**Congeneric weeds:** Yellow bush lupine (*Lupinus arboreus*) is known to occur as an invasive wildland pest plant in California (DiTomaso and Healy 2007). Nootka lupine (*L. nootkatensis*), which is native to Alaska, is known to occur as a non-native weed in northern Europe (Lid and Lid 1994).

### Legal Listings

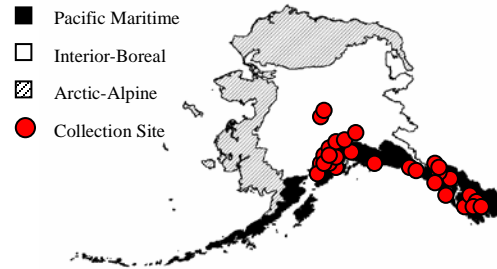
- Has not been declared noxious
- Listed noxious in Alaska
- Listed noxious by other states
- Federal noxious weed
- Listed noxious in Canada or other countries

### Distribution and Abundance

Bigleaf lupine is cultivated as an ornamental plant in Europe, Asia, and North America, including Alaska (Welsh 1974, Rapp 2009, eFloras 2008, Fremstad 2010). In Europe, it is also grown for fodder (Aniszewski et al. 2001, Fremstad 2010). This species has invaded riparian and wetland communities in Alaska (AKEPIC 2011, UAM 2011). It also invades riparian communities in Europe (Fremstad 2010). In Germany, Finland, and Russia, it invades natural acid grasslands, tall forb vegetation, meadows, pine forests, and forest edges (Valtonen et al. 2006, Fremstad 2010).

**Native and current distribution:** Bigleaf lupine is native

to western North America (Douglas et al. 1999). It grows in 16 states of the U.S. (USDA 2011). It is widely naturalized in Europe (Aniszewski et al. 2001), including Scandinavia (Jennersten et al. 1988, Lid and Lid 1994, NatureGate 2011) and Russia (Gubanov et al. 1995). This species has also been introduced to Asia, South America, and New Zealand (ILDIS 2010). It is known to grow as far north as 70.6°N in Norway (Norwegian Species Observation Service 2011). Bigleaf lupine has been documented from the Pacific Maritime and Interior-Boreal ecogeographic regions of Alaska (Hultén 1968, AKEPIC 2011, UAM 2011).



Distribution of bigleaf lupine in Alaska

### Management

**Note:** Due to its disputed nativity, Control should only be applied to populations of for which non-nativity is known. Small populations of bigleaf lupine can be eradicated by digging up rhizomes. However, manual treatments may need to be repeated to eliminate plants resprouting from rhizomes and seeds (Densmore et al. 2001). Mowing twice per year before plants flower prevents the spread of populations and may eradicate populations if repeated for three to five years (Valtonen et al. 2006, Fremstad 2010). Glyphosate herbicides likely control bigleaf lupine (Fremstad 2010).

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