ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract **Element Code:** PDCPR02010

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Linnaea borealis*
COMMON NAME: Twin Flower
SYNONYMS:
FAMILY: Caprifoliaceae

AUTHOR, PLACE OF PUBLICATION: Linnaeus, Carl von. Species Plantarum 2: 631. 1753.

TYPE LOCALITY: Not known.

TYPE SPECIMEN: Herb. Linn. No. 250. (Inst. France) Lectotype designated by Jonsell, Regnum Veg. 127: 61 (1993).

TAXONOMIC UNIQUENESS: *Linnaea* is a monotypic genus with *borealis* as the only species. Three subspecies are recognized: *L. b.* ssp. *borealis*, *americana* (American twinflower) and *longiflora* (Pacific twinflower). Arizona plants belong to the ssp. *americana*.

DESCRIPTION: Subshrubs, creeping, evergreen, 5-10 cm tall. Stem long, slender, sparsely shortly pubescent. Petiole 3-4 mm; leaf blade orbicular to obovate, abaxially glabrous, adaxially sparsely pubescent, margin with 1-3 pairs of rounded teeth. Flowers fragrant, nodding; main peduncles 60-70 mm; inflorescence bracts linear, shortly pubescent; inflorescence peduncles less than 10 mm. Sepals shortly pubescent, narrowly acute, deciduous in fruit. Corolla white to pink, to 10 mm; tube glabrous outside, pubescent inside. Stigmas capitate. Achenes nodding, yellow, orbicular.

AIDS TO IDENTIFICATION:

Leaf: Opposite, simple, persistent and somewhat leathery, less than 1/2 inch long, elliptical to nearly round, conspicuous netted veins; a few shallow teeth above the midpoint, shiny green above.

Flower: Paired, pink to white trumpet-shaped flowers borne on a 2-4 inch Y-shaped stalk, nodding, heavily scented.

Fruit: Brown, dry capsule producing nutlets with glandular hairs that stick to fur of passing animals.

Bark: Only woody at the base of the plant; often buried in the litter.

Form: Slender evergreen vine trailing over the ground and decaying logs. Ground-hugging except for flower stalks which may reach 2-4 inches.

To distinguish from other genera in the Caprifoliaceae (honeysuckle) family: Leaves simple (not pinnately compound), flowers relatively large, not very numerous, corolla tubular to funnelform. Plants low, only slightly woody (at base), not shrubby, with prostrate, creeping stems, flowers in pairs on an elongate, erect peduncle (Kearney & Peebles 1951).

ILLUSTRATIONS:

Line Drawing: http://www.efloras.org/object_page.aspx?object_id=119554&flora_id=2.
Photos: http://swbiodiversity.org/seinet/taxa/index.php?taxon=Linnaea borealis.
Photos: http://plants.usda.gov/core/profile?symbol=LIBO3.
Photos, Line Drawings, Herbarium Mounts: http://eol.org/pages/488733/media?page=1.

TOTAL RANGE: Circumboreal, Greenland to Alaska, south to New Jersey, West Virginia, Michigan, Illinois, South Dakota, New Mexico, northern Arizona, and California; Eurasia: Siberia and northern Europe.

RANGE WITHIN ARIZONA: The seven known collections in Arizona are split between the North Kaibab in Coconino County, and the White Mountains locality of Apache County.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Perennial forb-shrub-vine.

PHENOLOGY: Twinflower blooms from June through September throughout most of its range. Flowers last about seven days, and fruits mature approximately 36 days after flowering. The leaves persist for two years. Flowers have been collected in Arizona in both July and September.

BIOLOGY:

Sexual reproduction is uncommon, but seedlings are occasionally found in burned or other disturbed areas. Plants are self-incompatible (rarely self-fertile), requiring cross-pollination, which is effected by native bees and syrphid wasps. The literature differs on the amount of seed production ("produces abundant seed" or "does not set very much seed"), but the germination rate in low (about one in thirty) and the seed does not apparently persist in seed banks (EOL 2014, Howard 1993, Cooksey 2003). Seeds can attach to the fur, hide or feathers of animals, which serve as dispersal agents.

L. borealis is very slow to establish; it takes seedlings about thirteen years to bloom. Vegetative reproduction by stolons (which are first produced at 5-10 years of age) is the primary method of regeneration. The plant has been reported to spread as much as a 30 cm (1 ft) per year in lowland re-vegetation sites.

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Twinflower is killed by even low-intensity fire. The plant is considered to be a fire avoider: during fire, small patches of twinflower in draws, moist duff, or other protected places usually escape burning. These remaining plants then re-colonize the burn areas as their stolons slowly spread. Animal dispersed seed also facilitates re-colonization and establishment. *L. borealis* is described as both a pioneer species which spreads through the surface ash layer devoid of humus following a fire, and as a facultative seral species.

HABITAT: Throughout its range, *L. borealis* occurs in several grassland and many hardwood and coniferous forest types. In Arizona, predominantly in spruce-fir forest, found on shaded slopes and canyon bottoms, also in Ponderosa pine.

ELEVATION: Range-wide in the US, reported from 2200 – 8000 feet (670-2440m). All Arizona collected exceed the 8000 foot level, and range from 8030 – 9200 feet (2450-2805m). These higher elevations are very consistent with *L. borealis* as a "boreal" species. The higher elevation habitats provide the coolest temperatures for the southern-most extension of this species and are comparable to similar temperatures at lower elevations found at the more northern latitudes.

EXPOSURE: Occurs on all aspects. It also tolerates a wide spectrum of light intensity: from full daylight in alpine meadows to 2% (measured) of full daylight in closed canopy forests.

SUBSTRATE: Twinflower grows in soils derived from a variety of parent materials. Soil texture and nutrient levels also vary, and soil moisture levels range from xeric to hydric. The pH range of twinflower-supporting soils has been reported from 4.0-7.0 in peatland bogs of Minnesota and Saskatchewan and 5.0 to 6.0 in sandy soils of Washington state. One Arizona collection reported a rich, black soil.

PLANT COMMUNITY: Twinflower is found in recently disturbed, seral, and climax plant communities. These can be open or closed canopy, and range from grasslands to forest communities. In Arizona, it is most commonly found in spruce-fir associations, but was also found in Ponderosa pine. Plant species noted in association with Arizona collections include: *Picea engelmannii*, *Abies concolor*, *Pseudotsuga menziesii*, *Populus tremuloides*, *Vaccinium*, and *Actaea.*

POPULATION HISTORY AND TRENDS: Unknown for Arizona. There are only seven known occurrences in the State. The first collection was made in 1912; the latest in 2010. At one site, collections were made in 1912, 1963, 1979 and 2010, suggesting that these populations (two separate source features) exhibit possibly good to fair viability, and that the trend is probably stable. There is no other population data available for *L. borealis* in Arizona. Due to the very few collections, NatureServe ranks this plant as critically imperiled for the State. This reflects the status in other states that define the southern-most extension of this species in the US; in fact, it is actually noted as extirpated in three southern boundary states: Indiana, Ohio, and Tennessee. Globally and nationally, the species is ranked as secure.

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: None.
STATE STATUS: None.
OTHER STATUS: None.

MANAGEMENT FACTORS: There are a number of management considerations identified in the literature (EOL 2014, Howard 1993, and Cooksey 2003) for *L. borealis*:

1) The plant is killed by even low-intensity wildfires. While patches may survive in protected sites, the plant is extremely slow to spread and re-colonize, which is most often accomplished by vegetative means, rather than by the spread of seeds.
2) The plant is definitely palatable to wildlife (and although domestic cattle are not mentioned, sheep are) but the extent of any impact is not well defined. In more northern settings, big horn sheep, caribou and elk usage have been documented, sometimes significantly; in Arizona, deer and grouse are known to utilize the species. While overgrazing can be a threat, the complete absence of grazing can lead to the plants being crowded out by more dominant vegetation.
3) Forestry operations have both been reported as a threat, and as a possible improvement/disbursement mechanism, as plant fragments which can take root are scattered about.
4) Since many of the outlying southern sites for *L. borealis* are in habitats that are at high elevations or otherwise in cooler microhabitats than the surrounding general landscapes, ongoing and prospective climate change has become a concern for the conservation of this species.

PROTECTIVE MEASURES TAKEN: None. Although the majority of collection sites in Arizona are on federal lands (National Park, National Forest and Indian Reservation), the plant has no protective status. Furthermore, for such risks as wildfire and grazing (wild ungulates and grouse; possibly cattle?) even federal land status offers little to no protection.

SUGGESTED PROJECTS: Continue to monitor known populations, especially after any wildfire incidents. Survey other high elevation (>8000 feet) sites to ascertain if other populations due exist. Priority sites should include Mount Trumbull, Hualapai Peak, the Chuska/Lukachukai Mountains, Mount Baldy and Mount Graham. In southern Arizona, Mount Lemmon should definitely be surveyed, then possibly the high peaks of the Santa Rita, Huachuca, and Chiricahua Mountains.

LAND MANAGEMENT/OWNERSHIP: All but one of the seven known occurrences in Arizona are on federal lands: two are within the USFS Apache-Sitgreaves National Forest, two within the Kaibab National Forest, one is on USNPS Grand Canyon National Park land,

and one is on BIA White Mountain Apache Reservation land. The other site was on private land.

SOURCES OF FURTHER INFORMATION

REFERENCES:

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Kearney, Thomas H. and Robert H. Peebles. 1951 with Supplement 1960. Arizona Flora, 2nd ed. Univ. of Berkeley Press. Berkeley. p. 812.

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

ADDITIONAL INFORMATION: The twinflower was Linnaeus' favorite plant and although he wanted it to be named after him, this was considered bad form at the time. His friend and mentor in the Netherlands, the doctor and botanist Gronovius named it "*Linnaea*." This name, and the specific name *borealis* (meaning "from the north"), which was given by Linnaeus, was first published in the Species Plantarum in 1753. Linnaeus took the twinflower as his own personal symbol when he was raised to the Swedish nobility in 1757 (Linne on line 2008, EOL 2012).

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