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Conservation Assessment for the Large Round-leaved Orchid in the Black Hills National Forest, South Dakota and Wyoming

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EXECUTIVE SUMMARY

Large round-leaved orchid [*Platanthera orbiculata* (Pursh.) Lindl.] is endemic to North America from Newfoundland to southern Alaska, and south to Tennessee, Minnesota and Oregon. The species has a disjunct distribution in the Black Hills of South Dakota and Wyoming. There are 31 occurrences in Black Hills National Forest distributed in the northwestern Black Hills, the Bear Lodge Mountains of Wyoming, and in the Black Elk Wilderness Area. The species is present from 4,300 to 6,000 ft (1,300 to 1,830 m) elevation in patchy, scattered occurrences on shady, northwest to northeast facing slopes and draws in strong association with paper birch/hazelnut (*Betula papyifera/Corylus cornuta*) and white spruce (*Picea glauca*) forests. The species persistence in the Black Hills is primarily limited by the small extent of cool, moist boreal habitat, although it appears to be secure on the forest at this time. Long-term droughts or dramatic climate changes characterized by drier and warmer conditions may present the greatest risk to the orchid and its habitat. Management that includes prescribed burning and selective thinning of adjacent conifer stands is proposed to maintain a mosaic of seral stages, increase available moisture and to decrease the potential for widespread crown fires.

Key words: Round-leaved orchid, *Platanthera*, Orchidaceae, Black Hills, boreal forest ecology.

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INTRODUCTION

Large round-leaved orchid [*Platanthera orbiculata* (Pursh.) Lindl.] is a large terrestrial orchid endemic to North America from Newfoundland to southern Alaska, and south to Oregon, Minnesota North Carolina (Great Plains Flora Association 1986) and Tennessee (Bentley 2000) (fig. 1). It occurs in boreal forests in Canada and Minnesota, in temperate and montane forests of the Pacific Northwest, in mixed forests of the Great Lakes Region, and in deciduous forests of the Appalachians (Correll 1950; Luer 1975; Fertig 1993; Reddoch and Reddoch 1993; Bentley 2000). Large round-leaved orchid occurs in sparse, intermittent populations throughout its range (Luer 1975; Reddoch and Reddoch 1993). It was first reported in the Black Hills from Spearfish Canyon (Magrath 1973) based on a 1929 collection. In the Black Hills of South Dakota and Wyoming, the species is currently known to occur in 31 disjunct occurrences in remnant boreal/hardwood forests. The objective of this assessment is to review information on the occurrence and distribution of large round-leaved orchid in the Black Hills National Forest and to synthesize information relevant to the management, monitoring and long-term persistence of the species. The population biology and ecological relationships of this species are not well understood, particularly at the limits of its range. We relied on information on the species' biology and habitats from the Northeast and Pacific Northwest to develop this assessment. Species nomenclature follows the USDA NRCS Plants Database (1999).

CURRENT CONSERVATION SITUATION

The global conservation rank of large round-leaved orchidis possibly secure but not yet assessed (G5?) (NatureServe 2001). It is nationally unranked (N?) in the United States and Canada and is not under federal protection by the U.S. Fish and Wildlife Service (NatureServe 2001). Large round-leaved orchid is currently on the USDA Forest Service Region 2 Sensitive Species List. The species is widely, but sparsely distributed across the boreal regions of Canada and the northern United States, and in disjunct boreal habitats in the Appalachians, Great Lakes region (Sheviak 1974; Sheviak, In press; Case 1987; Smith 1993; Homoya 1993) and Black Hills (fig. 1). Toward the periphery of its range in Illinois, New Jersey, Rhode Island, and Wyoming, large round-leaved orchid is ranked as critically imperiled due to extreme rarity (S1), and is ranked as imperiled due to rarity (S2) in Alaska and South Dakota (NatureServe 2001) (table 1).

To date, 31 currently known occurrences of large round-leaved orchid, including six new occurrences discovered in 2000, have been located on the Black Hills National Forest: 25 in the northern hills; three in the Black Elk Wilderness; and three in the Bear Lodge Mountains of Wyoming (fig. 2). One site that was not relocated in 2000 was found in 2001, and two sites have not been relocated due to mapping difficulties. The occurrences range from 1 to 126 individuals distributed over areas up to approximately 3 acres (1.2 ha) (table 2). The population on the Black Hills National Forest is estimated at over 700 above ground individuals. Although most occurrences are small and consist of scattered individuals (Marriott and others 1990), the species is more abundant and well distributed than previously believed (USDA Forest Service 2000). The status of large round-leaved orchid occurrences on private lands in the Black Hills is not known; therefore private land occurrences are not considered in this assessment.

REVIEW OF TECHNICAL KNOWLEDGE

Species Taxonomy

Large round-leaved orchid, *Platanthera orbiculata* (Pursh) Lindl. [Gen. Sp. Orchid Pl. 286. 1835; *Orchis orbiculata* Pursh. Fl. Amer. Sept. 2: 588. 1814] is classified as Phylum Anthophyta, Class Monocotyledonae (Liliopsida), Order Orchidales, Family Orchidaceae (the Orchid family) (Reddoch and Reddoch 1993; NatureServe 2001), Subfamily Orchidoideae, Tribe Orchideae, Subtribe Orchidinae (Luer 1975). Alternative taxonomic treatments include: *Habenaria orbiculata* (Pursh) Torr 1826; *Platanthera menziesii* Lindl. 1835; *Habenaria menziesii* (Lindl.) Macoun. 1888; *Lysias orbiculata* (Pursh) Rydb. 1900; *Habenaria orbiculata* (Pursh) Torr. *var. longifolia* Clute. 1904; *Lysias menziesii* (Lindl.) Rydb. 1917; *Lysias orbiculata* (Pursh) Rydb. var. *pauciflora* Jenn. 1920; *Habenaria orbiculata* (Pursh) Torr. f. *trifolia* Mousley. 1934; *Habenaria orbiculata* (Pursh) Torr. *var. menziesii* (Lindl.) Fernald 1950; *Habenaria orbiculata* (Pursh) Torr. var. *lehorsii* Fernald 1950; and *Platanthera orbiculata* (Pursh) Lindl. var. *lehorsii* (Fernald) Catling 1982 (Reddoch and Reddoch 1993; USDA NRCS 1999).

Large round-leaved orchid is closely related to greater round-leaved orchid (*P. macrophylla*), a nearly identical species that varies only in flower spur length and pollinium structure, both of which are adaptations to a species-specific pollinator (Reddoch and Reddoch 1993). The two species share a similar range in the northeastern United States and co-occur in some areas, but *P. macrophylla* does not occur west of Michigan (Reddoch and Reddoch 1993). Until 1988, *P. macrophylla* was considered a variety of *P. orbiculata* (Reddoch and Reddoch 1993).

Species Description

Large round-leaved orchid is a fleshy-rooted, perennial herb that is characterized by: two round, opposite, shiny leaves 3 to 4 inches (8 to 10 cm) wide that lie flat along the ground; a single flowering stem 12 to 24 inches (30 to 60 cm) high that bears 5 to 20 whitish-green bilaterally symmetrical flowers; and each flower has a slender, curved spur ½ to 1 inch (1.5 to 2.5 cm) long, three sepals, two small upper petals, and an oblong, drooping lip petal (Correll 1950; Hitchcock and Cronquist 1973; Luer 1975; Dorn 1977; Van Bruggen 1985; Great Plains Flora Association 1986; Gleason and Cronquist 1991; Fertig 1993; Smith 1993) (fig. 3, Appendix A). Large round-leaved orchid is virtually identical to greater round-leaved orchid (*P. macrophylla*), which has flower spurs up to1¾ inches (4.5 cm) long (Reddoch and Reddoch 1993). Other members of the genus *Habenaria* and genus *Platanthera* are distinguished from large round-leaved orchid by their leafy stems and/or fringed petals (Fertig 1993).

Species Significance

The distribution of large round-leaved orchid in the Black Hills is unique in its isolation from the species' primary range (Marriott and others 1990; Sheviak, In press). Disjunct occurrences on the periphery of a species' range may be evolutionarily important and genetically valuable, and could contribute to the overall genetic diversity of the species (Thomas and others 1993). The orchid's geographic isolation in the Black Hills may indicate that the collective population possesses unique genetic material, or could result in a speciation event or play a role in determining the future biogeography of the species. Large round-leaved orchid was apparently used by the Iroquois tribe of upstate New York and Quebec as a treatment for dermatitis and cuts and as a tuberculosis remedy; and by the Montagnais tribe of eastern Quebec and the St.

Lawrence River region as a treatment for blisters of the hands and feet (Moerman 1998). The species may also have been used as a panacea or "heal all" by native mountaineers (Luer 1975). It is likely that insect pollinators, particularly moth species (Lepidoptera), utilize the orchid's nectar for food. Large round-leaved orchid was first cultivated in England by Conrad Loddiges & Sons ca. 1832 (Correll 1950), but we have no information that addresses the particulars of cultivation.

Life History

Large round-leaved orchid is a terrestrial herbaceous perennial that reproduces by seed (Catling and Catling 1991). The species has a dimorphic root system with one or two root-like tubers and two or more fleshy roots that are replaced annually (Currah and others 1990). Asexual reproduction is not known to occur in the species (Catling and Catling 1991). Orchids produce millions of nearly microscopic seeds that are >96 percent air to facilitate wind dispersal (Arditti and others 1979) and can travel up to 1,250 mi (2,000 km) or more (Close and others 1978). Dispersal of viable seeds in orchids may be limited by desiccation, but some orchid seeds can survive prolonged arid conditions and frigid temperatures (Arditti 1992). Little is known about large round-leaved orchid's germination requirements (Smreciu and Currah 1989; Arditti and others 1990). However, germination may be episodic and coincident with high soil moisture, as was noted with the western prairie fringed orchid (*Platanthera praeclara)* (Hof et al. 1999). Orchid seeds lack an endosperm (stored food) or a radicle (rudimentary root) and are dependent upon a below ground fungal association (specifically, an endomycorrizal basidomycete, a form of vesicular-arbuscular mycorrizhal fungi) to supply nutrients for germination and initial plant development (Arditti and others 1990; Currah and others 1990). The mycorrhizal fungi involved in germination and development are predominantly wood-decomposing species (Currah 1991). Moist soil conditions are required for seed germination to occur and presumably for establishing contact with mycorrhizae.

Following fungal infection and germination, the orchid seed develops into a non-photosynthetic corm, or protocorm that is completely dependent on mycorrhizal fungi for its survival (Smreciu and Currah 1989) until it produces aerial shoots and photosynthetic leaves (Smith 1993). The fungal species associated with the orchid are not known, but in a study in Ontario, the endomycorrhizal fungi *Sebacina* and a wood decomposing fungus, *Leptodontidium orchidicola*, were isolated from the roots of large round-leaved orchid (Currah and others 1990). *Leptodontidium* species occur in association with northern green orchid (*Platanthera hyperborea*), and spotted coralroot (*Corallorhiza maculata*) (Currah and others 1990), another disjunct boreal species found in the Black Hills. The vesicular-arbuscular mycorrhizae species associated with large round -leaved orchid may vary across its large geographic range.

In the Black Hills, flowering occurs from late June to August (Fertig 1993). The flowers produce a light fragrance at night when moth pollinators (Lepidoptera) are active (Brackley 1985). Large round-leaved orchid is reportedly pollinated by the night-flying hawk moth, *Sphinx drupiferanum*, (Sawyer 1894 in Van der Pijl and Dodson 1966); however, this report has not been verified (Reddoch and Reddoch 1993). Another unverified report suggests that two, small gray moths, *Autographa ampla* and *Diachrysia* (*Plusia*) *balluca*, pollinate the species (Luer 1975). While these reports are unverified, these moth species have characteristics that make them capable of pollinating large round-leaved orchid flowers (Reddoch and Reddoch 1993; Van der Pijl and Dodson 1996). These characteristics include: a long proboscis that can reach the

nectar at the base of the spur, and heads wide enough so that pollen-filled sacs can attach to the moth's eyes as they attempt to reach the nectar (Sheviak and Bowles 1986; Reddoch and Reddoch 1993). At this time, it can only be assumed that large round-leaved orchid is moth pollinated. However, the orchid flower's nocturnal fragrance (Brackley 1985), light color and abundant nectar are characteristic of moth pollination (Dressler 1981; Arditti 1992). There are no reports of hybridization in the species and it is reproductively isolated by its pollinator specificity from greater round-leaved orchid.

Large round-leaved orchid may be a species that is capable of "disappearing" or becoming seasonally dormant during drought conditions and then "reappearing" with the return of favorable environmental conditions. This adaptation allows the mature plant to persist with no aboveground shoots through one or more growing seasons (Tamm 1972; Lesica and Steele 1994). Like the early protocorm stage of the orchid's life history, the plant is mycotrophic, or dependent upon an endomycorrhizal associate for its survival during dormancy (Gill 1996 in Allen 1996).

Distribution And Local Abundance

Large round-leaved orchid is widely distributed in eastern North America and infrequent across the western Great Lakes region and Prairie Provinces, with limited distribution in the west (Reddoch and Reddoch 1993). In the Black Hills, the species occurs in relic boreal hardwood forests from 4,300 to 6,000 ft (1,300 to 1,830 m) (Marriott and others 1990). The orchid occurs in small, scattered populations throughout its range (Lesher and Henderson 1998), and in the Black Hills (Marriott and others 1990). To date, 31 occurrences of large round-leaved orchid, including six new occurrences found in 2000, have been located in the Black Hills National Forest: 25 in the Northern Hills; three in the Black Elk Wilderness; and three in the Bear Lodge Mountains of Wyoming. These occurrences range from 1 to 126 above-ground individuals (one-leaved seedlings, non-reproductive plants, and mature reproductive two-leaved plants are all counted as individuals) over areas up to ca. 3 acres (1.2 ha). One occurrence not relocated in 2000 was found in 2001, and two occurrences have not been relocated due to mapping difficulties. The Black Hills collective currently known population is estimated at over 700 individuals and approximately 30 percent of the plants were in bud or flower at the time of the July 2000 survey. The species may also occur on private land in the area, but no data are currently available.

Habitat Relationship

Large round-leaved orchid occurs in boreal habitats in Canada, in boreal, subalpine, montane and coastal forests of the Pacific Northwest, in mixed forests of the Great Lakes Region, and in mixed and deciduous forests of the Appalachians (Luer 1975; Reddoch and Reddoch 1993; NatureServe 2001). The species most often occupies damp, rich humus soil in the deep shade of heavily forested areas (Luer 1975). It is often associated with late-successional forests (Thomas and others 1993). In Minnesota, large round-leaved orchid is typically found in *Sphagnum*/coniferous swamps beneath white cedar (*Thuja occidentalis*), black spruce (*Picea mariana*), or tamarack (*Larix laricina*), and is occasionally found in upland forests (Smith 1993). In Washington, the orchid occurs in moist, shaded habitats in mature to old-growth forests with abundant coarse woody debris, a deep undisturbed litter layer, and dense moss cover (Lesher and Henderson 1998). In the Black Hills, the orchid occurs in association with deep litter and relatively high moss cover. In general, the species occurs in conifer and hardwood forests in

moist to swampy soils where high soil moisture appears to be a key component of its habitats (Reddoch and Reddoch 1993). However, large round-leaved orchid's sparse, patchy distribution may be attributed to its specialized interactions with other organisms as well as environmental factors (Lesher and Henderson 1998). The orchid's distribution in the Pacific Northwest and elsewhere is believed to be partly a function of the occurrence of its co-evolved associations with mycorrhizal fungi and its pollinators (Lesher and Henderson 1998).

In the Black Hills, known orchid occurrences are restricted to the Northern Hills, higher elevations of the granitic Central Core, and the Bear Lodge Mountains (USDA Forest Service 2000). The occurrences are scattered in sheltered, northwest- to northeast-facing cool, shady slopes and draws in mid- to late-successional paper birch/hazelnut (*Betula papyrifera*/*Corylus cornuta*) forest (Marriott and Faber-Langendoen 2000), often with an overstory of white spruce (*Picea glauca*) and plant species common to boreal forest habitats (USDA Forest Service 2001) (fig. 4, table 3). These habitats may be transitional to late-seral boreal forest communities such as white spruce/twinflower (*Picea glauca*/*Linnaea borealis*) forest (Marriott and Faber-Langendoen 2000).

Typical habitat for the large round-leaved orchid in the Black Hills is characterized by a dense to partially open canopy with filtered light, dense understory vegetation, and damp, humic soil with a thick litter layer. A few scattered individuals occupy ridge tops in more open and significantly drier conditions, but these appear to be extensions of large concentrations in adjacent, more mesic sites. The orchid and its habitats occupy three geologic bedrock types in the Black Hills: sandstone in the Bear Lodge Mountains, limestone in the northern Hills, and granite in the Black Elk Wilderness. This distribution suggests that the species may have a wider potential range in the Black Hills Central Core, provided that its boreal hardwood habitats are present. However, the species' paper birch/hazelnut/spruce forest habitats are relatively uncommon in the Black Hills National Forest, where spruce comprises <2 percent and paper birch only 0.1 percent of forest habitats (USDA Forest Service 1996). Within these forest types there are large areas of what appears to be suitable habitat that large round-leaved orchid does not occupy, which suggests that stochastic events or another environmental factor may play an important role in its distribution (USDA Forest Service 2000, 2001).

In the Black Hills, the orchid's boreal white spruce forest habitats are disjunct from spruce forests along the Canadian border and elsewhere in the Rocky Mountains (Hoffman and Alexander 1987). These remnant boreal habitats occur on north-facing slopes and draws that are concentrated in the Northern Hills, where conditions are cooler and considerably moister than the rest of the Black Hills (Hoffman and Alexander 1987; Marriott and Faber-Langendoen 2000). The high precipitation and cooler temperatures of the Northern Hills are within the range of boreal forest and mountain climates elsewhere (Marriott and Faber-Langendoen 2000). However, due to limited elevational gradients in the Black Hills, relationships between vegetation and elevation, temperature, and precipitation are confused (Hoffman and Alexander 1987). Currently known large round-leaved orchid occurrences are found in cool, mesic portions of the Black Hills: in the central Bear Lodge District; south of Spearfish and Lead; and in the highest elevation areas of Central Core in the Black Elk Wilderness (Appendix B).

The orchid's patchy distribution in the Black Hills may be, in part, due to hill-shade on north-facing slopes and other sheltered sites that result in late-season snow retention and higher soil moisture throughout the year. Shaded sites retain snow pack much later in the spring and after

early snows in late autumn. This may create high moisture microhabitat conditions that do not extend more that a few feet away from the snow-covered site.

Large round-leaved orchid is sparsely distributed beneath dense understory growth. It co-occurs with western rattlesnake plantain (G*oodyera oblongifolia* Raf.) at the majority of sites, with the exception of occurrences in the Black Elk Wilderness, where it occurs with lesser rattlesnake plantain (*Goodyera repens*). Zettler and Hofer (1997) noted that more common species of orchids, such as *Goodyera*, may serve as "refugia" for the endomycorrhizal fungi that sustain rare orchid species that occupy the same habitat. The fungi may be able to survive independently as well. Most sites where large round-leaved orchids occur in the Black Hills National Forest also support other orchid species (see table 3). In Washington, large round-leaved orchid has been found to occur with western rattlesnake plantain with 78 percent constancy (Lesher and Henderson 1998). Paper birch occurs at all known sites except one. Beaked hazelnut (*Corylus cornuta*), twinflower (*Linnea borealis*), and thimbleberry (*Rubus parviflora*) occur at most of the sites in the Black Hills. Other common species associates include several species of wintergreen (*Pyrola* spp.), wild sarsaparilla (*Aralia nudicaulis*), and Canada mayflower (*Maianthemum canadense*) (table 3), which represent a suite of disjunct boreal species.

Disturbance Ecology

Periodic fires that suppressed white spruce and enhanced birch historically, likely maintained successional paper birch/hazelnut forests where large round-leaved orchids occur in the Black Hills. Paper birch and other short-lived, fire-adapted trees, shrubs and herbs are commonly noted on orchid sites in the Black Hills, including thimbleberry, beaked hazelnut, sarsaparilla, and Canada mayflower (Wright and Bailey 1982). Some herbs found at orchid sites in the Black Hills are considered susceptible to fire mortality because their roots and stolons grow mostly in the duff or between the duff and mineral soil (McLean 1969). Included in this group is rattlesnake plantain and twinflower; however twinflower has been reported as a common species within a few years of burning in northeastern Minnesota (Alhgren 1960).

Historic land use in the Black Hills, particularly fire suppression, has likely altered the distribution of boreal habitats and led to an increase in spruce (Parrish and others 1996). Increased densities of spruce influence the habitat of this orchid both directly and indirectly. Direct effects include the suppression of early seral plant species such as birch and other disturbance-adapted species. However, an increase of spruce adjacent to orchid habitat also has the potential to decrease available soil moisture and to increase the potential for large-scale fires to occur. Fires may enhance soil moisture availability within orchid sites where the fire misses the species' sheltered microsites, but removes conifers from surrounding uplands, thereby increasing groundwater flow. However, fire affects successional dynamics and can impact large round-leaved orchid's habitat by returning it to an earlier seral stage. Fire may also impact the orchid's species associates (Lesher and Henderson 1998). However, in time, mid-seral birch/hazelnut forest may develop on burned sheltered sites that provide boreal habitat conditions, especially following high moisture years. Therefore, large and small-scale disturbances, such as fire, are important in the development of a shifting mosaic of successional stages and vegetation structures (Lesher and Henderson 1998).

Microclimatic conditions also play a role in maintaining boreal habitats in the Black Hills. The strong association of the orchid with north-facing slopes and draws in the Black Hills is

indicative of the importance of cool moist conditions. Both the orchid and its associated boreal species likely expand during cool wet periods and decline during extended droughts. However, significant change in habitat area is unlikely over short-term climatic cycles. Given the unpredictable nature of this species and its dependency on high soil moisture, it is possible that all individuals at many of the sites would go dormant or perish during dry years. All census data to date have been collected during or immediately following wet years, so we have a poor understanding of the effects of dry years on the species.

In addition to soil moisture, other habitat characteristics are likely important for maintaining the orchid and its mycorrhizal fungi and insect pollinators. Although the species has broad ecological amplitude, it is vulnerable to small shifts in its habitat conditions, such as increased light exposure or a decline in litter cover (Lesher and Henderson 1998). For this reason, the influence of surrounding habitat structure may influence microhabitat conditions, particularly shade and moisture, in adjacent areas. Further, although the orchid may not occupy surrounding habitats, continuity of habitat conditions could influence the movement of its species associates. Alterations in the amount of litter and decomposing woody material could have profound impacts on the orchid's mycorrhizal fungi. The ecological requirements of its insect pollinators are also unknown and little information is available.

Key Risk Factors

In the Black Hills, the primary risk to large round-leaved orchid is large-scale alterations of cool, moist boreal habitats. The most likely factor to cause such large-scale alterations of boreal habitats is a prolonged drought or persistent warmer and drier climatic conditions. Boreal habitats of the Black Hills have retreated to the coolest settings available; widespread drying and warming could alter orchid habitat by reducing soil moisture levels below those needed to sustain the orchid, its plant associates and its mycorrhizal fungi. Management activities or stochastic events that interfere with the distribution of its habitat or viability of its species associates are considered a risk to the orchid (Lesher and Henderson 1998) throughout its range.

In addition to climatic change, widespread cessation of periodic disturbances that maintain birch/hazelnut forest would likely be detrimental to the orchid's persistence. Although unfavorable within extant orchid sites, disturbances (especially fire) facilitate the successional development of the orchid's seral birch habitats, limit spruce and pine expansion, and may increase soil moisture in potential orchid habitats. Continued fire suppression will favor the expansion of spruce to the detriment of early and mid-successional fire-dependent species such as paper birch, and increase the probability of large-scale crown fires that could impact individual occurrences or clusters of orchid sites.

Impacts (human, stochastic, or climatic) to its pollinators or fungal associates could negatively affect local occurrences or regional populations. The orchid's limited distribution in a narrow and poorly defined ecological niche and dependence upon other species for its survival and ability to reproduce are also important limiting factors in its long-term persistence (Lesher and Henderson 1998). Additional risks include direct and indirect impacts from timber harvest, mining, livestock and wildlife use, and insect pest and weed control. Recreational use is a risk factor in the Black Elk Wilderness, where the orchid occurs near trails, but current monitoring has not documented any impacts from recreation at this time. Any mining activities that occur in the species' habitats could negatively affect individuals or occurrences (USDA Forest Service 2000).

Timber management activities can alter moisture, temperature, and light availability in large round-leaved orchid's densely shaded habitats, and can impact the litter layer and result in loss of mycorrhizal fungi from clearing and soil compaction (USDA NRCS 1999). Also, large-scale overstory removal causes an increase in light and temperature, which may adversely affect the plant (Lesher and Henderson 1998). In contrast, selective removal of spruce and pine or the creation of fuel breaks upslope from orchid occurrences has the potential to enhance soil moisture and reduce intensities or improve chances of containing wildfires. However, any changes to the immediately surrounding macrohabitat could negatively affect the species by reducing shade, and thereby, snow and moisture retention. Immediately surrounding habitat conditions may positively or negatively influence the orchid's microhabitats and any disturbance that results in shade reduction at known sites is also a potential risk.

All currently known occurrences of large round-leaved orchid in the Black Hills are within grazing allotments, with the exception of locations in the Black Elk Wilderness. Livestock or wildlife use could negatively affect the species where grazing or trampling of its single pair of leaves results in the loss of energy producing tissues, impairs the function of underground structures, or decreases the viability or vigor of individuals (Lesher and Henderson 1998; USDA Forest Service 2000). Livestock and wildlife use can also negatively affect the species' habitats by impacting soils and altering microclimate. However, most of the large round-leaved orchid sites in the Black Hills are on steep slopes with dense shrub vegetation, both of which deter livestock. Also, the prostrate leaves are probably very difficult for mammalian herbivores to browse (Ode, personal communication), and trampling is probably a greater risk to the species. Occurrences of the orchid in the Black Hills National Forest are expected to receive little to no impacts from timber harvesting or other management activities. National Environmental Policy Act of 1969 [42 U.S.C. 4321 (note)] (NEPA) analyses for proposed management include an assessment of known locations of designated sensitive species such as large round-leaved orchid. Currently known sites are avoided to the extent possible. Any prescribed fire or fuels reduction activities are also subject to NEPA analysis.

The introduction of invasive plants by vehicles, animals, or humans is also a risk to the orchid and its habitats. Canada thistle (*Cirsium arvense*) occurs at a few of the large round-leaved orchid locations but along forest edges created by trails, roads, and other disturbances or openings. Treatment of weed species at these sites could negatively affect adjacent large round-leaved orchid occurrences. Treatment of insect pests could pose a serious risk to the orchid's moth pollinators (Lesher and Henderson 1998), which could not be replaced or restored since their identification, life history, host species, and habitat associations are unknown. Other impacts to its insect pollinators, such as climate change or landscape-scale habitat changes, are also potentially detrimental (Lesher and Henderson 1998).

Although habitat conservation is integral to plant species conservation, the small-scale distribution of large round-leaved orchid in the Black Hills is not well understood. It may be that cool, moist microclimatic conditions produced by topographic settings, canopy associations, fungal associations, or a combination of these factors defines extant habitats. In addition, these factors may be limited to certain seral stages in successional development. Large round-leaved orchid is somewhat restricted by its isolated habitats; however, all orchid species are sought by private collectors or for commercial trade. At this time, there is no record of orchid collection in the Black Hills and no evidence of plant collecting in large round-leaved orchid locations.

CONSERVATION PRACTICES

Management Practices

Twenty-five currently known locations of large round-leaved orchid are on the Northern Hills (formerly Spearfish) Ranger District; three sites are on the Bear Lodge District; and three sites are in the Black Elk Wilderness Area on the Hell Canyon Ranger District, all on lands administered by Black Hills National Forest (USDA Forest Service 1996). There are no data currently available on the distribution, abundance, or management of the species on private land in the Black Hills.

Currently known orchid occurrences on lands administered by the Forest Service in the Black Hills are presently at low risk from direct impacts resulting from timber harvest, livestock grazing or other management practices. Timber harvest is unlikely to directly impact orchid habitat for two reasons. First, birch/spruce habitats in the Black Hills are rarely selected for timber harvest because of the low commercial value of both of these species (USDA Forest Service 2000), although spruce stands have been treated recently to provide wildlife habitat or to restore hardwoods. Second, most of the sites where orchids occur would be difficult to log due to their steep slopes or narrow canyons. However, if timber was harvested from orchid sites or immediately adjacent to these sites, the construction of roads, skid trails or log decks has a potential to directly or indirectly impact the orchid and its habitat. In the Black Elk Wilderness Area, livestock grazing, timber management and other management activities are restricted, and recreational use is limited to hiking, horseback riding, rock climbing, and camping. Elsewhere, livestock access is often restricted by steep slopes, dense vegetation, or by fencing in allotments where the orchid occurs.

In contrast, management strategies that encourage the development of a continuous conifer overstory increase the risk of large-scale crown fires in these habitats. Prescribed burning, patch cutting and selective thinning of dense conifer stands is recommended to create a mosaic of seral stages. Resulting patches of paper birch will provide firebreaks due to the low flammability of the birch type. Birch firebreaks can greatly alter the spread of fire across the landscape, causing crown fires to drop to the ground or even stop (Foster and King 1986). In addition to slowing the spread of crown fires, landscape patchiness resulting from small-scale disturbances will provide a strategy whereby both fire-adapted and fire sensitive species are more likely to be maintained.

Conservation Measures

Maintaining core occurrences in three geographically separated regions will enhance the odds of the large round-leaved orchid persisting in the Black Hills. The species is afforded additional protection, as it is a designated “sensitive” species by the Forest Service Region 2. This designation provides conservation measures such as surveying for these species before projects are initiated and incorporating beneficial activities, mitigation or avoidance into project designs. In addition, The Nature Conservancy has identified five occurrences as conservation targets in its ecoregional conservation plan for the Black Hills (Hall and others 2002). However, the persistence of large round-leaved orchid in the Black Hills may be most affected by the species’ dependence upon patchily distributed boreal microhabitats and by variable precipitation. The greatest risk to the species is long-term drought. In the event of a long-term drought that makes lower elevation sites uninhabitable for the orchid, it remains to be seen whether or not suitable

boreal habitats will exist at higher elevations. As a conservative measure, collection and storage of large round-leaved orchid seed in a certified repository could be considered, as well as the possibility for *ex situ* or *in situ* propagation, or cultivation by botanical gardens or private growers. The availability of seeds or even plants would be valuable should the need to reintroduce the species arise.

Survey, Inventory And Monitoring Approach

The large round-leaved orchid conceptual metapopulation in the Black Hills consists of 31 occurrences. These occurrences range from 1 to 126 aboveground individuals, and are concentrated in three general regions: the northern Black Hills (25), Black Elk Wilderness area (3) and the Bear Lodge Mountains (3). Metapopulation analyses focus on identifying habitat patches that are thought to be critical to the maintenance of the metapopulation (Meffe and others 1997). "Core" occurrences are intended to provide a substantial, reliable seed source for establishment and reestablishment of the species in adjacent suitable habitats (= the "rescue effect" of the core occurrences). As such, the persistence of these core occurrences is central to maintaining the metapopulation in each area and the regional population as a whole. Smaller occurrences are less stable than the core occurrences, and those that are near core occurrences may be reestablished by seed dispersal from core occurrences. These smaller occurrences may also allow for expansion of the orchid metapopulation in favorable years, and provide experimental opportunities for habitat enhancement or recovery purposes.

The most recent data available were used in developing proposed monitoring guidelines for the Black Hills National Forest. Designated "core" orchid occurrences were identified using two criteria: geographic distribution of the occurrence and size (estimated number of individuals). Maintenance of the orchid metapopulation in the Black Hills is dependent on sustaining occurrences in each of the three regions where it presently is known to occur. Maintenance of occurrences in each of these regions decreases the odds that a random stochastic event, such as a wildfire, will extirpate the species from all known habitat. Therefore, three occurrences from each of these regions were designated as "core" occurrences. In the Black Elk Wilderness area and Bear Lodge Mountains where the species' distribution is more limited, the three known occurrences in each area were designated as "core" occurrences. In the northern Black Hills, the largest estimated number of individuals was a primary factor for selecting three "core" occurrences, but the sites were also chosen to represent the species' wide distribution in that region.

The proposed monitoring design involves assessing the status of these nine core occurrences on an annual basis. The monitoring addresses three questions: 1) is the species present, 2) is there evidence of plant collecting, and 3) have noxious weeds and other exotic, invasive species become established at the site? Although the proposed monitoring focuses on the presence or absence of a given occurrence, plants are to categorically estimate the number of individuals in each occurrence. If any of the core occurrences is not present, then the reason is to be documented if it can be determined, and plans are to randomly select additional sites to serve as core sites. Also, any occurrences that are subject to random disturbance (such as wildfire, disease or flooding) could be considered for monitoring or research to follow any effects to the species.

Monitoring is best conducted during the species' blooming period from late June to July, but may extend into early August if necessary. Data on the reproductive status of plants and whether

or not fruits and seeds are produced is useful, but a flower is not necessary for identification. Plants with single leaves, two leaves, and plants with leaves and flowering stalks are all counted as individual plants; however, the number of individual plants counted at each site is probably an underestimate due to heavy understory shrub growth that limits accessibility and visibility of the forb layer. Voucher specimens have been collected from the known locations in the Forest and are stored at the Rocky Mountain Herbarium in Laramie, Wyoming.

The second aspect of the proposed monitoring plan is designed to provide baseline data on the persistence of the orchid during dry conditions. Therefore, in the event of drought, the plan is to monitor all of the known sites for presence/absence and census the number of individuals during the first drought year. Our assumption is that the high numbers of orchids observed in 2000 were partially reflective of several years of above-average precipitation. By documenting plant numbers during dry years, we hope to have a better understanding of the role that precipitation levels play in the distribution of the orchid. Any changes in the number of occurrences, evidence of plant collection, or the presence of weed species will be documented at the time of follow-up surveys.

The third aspect of the proposed monitoring plan is to assess any additional changes in the persistence of orchid occurrences following a second consecutive dry, or below-average precipitation year. Information on changes in orchid occurrences following two drought years is critical for reassessing the monitoring strategy.

The fourth aspect of the proposed monitoring plan is to provide information on orchid occurrences during the first and second years of average or above average precipitation after the drought. The current monitoring plan proposes counting individuals at nine core occurrences plus three additional sites selected from geographic extremes in the northern Hills. Data on orchid population persistence in both wet and dry years will provide valuable data for re-examining, and potentially changing, the proposed monitoring plan.

CONCLUSIONS AND INFORMATION NEEDS

Large round-leaved orchid appears to be relatively secure in the Black Hills, based on the large number of occurrences (31) that are distributed in three geographically separated regions. However, the persistence of large round-leaved orchid in the Black Hills may be most affected by the species' dependence upon patchily distributed boreal microhabitats. Also, it remains to be seen how the species abundance is affected by variations in precipitation or other climatic changes. It may be that the relatively high number of plants observed in 2000 and 2001 reflect several recent years of above average moisture (NOAA 1996-2001) in the Black Hills. Therefore, data on the orchid's distribution and population size from a sequence of dry years, as proposed in the monitoring strategy, are needed to understand the species' response to weather patterns.

The species is a target for plant surveys being completed on the Black Hills National Forest. A predictive habitat mapping effort was conducted in the Northern Black Hills in 2002 that identified potential rare plant locations, based upon the distribution of sheltered north-facing aspects (Zacharkevics and Silvey 2002, unpublished data). This approach was effective in identifying boreal remnant habitats, particularly those dominated by birch (Zacharkevics and Silvey 2002, unpublished data). Similar mapping efforts could be used to identify potential

occurrences of large round-leaved orchid.

There are many aspects of the genetic makeup and life history attributes of large round-leaved orchid that are unknown. Does the genetic makeup of large round-leaved orchids in the Black Hills differ from that in orchids in the main portion of its range? What moth species function as pollinators, and what fungal associates are required for germination, protocorm development and plant growth? Do seeds or protocorms remain viable in the soil for more than a year? There is also a need to determine how to manage exotic invasive species in orchid habitats. Also, is it possible that a combination of timber harvest and prescribed burning can be used to enhance the distribution of the species' seral boreal plant communities and to enhance soil moisture conditions at known orchid locations? This basic information on life history attributes, in addition to an understanding of large round-leaved orchid habitat needs, has the potential to increase the odds that this species will persist in the Black Hills.

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APPENDICES

Appendix A. Technical description of large round-leaved orchid (*Platanthera orbiculata* [Pursh] Lindl.).

The genus *Platanthera* is characterized by a concave, recessed stigmatic surface (Reddoch and Reddoch 1993). The stem is "8 to 23 inches (20 to 59 cm) long (including inflorescence), glabrous; roots fleshy; two per stem, opposite, basal, broadly elliptical to orbicular, 1½ to 6 inches (6 to 15 cm) long, 1 to 6 inches (3 to 15 cm) wide, widely spreading and more or less lying flat on the ground; cauline bracts 1 to 6, scattered below the inflorescence; inflorescence a terminal racemose spike, 1½ to 8 inches (6-21 cm) long, 1 to 1½ inches (3-6 cm) wide, consisting of 6 to 33 greenish white flowers (becoming light brown or straw-colored when dried); floral bracts ¼ to ½ inch (0.6 to 1.6 cm) long; ovaries ½ inch (0.9 to 1.5 cm) long, 1/16th inch (1.8 to 2.2 mm) wide at anthesis, on a slender elongated pedicel-like ovary 1/8th to ¼ inch (4 to 10 mm) long; dorsal sepal orbicular to depressed-orbicular, free from the petals 1/8th inch (3.5 to 6 mm) long, 1/8th inch (4.2 to 6.5 mm) wide; lateral sepals bilaterally symmetrical ovate, ¼ to ½ inch (7 to 10 mm) long, 1/8th to ¼ inch (4 to 5.3 mm) wide at the widest point; petals narrowly ovate, 1/8th inch (5.5 to 7.2 mm) long, 1/16th inch (2.2 to 3 mm) wide at the widest point; lip entire, linear, with a blunt or rounded tip, ½ to ¾ inch (9 to 15 mm) long and about 1/16th inch (2 mm) wide at the middle; spur ¾ to 1 inch (2 to 2.7 cm) long, slightly thickened near the tip" (Smith 1993).

Appendix B. Climate summary for round-leaved orchid, *Platanthera orbiculata*, on Black Hills National Forest.

Average temperature extremes, annual precipitation and total snowfall at the climate stations in closest proximity to Black Hills large round-leaved orchid occurrences are given in the table below.

Twenty-five round-leaved orchid occurrences occur in the Northern Hills Ranger District in the Higgins Gulch Botanical Area and Higgins and Tollgate grazing allotments. The climate of this area is somewhere between the conditions at the Spearfish and Lead, South Dakota Climate Stations. Precipitation is concentrated in April, May and June. The Lead Climate Station, located approximately ten miles east of the Higgins Gulch area, reports a more moderate and more mesic climate than the Spearfish Climate Station located roughly ten miles north of the occurrences in Higgins Gulch.

In the Bear Lodge Ranger District, the closest climate station to the three known round-leaved orchid occurrences is at Alva, Wyoming. Precipitation is concentrated in April, May and June.

The three round-leaved orchid occurrences in the Mystic Ranger District of the Black Elk Wilderness are the southernmost known occurrences of the species in the Black Hills. The climate in this high elevation area is wetter than the surrounding hills and plains. The climate at known orchid sites is likely cooler than conditions reported by the two closest climate stations at Hill City and Mount Rushmore, and is probably moderated by the limited exposure of the sites and spruce canopy. The Hill City Climate Station is approximately six miles northwest of known round-leaved orchid sites, and the Mount Rushmore Climate Station is approximately three miles east-northeast of these occurrences. Precipitation is concentrated in May, June and July at both stations (High Plains Regional Climate Center 2001).

Climate summary for large round-leaved orchid occurrences in the Black Hills National Forest (High Plains Regional Climate Center 2001).

Climate Station	Period of record	Average min. temp. (January)	Average max. temp. (July)	Total annual precip.	Average total snowfall
Spearfish	1948-2000	12.9º F (-10.6º C)	85.0º F (29.4º C)	21.2 inches (53.8 cm)	59.8 inches (151.9 cm)
Lead	1948-2000	14.0º F (-10º C)	79.5º F (26.4º C)	29.0 inches (73.7 cm)	169.3 inches (430 cm)
Alva 5 SE	1948-1986	5.6º F (-14.7º C)	82.2º F (27.9º C)	22.9 inches (58.2 cm)	90.1 inches (228.9 cm)
Hill City	1955-2000	7.9º F (13.4º C)	79.1º F (26.2º C)a	20.4 inches (51.8 cm)	60.0 inches (152.4 cm)
Mt. Rushmore	1962-2000	15.8º F (-9º C)	80.6º F (27º C)	22.0 inches (55.9 cm)	57.9 inches (147.1 cm)

a Average Maximum Temperatures are in August at this station.

Appendix C. Soil descriptions for *Platanthera orbiculata* habitats in the Black Hills.

With the exception of those found in the Black Elk Wilderness, large round-leaved orchid was found on three main soil types in the Black Hills: Vanocker-Citadel association steep; Rock outcrop-Vanocker association very steep; and Citadel association hilly. "The Vanocker-Citadel association steep consists of deep well drained, steep to very steep soils. Vanocker soil has a surface layer of dark grayish brown loam about 4 inches thick that is covered by about 1 inch of forest litter. Water permeability and available water capacity are moderate. Citadel soil has a surface layer of very dark gray loam about 1 inch thick that is covered by about 2 in (1 cm) of forest litter. Water permeability is moderately slow and available water capacity is high. Rock outcrop-Vanocker association, very steep consists of rock outcrop and deep well drained soil on sides of mountain valleys. Rock outcrop consists of exposures of vertical cliffs of limestone and sandstone. Vanocker soil was described above. Citadel association, hilly consists of deep well drained soils on smooth upland divides and on the sides of mountain valleys and along drainageways. Citadel soil has a surface layer of very dark gray loam about 1 in (2.5 cm) thick that is covered by about 1 in (2.5 cm) of forest litter. Water capacity is high and permeability is moderately slow" (USDA, USFS and SD Ag. Experiment Station, Soil Survey Lawrence Co. 1976).

The three large round-leaved orchid locations in the Black Elk Wilderness are found on Rock outcrop-Mocmont complex, 40 to 80 percent slopes. "Rock outcrop is gray, granite rock and occurs as narrow spires or massive domes. Mocmont soil is dark grayish brown gravelly loam about 2 in (5 cm) thick with about 1 in (2.5 cm) of forest litter. Water capacity is low and permeability is moderate" (USDA, USFS and SD Agricultural Experiment Station, Soil survey Pennington and Custer Counties 1990).

FIGURES

Figure 1. North American distribution of large round-leaved orchid, *Platanthera orbiculata* [Pursh] Lindl. (Sheviak 2002 *In Press*)

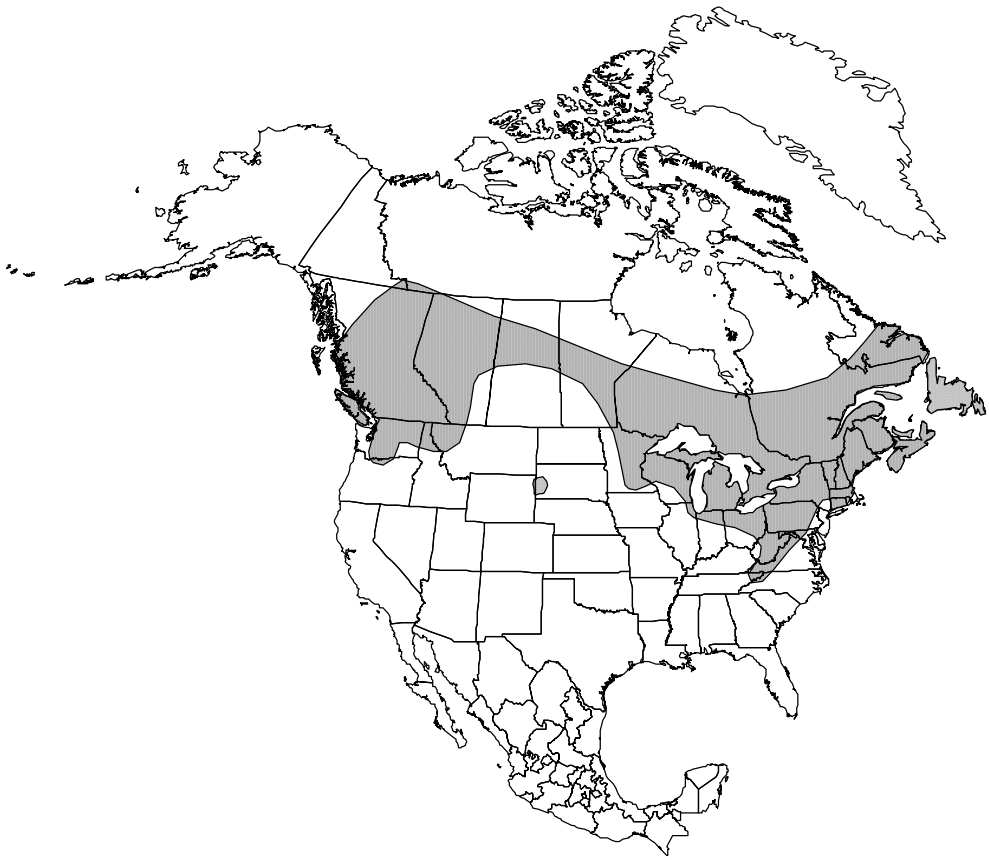


Figure 2. Black Hills distribution of large round-leaved orchid, *Platanthera orbiculata*.

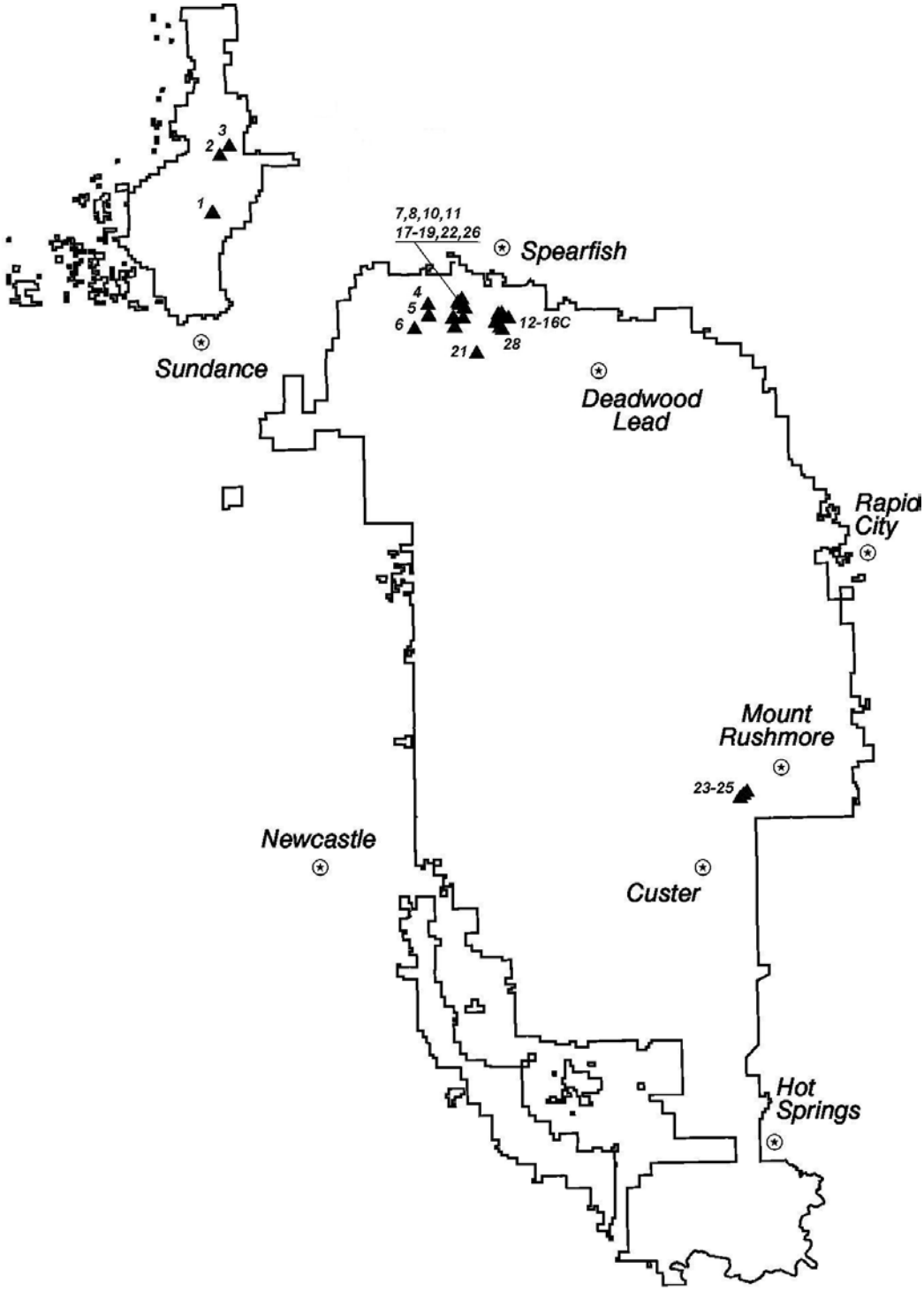
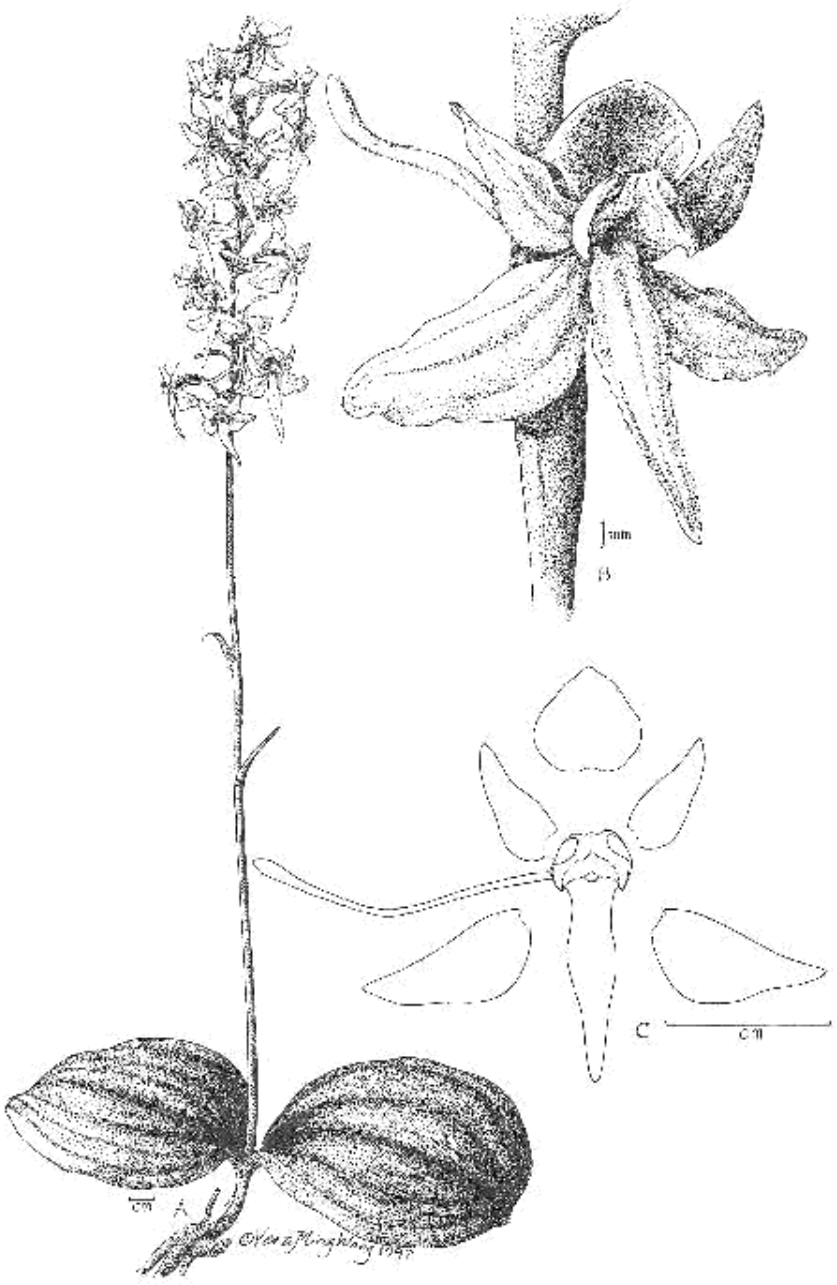


Figure 3. Illustration of large round-leaved orchid, *Platanthera orbiculata* (Vera Ming Wong in Smith 1993).



Platanthera orbiculata **A**—Flowering plant, **B**—Flower, **C**—Flower, exploded view

Figure 4. Large round-leaved orchid habitat in Black Hills National Forest.

Table 1. Range-wide conservation rank of large round-leaved orchid [*Platanthera orbiculata* (Pursh) Lindl.] (Compiled from NatureServe 2001).

State or Province	Rank	Definition
Illinois	S1	Critically imperiled due to extreme rarity.
New Jersey	S1	Critically imperiled due to extreme rarity.
Rhode Island	S1	Critically imperiled due to extreme rarity.
Wyoming	S1	Critically imperiled due to extreme rarity.
Alaska	S2	Imperiled due to rarity.
South Dakota	S2	Imperiled due to rarity.
Prince Edward Island	S2S3	Imperiled to vulnerable.
Saskatchewan	S2S3	Imperiled to vulnerable.
Wisconsin	S2S3	Imperiled to vulnerable.
Alberta	S3	Vulnerable.
Idaho	S3	Vulnerable.
Manitoba	S3	Vulnerable.
North Carolina	S3	Vulnerable.
Tennessee	S3	Vulnerable.
Nova Scotia	S3S4	Vulnerable to apparently secure.
New Brunswick	S4	Apparently secure.
Virginia	S4	Apparently secure.
Ontario	S4S5	Apparently secure to secure.
Labrador (Newfoundland)	SR	Reported.
Maine	SR	Reported.
Maryland	SR	Reported.
Minnesota	SR	Reported.
Montana	SR	Reported.
Newfoundland Island	SR	Reported.
New Hampshire	SR	Reported.
New York	SR	Reported.
Northwest Territories	SR	Reported.
Pennsylvania	SR	Reported.
South Carolina	SR	Reported.
Vermont	SR	Reported.
Washington	SR	Reported.
Yukon Territory	SR	Reported.

State or Province	Rank	Definition
Connecticut	SH	Historically reported, possibly extirpated.
Oregon	SH	Historically reported, possibly extirpated.
Indiana	SX	Presumed extirpated.
British Columbia	S?	Unranked.
Massachusetts	S?	Unranked.
Michigan	S?	Unranked.
Ohio	S?	Unranked.
Quebec	S?	Unranked.
West Virginia	S?	Unranked.

Table 2. Known occurrences of large round-leaved orchids in three regions of the Black Hills National Forest, date last observed and estimated number of individuals present at last observation (747 plants total).

Region Occurrence No.	Date last observed	Number of individuals observed on monitoring date
Bear Lodge		
1*	28 June 2001	34
2*	15 June 2001	51 in 2000
3*	27 June 2001	37 in 2000
Northern Hills		
4	10 July 2000	14
5	10 July 2000	39
5A	1 August 2000	5
6*	28 June 2001	26 in 2000, 24+ in 2001
7	26 July 2000	24
8	13 July 2000	12
9	11 July 1984	(1) Not relocated
10	28 June 2000	17
11	26 June 2000	41
12*	26 June 2001	124
13	29 June 2000	28
14	29 June 2000	7
15	7 July 2000	2
16	13 July 2000	25
16A	11 July 2000	9
16B	13 July 2000	35
16C	13 July 2000	5
17	6 July 2000	24
18	6 July 2000	20
19*	26 June 2001	126+ (merges with PLOR-26)
20	1994?	Not relocated
21	2 August 2000	40
22	15 August 2000	1-10
26	15 August 2000	2
27	2000?	Not relocated
28	17 July 2001	88

Region Occurrence No.	Date last observed	Number of individuals observed on monitoring date
Black Elk Wilderness		
23*	25 June 2001	30
24*	25 June 2001	11
25*	25 June 2001	10

* Sites designated for annual monitoring

Table 3. Species associates of large round-leaved orchid (*Platanthera orbiculata*) on 30 sites in Black Hills National Forest.

Scientific Name	Common Name	No. sites
Aconitum columbianum	Columbia monkshood	5
Actea rubra	Red baneberry	10
Adenocaulon bicolor[a]	Trail plant	6
Amelanchier alnifolia	Saskatoon Serviceberry	7
Amelanchier sp.	Serviceberry	10
Aralia nudicaulis[a]	Wild sarsaparilla	25
Arctostaphylos uva-ursi	Kinnikinnik	5
Arnica cordifolia	Heartleaf arnica	16
Berberis repens	Oregon grape	15
Betula papyrifera	Paper birch	29
Castilleja sulphurea	Sulfur paintbrush	12
Chimaphila umbellata	Prince's pine	15
Corallorhiza maculata[b]	Spotted coralroot	10
Corallorhiza sp.	Coralroot	3
Cornus canadensis	Bunchberry	14
Cornus sericea ssp. sericea	Redosier dogwood	4
Corylus cornuta	Beaked hazelnut	26
Crataegus sp.	Hawthorn	2
Cypripedium parviflorum	Yellow lady's slipper	2
Disporum trachycarpum[b]	Roughfruit fairybells	13
Erigeron philadelphicus	Philadelphia fleabane	2
Erigeron subtrinervis	Three-nerve fleabane	3
Fragaria virginiana	Wild strawberry	13
Frasera speciosa	Elkweed	2
Galium boreale	Northern bedstraw	12
Galium sp.	Cleavers	4
Galium triflorum	Sweet-scented bedstraw	11
Geranium richardsonii	Richardson's geranium	10
Goodyera oblongifolia[b]	Rattlesnake plantain	22
Goodyera repens	Dwarf rattlesnake plantain	2
Halenia deflexa[a]	Spurred gentian	16
Heracleum lanatum	Cowparsnip	5

Scientific Name	Common Name	No. sites
Juniperus communis	Common juniper	11
Lathyrus ochroleuca	Cream colored vetchling	9
Lilium philidelphicum	Wood lily	6
Lilium sp.	Lily	2
Linnea borealis	Twinflower	22
Lonicera dioica	Wild Honeysuckle	14
Lupinus sp.	Lupine	3
Lycopodium dendroideum[c]	Ground pine	5
Maianthemum canadense	Wild lily-of-the-valley	23
Orobanche uniflora[a,d]	One-flowered broomrape	1
Osmorrhiza depauperata	Bluntseed sweetroot	8
Picea glauca	Black Hills Spruce	16
Pinus ponderosa	Ponderosa pine	23
Piperia unalacensis[b]	Alaskan rein-orchid	3
Platanthera sp. (hyperborea complex*)*[b]	Northern green orchid	1
Populus tremuloides	Quaking aspen	4
Prunus virginiana	Chokecherry	8
Pteridium aquilinum	Bracken	16
Pterospora andromedea	Pinedrops	2
Pyrola asarifolia	Liverleaf wintergreen	14
Pyrola chlorantha[b]	Greenflower wintergreen	10
Pyrola picta[a,e]	Whiteveined wintergreen	3
Pyrola (Orthilia) secunda	Sidebells wintergreen	4
Pyrola sp.	Wintergreen	12
Quercus macrocarpa	Bur oak	7
Rosa sp.	Wild rose	13
Rubus parviflora	Thimbleberry	20
Rubus pubescens	Creeping blackberry	14
Sanicula marilandica	Maryland sanicle	7
Sanicula sp.	Sanicle	3
Shepardia sp.	Buffaloberry	2
Sheperdia canadensis	Russet buffaloberry	3
Smilacina stellata	Starry false Solomon's seal	4
Sorbus scopulina	Western mountain ash	1

Scientific Name	Common Name	No. sites
Spiraea betulifolia	Wild spiraea	22
Spiraea sp.	Spiraea	3
Symphorocarpus albus	White coralberry	7
Symphorocarpus sp.	Snowberry	14
Syphorocarpus occidentalis	Western snowberry	4
Vaccinium membranaceum[a,e]	Mountain huckleberry	1
Vaccinium scoparium	Grouseberry	12
Vicia americana	American vetch	10
Viola sp.	Voilet	8
Zigadenus elegans	Showy deathcamas	3
Zizia aptera	Heartleaf alexanders	5

[a] S2 (Imperiled due to rarity) in Wyoming

[b] S3 (Vulnerable) in Wyoming

[c] S1 (Critically imperiled due to extreme rarity) in Wyoming

[d] SU (Unrankable) in South Dakota

[e] S2 (Imperiled due to rarity) in South Dakota