
3-3.2. Flora

The following sections consider members of the plant community that have been identified as “Emphasis Species” for consideration in this EIS. These species include no threatened or endangered species, but do include the following:

- Region 2 sensitive species
- Species Of Local Concern

3-3.2.1. Threatened And Endangered Species

There are no threatened, endangered, or proposed species in the Forest. The candidate species, *Botrychium lineare*, is discussed in the Region 2 Sensitive Species section (see Appendix C).

3-3.2.2. Region 2 Sensitive Species

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is currently of concern as evidenced by significant current or predicted downward trends in population numbers or density or by significant current or predicted downward trends in habitat capability that would reduce the existing distribution of a species (FSM 2670.5 Parts 19a and b). Sensitive species are evaluated in detail in Appendix C. The effects determinations for Region 2 sensitive plants are summarized below.

The following Region 2 Sensitive plant species have a determination of “**may adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing**” for all alternatives:

- Iowa moonwort (*Botrychium campestre*)
- Narrowleaf grapefern (*Botrychium lineare*)
- Leathery grapefern (*Botrychium multifidum*)
- Foxtail sedge (*Carex alopecoidea*)
- Lesser yellow lady’s slipper (*Cypripedium parviflorum*)
- Stream orchid (*Epipactis gigantea*)
- Groundcedar (*Lycopodium complanatum*)
- Lesser roundleaved orchid (*Platanthera orbiculata*)
- Sageleaf willow (*Salix candida*)
- Autumn willow (*Salix serissima*)
- Bloodroot (*Sanguinaria canadensis*)
- Highbush cranberry (*Viburnum opulus* var. *americanum*)
- Selkirk’s violet (*Viola selkirkii*)

3-3.2.3. Species Of Local Concern – Plants

3-3.2.3.1. Common Maidenhair (*Adiantum capillus-veneris*)

Affected Environment

Adiantum capillus-veneris occurs primarily in tropical and warm temperate regions of the world. In North America, *A. capillus-veneris* is mainly distributed across the southern third of the United States. It was introduced in California and has spread elsewhere beyond its original range. Disjunct occurrences have been found in South Dakota and British Columbia, Canada (Hornbeck et al. 2003a).

Disjunct northern occurrences (e.g., Black Hills) appear to be restricted to moist, calcareous substrates closely associated with warm or hot springs (Hornbeck et al. 2003a). In the Black Hills, *Adiantum capillus-veneris* is found at about 3,400 feet elevation at Cascade Springs and along Cascade Creek in Fall River County, South Dakota. Cascade Springs is the largest undeveloped spring in the Black Hills (Hornbeck et al. 2003a).

The current global conservation status rank for *Adiantum capillus-veneris* is listed as secure (G5). In South Dakota, the species is ranked as critically imperiled due to rarity (S1) (NatureServe 2005).

On the Black Hills National Forest, *Adiantum capillus-veneris* occurs within Forest MA 8.2 – Developed Recreation Complexes. The Forest administers two portions of land (J. H. Keith Cascade Springs Picnic Ground and Cascade Falls Picnic Ground) with habitat conditions that support portions of the *A. capillus-veneris* occurrence at Cascade Creek. With the exception of 4 private acres in the middle of the occurrence, the rest of the occurrence is managed by The Nature Conservancy (Whitney Preserve) (Hornbeck et al. 2003a).

Adiantum capillus-veneris is a perennial herb with creeping rhizomes. It reproduces sexually by spores and asexually by rhizomatous growth or the transportation of clumps of vegetative material downstream. *A. capillus-veneris* can form large colonies (Hornbeck et al. 2003a). Across its range, it has been found to occur on moist calcareous cliffs, banks, and ledges along streams and rivers, on walls of limestone sinks, on canyon walls (in the American southwest), around foundations, and on mortar of storm drains (Flora of North America Editorial Committee 1993). Due to narrow habitat conditions associated with this species, *A. capillus-veneris* is unlikely to occur or disperse into other habitats on the Forest (Hornbeck et al. 2003a). However, the Cascade Creek occurrence appears to be vigorous and occupies almost all suitable streamside habitats. Due to its likely restriction to warm springs in the northern part of its range, *A. capillus-veneris* is unlikely to occur or disperse into other habitats on the Forest.

Direct And Indirect Effects

The only known occurrence of *Adiantum capillus-veneris* in the Black Hills is located along Cascade Creek. Two portions of this occurrence are located on National Forest lands at the developed recreation locations that make up the Cascade Complex. In 1962, this area that once had been in private ownership was deeded to the Black Hills National Forest. The land deed granted to the Forest specifically requires that the grantee must preserve, develop, care for and maintain the area as a park for the use of the public and for no other purpose (Hornbeck et al. 2003a). Effects associated with ongoing recreational use and invasion by, or treatment of, exotic plant species (including noxious weeds) are currently considered to be the most significant risks to the fern and its habitat on the Black Hills National Forest administered lands (Hornbeck et al. 2003a).

Recreational use of the area is expected to continue as specified in the land deed. Forest direction in Standard 8.2-9106 (Alternatives 2, 3, 4, and 6) states that there will be no new developments, including road and trail construction in the Forest-administered land parcels at Cascade Falls and Cascade Springs (J. H. Picnic Ground) areas. This standard is not included in Alternative 1. Goal 8.2-201 (Alternatives 3 and 6) states that the vegetation at Cascade Springs (J. H. Keith Picnic Ground) and Cascade Falls (both are high use recreation areas) is to be managed in a way to protect the species of local concern (SOLC) plants as well as maintain or improve the desired recreation setting and conserve the botanical features. Alternatives 1, 2, and 4 Goal 8.2-201 does not include specifically listed direction for SOLC plants. Standard 8.2-2104 is strengthened in Alternatives 3, 4, and 6. It states that if monitoring of SOLC plant occurrences documents species are being impacted by recreational use, management will be implemented to protect the species. Under Alternatives 1 and 2, Standard 8.2-2104, the wording is less specific and targets the protection of unique biological features in general. In an area that receives an intensive amount of recreational use, there is always the potential for plant collecting to become a risk to the species, especially for species that have been used elsewhere in the floral industry, such as *Adiantum capillus-veneris*. Standard 3119 is included in Alternatives 3 and 6 to restrict the collection of SOLC plants (or parts thereof) to only those needed for scientific or educational purposes, or as recognized for American Indian traditions (Standard 7103). This would prohibit collecting for both personal (other than for American Indian traditional uses) and commercial uses, thereby limiting the associated direct effects of *A. capillus-veneris* individuals removed from occurrences. It is unknown how many plants would be used for American Indian traditional uses; however, they have indicated at meetings that their interests are in maintaining plant species that have traditional uses. Although uncertain, the assumption is that traditional uses and scientific collections may be expected to directly affect individual plants, however, it is not expected that this type of collection would present much risk to the overall long-term persistence of this species on the Black Hills National Forest. Alternatives 1 and 2 do not include this standard.

All alternatives target various levels of conservation and protection for SOLC plants from noxious-weed invasion and treatment. The assumption is that Alternatives 3, 4, and 6 would have a greater reduction in risk of indirect and direct impacts to *Adiantum capillus-veneris* from noxious weeds and their treatment. Objective 231 is included in all alternatives to target prevention and reduction of noxious-weed invasion into native plant communities. In Alternatives 1 and 2, the targeted objective is to treat 3,600 acres per year. Targeted treatment acres are increased to 6,000 acres per year in Alternatives 3 and 4, and increased to a minimum target of 8,000 acres per year in Alternative 6. Guideline 4303 is revised in Alternatives 3, 4, and 6 to specify that occurrences of SOLC, along with Region 2 sensitive species, are the priority for treatment of noxious weeds on the Forest. Guideline 4304 (Alternatives 1 and 2) was revised and strengthened to a standard in Alternatives 3, 4, and 6. This would be expected to provide more protection to *A. capillus-veneris* by requiring use of treatment methods that pose the least risk to the species. Standard 4300-01 specifies monitoring of weed-control effectiveness at SOLC sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed competition. This standard was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to SOLC plant species. No Action Alternatives (Alternatives 1 and 2) do not include monitoring weed-treatment effectiveness at SOLC plant locations. Alternatives 1 and 2 require the use of certified noxious weed-free seed, feed, and mulch on the Forest (Standard 4306). This standard was revised in Alternatives 3, 4, and 6 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. Prevention of noxious-weed invasion is further targeted in native plant communities by revegetating with native species and is included as a guideline (1110) in Alternatives 1 and 2. The original guideline was revised and was strengthened to a standard in Alternatives 3, 4, and 6 (Standard 1110). Objective 8.2-208 (Alternatives 3 and 6) targets the detection during monitoring and treatment of *Tamarix* spp. (Salt cedar) and *Lythrum salicaria* (Purple loosestrife) along Cascade Creek. These two aggressive plant species are noted for invading riparian areas and could outcompete *A. capillus-veneris* should they become

established in the area. Alternatives 1, 2, and 4 do not specifically address these two invasive species. Further discussion on Noxious Weeds as related to implementation of the various Phase II Amendment alternatives can be found in Section 3-7.3 of the FEIS.

Since the species is limited to a single watershed, it is vulnerable to high intensity disturbance events such as noxious-weed invasion or invasion by other exotic plant species (addressed above), disease, insect infestation, high intensity wildfire, etc. (See Sections 3-7.1 Fire, 3-7.2 Insects, and 3-7.3 Noxious Weeds in Chapter 3 of the FEIS for discussions of these disturbances within the Black Hills.) Although the risk of crown-fire events occurring at Cascade Creek is likely to be limited by the riparian vegetation systems located there (although periods of drought can alter this), Objective 200-05 (Alternatives 3 and 6) addresses the fire risk by targeting the maintenance or creation of a moderate (Alternative 6) to low (Alternative 3 and 6) crown-fire hazard adjacent to occurrences of SOLC plants. Alternatives 1, 2, and 4 do not address the issue of fire risk for these species. Objective 200-04 (Alternatives 3, 4, and 6) addresses the collection of seeds, spores, or other plant material from SOLC plant species to target the availability of material for the reintroduction of the species should the existing occurrence be lost. Alternatives 1 and 2 do not address the issue. Guideline 4102 (Alternatives 1 and 2) provides direction for protecting heritage resources, streams, stream banks, shorelines, lakes, and associated vegetation from degradation by wildfire-suppression efforts. In Alternatives 3 and 6 the direction for protection is extended to SOLC such as *Adiantum capillus-veneris*. In addition, Standard 3200-03 states that wildfire-suppression camps will not be placed at known mapped SOLC plant locations (the *A. capillus-veneris* occurrence at Cascade Springs and Cascade Falls is known and mapped). Alternatives 1 and 2 do not contain this standard. This direction is intended to reduce the effects associated with wildfire and suppression and, if fully implemented, the least risk to the long-term persistence from fire and suppression would be expected through the selection of Alternatives 3, 4, or 6.

Additional potential risks to the species could include alterations to the habitat by hydrologic or geologic modifications, or from erosion (Hornbeck et al 2003a). Management Area Goal 8.2-207 (Alternatives 3 and 6) requires the implementation of additional measures to prevent and control erosion, including erosion created by recreational use at locations along Cascade Creek where known *Adiantum capillus-veneris* individuals exist, if monitoring reveals that the existing measures are not adequate. Alternatives 1, 2, and 4 do not contain Goal 8.2-207.

Livestock grazing is not permitted on Forest administered land at Cascade Springs or Cascade Falls. There are no timber harvest or other vegetation management activities planned on land administered by the Forest in the immediate area, other than suppression of noxious weeds or other exotic invasive plants (Hornbeck et al. 2003a).

This species had once been included on the USDA Forest Service Region 2 Sensitive Species List and baseline-monitoring data were gathered and a monitoring design was developed for monitoring *Adiantum capillus-veneris*. Monitoring continues to document the presence and extent of *A. capillus-veneris* at J. H. Keith Memorial Picnic Ground and Cascade Falls on lands administered by the Forest. Monitoring direction for SOLC is included in Chapter 4 of the LRMP for this amendment. The type and level of information being collected for monitoring this species is available in the Black Hills Monitoring Implementation Guide (USDA Forest Service 2005f).

The *Adiantum capillus-veneris* occurrence is not located within any of the candidate RNAs, and no beneficial or negative effects are expected to be associated with any that may proposed for designation through the Phase II Amendment decision.

Since the only *Adiantum capillus-veneris* occurrence on the Black Hills National Forest is located within the 1.5-mile WUI circumference area of an ARC, it is likely that Objective 200-05 could be achieved near the site in conjunction with fuels-reduction efforts near ARCs (refer to Appendix G, Map G-6: At-risk Communities and Wildland-urban Interface) that has been included in Alternative 6. However, in all reality, various areas can be expected to receive treatment under all alternatives because of the tie to the legislation (refer to Appendix B of the FEIS for discussion of ARCs and the WUI for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARCs and *A. capillus-veneris* because without a priority system or a map indicating which ARCs are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of the species occurrence. In addition, as mentioned earlier, the vegetation systems (riparian and grassland) on the Forest parcels at Cascade Springs and Cascade Falls would not be expected to lend themselves to high intensity crown-fire events. The Cascade Springs area has a limited number of encroaching conifers.

Cumulative Effects

The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (Liggett et al. 2003).

The spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species is smaller than generally encompasses the Black Hills Ecoregion as defined by Bailey (1995). The spatial area used for the cumulative effects analysis for *Adiantum capillus-veneris* primarily includes the Cascade Creek watershed. This area was chosen because it encompasses the ecosystem components to where the known occurrence is located. A larger area would include higher elevation and cooler ecosystem components that include a vastly different suite of species than what occurs along Cascade Creek.

Adiantum capillus-veneris was first documented at Cascade Springs in 1898. With the exception of approximately 4 acres in a central portion of the occurrence, the rest of the *A. capillus-veneris* occurrence site is either administered by the Forest or else owned or under a conservation agreement with The Nature Conservancy (Whitney Preserve) (Hornbeck et al. 2003a). The effect of activities on adjacent private lands is unknown; however, the Cascade Creek occurrence has persisted since it was first documented in 1898, indicating that in spite of the type or levels of activities that have taken place, the species has managed to persist for over 100 years. The recent acquisition of lands along Cascade Creek by The Nature Conservancy is expected to contribute to the conservation of the single occurrence of *A. capillus-veneris* in the Black Hills as the Preserve is expected conserve portions of the site outside the Black Hills National Forest boundary.

The area has historically received intensive levels of recreational use. The resort town of Cascade Springs was founded in 1888 just south of the springs, which were used as commercial mineral spas until shortly after the turn of the century. Both Cascade Springs and Cascade Falls have continued to be used as recreational areas by the public since that time. The long history of natural and human disturbance at Cascade Creek suggests that *A. capillus-veneris* is tolerant of, or perhaps able to exploit disturbances. Although the species has persisted during periods of heavy human use in the past, and may even benefit from intense episodic disturbance, there is a concern that recreational effects might be insidious until a threshold is reached that could result in the local population being decimated (Hornbeck et al. 2003a)

The constant flow of warm water from Cascade Springs is essential to the persistence of *Adiantum capillus-veneris* in the Black Hills. Due to the springs' deep source in Hell Canyon, the quality and quantity of its water is not expected to be greatly affected by alteration of surrounding lands. However,

local disturbances may affect sediment levels and have the potential to increase non-point source pollutants (Hornbeck et al. 2003a). Of recent (March 2005) concern for this species' persistence is a new project that is being proposed in the southern Black Hills. The Southern Hills Water Project (being proposed by local city and county governments) is currently in the initial stages with few site-specific details available; however, included in the proposal is that some large capacity wells are to be created in areas that may affect the water source at Cascade Springs. General sites for a couple of the wells that could affect Cascade Creek include a potential well location in the Minnekahta area and a potential well placed in the general vicinity of Cascade Creek. If these wells decrease the amount of available water supplying Cascade Springs and Cascade Creek, it is likely that an adverse effect to the species persistence of *A. capillus-veneris* could be expected.

According to Hornbeck et al. (2003a), the close proximity of South Dakota Highway 71 is a concern due to the potential for contamination of the springs and Cascade Creek with toxic substances or introduction of noxious weeds or other invasive species by vehicles.

Private land development is occurring in many areas of the Black Hills, including the area above Cascade Springs. Development could cause increased water runoff, erosion, increase the nutrient load in the creek and riparian habitats, and introduce pollutants or invasive plants to the Cascade Springs system. Increased development in the area could also lead to an increase of recreation at the site. Such alterations could put the persistence of *Adiantum capillus-veneris* at risk. Livestock grazing is not permitted at Cascade Springs and Cascade Falls, but may occur on bordering private lands and on The Nature Conservancy's Whitney Preserve. There is no recent evidence of browsing, disease, or predation on plants at Cascade Springs or Cascade Falls on lands administered by the Forest (USDA Forest Service 2005a). There is no evidence of livestock grazing in the past, when the J. H. Keith Picnic Ground (Cascade Springs) was a public park, and there are no plans to permit livestock grazing at Cascade Springs or Cascade Falls in the future (Hornbeck et al. 2003a).

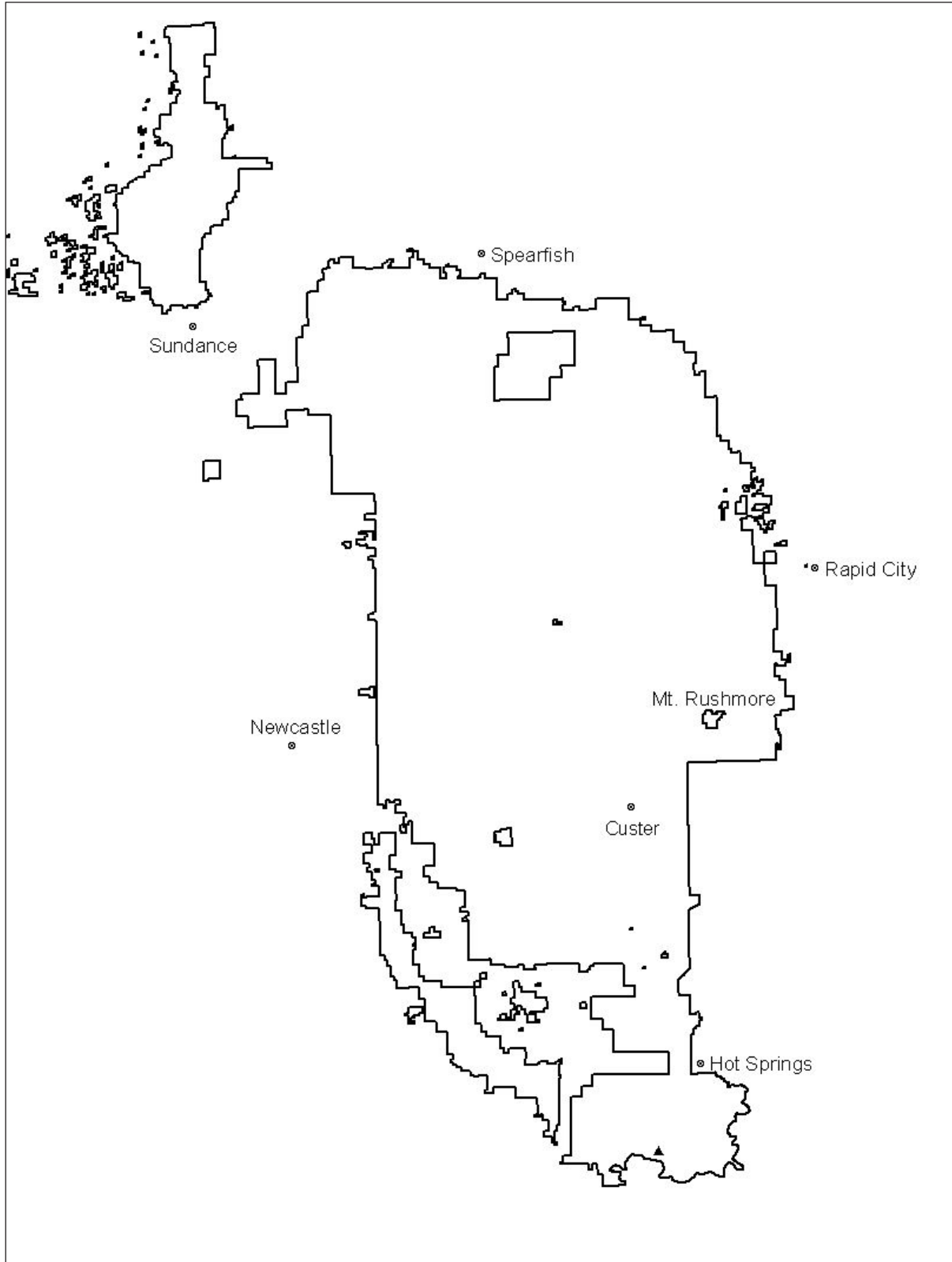
Activities and effects on *Adiantum capillus-veneris* were discussed in the section based on the current locations of designated ARCs (Refer to Map G-6 in Appendix G: At-Risk Communities and Wildland-urban Interface). This map is subject to change, with the potential that more areas could likely be designated as ARCs (refer to Appendix B of the FEIS for discussion of ARCs and the WUI for more information), with fuel-reduction actions to occur within an estimated 1.5-mile WUI circumference area around those designated areas. It is uncertain how this expected revision of the list will result in changes in placement of, or levels of treatments around species occurrences, and how effects would be expected to change.

There has been some damage to the habitat and loss of some individuals due to the recreational developments in the past, but recent conservation actions on private land, as well as focused management by the Forest plus increased attention in the foreseeable future indicate that *Adiantum capillus-veneris* could be expected to persist if the water source would remain stable. The limited habitat in the Black Hills will always leave this species vulnerable to stochastic events. It is important to recognize that natural catastrophic events, such as droughts, or human development on adjacent private lands that could affect the water supply (see Southern Hills Water Project discussion above) and could offset or negate the effects of the current management actions or future actions as they would occur under the full implementation of the Phase II Amendment alternatives.

It should be recognized that no matter what management actions take place, persistence of this species is uncertain based on a single occurrence that lends a greater vulnerability to loss from stochastic events (e.g., drought, fire). When all five alternatives and information specific to the species are considered, the most conservation opportunities and protection for *Adiantum capillus-veneris* are considered to be afforded under Alternatives 3 and 6, as described above. Therefore, it is expected that the least risk to

the long-term persistence of this species would be through the full implementation of those alternatives. Alternative 4 also targets conservation and protection, but the alternative takes a more passive approach (primarily focuses on more natural processes) for species rather than taking more aggressive actions if needed. Therefore it is assumed that more risk to the species persistence could be expected to be associated with Alternative 4. The No Action Alternatives (Alternatives 1 and 2) do not include additional measures for SOLC, and it is expected that the reduction of risks to the species long-term persistence would be the lowest in these alternatives; however, monitoring of the species would still be expected to be targeted.

Figure 3-5. General Distribution Of *Adiantum Capillus-veneris* On Lands Administered By The Black Hills National Forest



3-3.2.3.2. Southwestern Showy Sedge (*Carex bella*)

Affected Environment

The primary range for *Carex bella* occurrences is located to the south and west of the Black Hills and the species has been reported to occur in Colorado, New Mexico, Utah, Arizona, Nevada, and South Dakota (NatureServe 2005) and Mexico (Glisson 2003c). *C. bella* occurrences on lands administered by the Black Hills National Forest are all located within a single section at the highest elevations of the Forest, with all reported locations occurring within Pennington County, South Dakota on the Hell Canyon Ranger District. These occurrences are located near Harney Peak, Nelson Creek and Lost Cabin Creek within the Black Elk Wilderness Area (MA1.1A). Five occurrences have also been reported within in the northern portion of Custer State Park, which lies adjacent to Black Elk Wilderness.

Carex bella is currently ranked as globally secure (G5) but has a conservation rank of critically imperiled due to rarity (S1) for South Dakota (NatureServe 2005).

Carex bella is a robust, perennial, cespitose graminoid between 1.5- and 3-feet tall. The approximate flowering period in the Black Hills is July through August. This sedge is reported to have low seed production; a low seed spread rate, and low seedling vigor. Seed dispersal is likely accomplished on a localized basis by wind, insects, animals, and water. Birds likely accomplish long-range seed transport. Elsewhere in its range, this species typically inhabits streambanks, meadows, and moist woods or open (sunny) slopes at elevations of 9,000 to 10,000 feet, frequently above the timberline (Glisson 2003c). In the Black Hills, occupied sites have been documented among granitic outcrops and bouldery areas of low order streams (uppermost portions of high elevation Black Hills watershed streams). The occurrence locations are cool and moist, *Picea glauca* (white spruce) or *Betula papyrifera* (paper birch) forests with shaded conditions. These eight occurrences range from small, clustered stands to scattered occurrences and reportedly range in size from fewer than 25 plants to over 200 flowering stems. The occurrences are located at some of the highest elevations in the Black Hills, between 6,600 and 7,100 feet, which are considered low elevations for occurrences of this sedge from the main portion of this species range. This indicates this species may be approaching the limit of habitat availability in the Black Hills (highest elevations of the Black Hills within the granitic core area) under the present climatic conditions (Glisson 2003c). In recent years (primarily since 2001 when it was located on lands administered by the Forest), emphasis has been placed on targeting and reporting *C. bella* occurrences during plant surveys completed on the Forest. Since no additional occurrences of *C. bella* have been discovered during a number of recent surveys that have been completed throughout the Black Hills since 2001 (USDA Forest Service 2005a), this information further supports the likelihood that this plant may be restricted to the highest elevations in the granitic core area of the Black Hills (on the Black Hills National Forest this land is located within the Black Elk Wilderness).

Direct And Indirect Effects

On the Forest, *Carex bella* is considered to be relatively secure from most potential risks, with the potential exception of an extreme climatic change, since the species is reportedly intolerant to drought (Glisson 2003c). Based on the existence of eight documented *C. bella* occurrences (three on the Forest) limits the likelihood that single high intensity localized events would be expected to result in the loss of all occurrences, however, they are located within a limited geographic area. Factors that could affect the continued likelihood of persistence of *C. bella* in the Black Hills include: limited distribution; small occurrence size (limited number of individuals); limited ability to disperse; restricted availability of suitable habitat within the Black Hills; and stochastic natural events (Glisson 2003c). Other potential future risks may include increases in activities associated with recreational rock climbing and hikers,

browsing by non-native mountain goats (*Oreamnos americanus*), invasion by noxious weeds or other exotic plant species and efforts to control them. In addition, future fire-suppression efforts could be expected to be potential risks at some sites. For discussions of natural disturbances and noxious weeds refer to Sections 3-7.1 Fire, 3-7.2 Insects and 3-7.3 Noxious Weeds in Chapter 3 of the Final EIS.

As previously indicated, *Carex bella* occurrences on Black Hills National Forest lands are located in the Black Elk Wilderness and their persistence are not currently at risk from most vegetation management activities (i.e., timber management and grazing are not currently occurring at known occurrences). Although off-road vehicle use is prevalent in the Black Hills it is not permitted (Standard 1.1A-9108) within the Black Elk Wilderness therefore is not considered to be a risk to the Forest occurrences. The persistence of *Carex bella* on Forest Service administered land is not currently at risk from livestock grazing (Allen et al. 2005, USDA Forest Service 2005a, Glisson 2003c). Occurrences are located in an area where no permits are currently issued for livestock grazing. The area is not fenced, so occasionally cattle may access the lower portions of watersheds within the Wilderness. Due to the bouldery and rocky conditions and steep slopes in the high elevation and upper portions of the watersheds, cattle are unlikely to access the known sites.

Concentrations of wildlife species, particularly mountain goats (a non-native species), could be expected to impact *Carex bella* individuals directly by herbivory. Evidence of herbivory by mountain goats has not been documented at the Forest occurrences, but mountain goats are present in Black Elk Wilderness and Custer State Park and may be expected to use *C. bella* habitat. Mountain goat diet information from Colorado and Montana indicated that the summer diet of mountain goats in Colorado and Montana included sedges; however, a vegetation utilization study completed in the Black Hills indicated that shrubs, mosses and lichens were the primary components of mountain goat diets (Glisson 2003c).

The nearest *Carex bella* occurrences to those in the Black Hills are located several hundred miles away; therefore, it is not expected that natural recolonization would be able to occur if the Black Hills occurrences ceased to exist (Glisson 2003c). However, information is available that *C. bella* may be propagated (Glisson 2003c). Objective 200-04 (Alternatives 3, 4, and 6) targets the collection of seeds, spores or other plant materials of SOLC for storage in a long-term repository for potential propagation and reintroduction efforts in the event that existing occurrences may be lost and where it is likely that reintroduction efforts would be expected to be successful. Alternatives 1 and 2 do not include direction for the collection of material to provide for the reintroduction of SOLC plants.

The creation or maintenance of low-to-moderate (Alternatives 3 and 6) crown fire-hazard conditions around emphasis plant species (Objective 200-05) is targeted, however, these type of activities would not be expected to occur within the Black Elk Wilderness where *Carex bella* is located. Therefore it is assumed that effects associated with crown fires would be expected to remain the same for *C. bella* under any of the alternatives (see Section 3-7.1 Fire for fire discussions for alternatives).

Objective 214 targets the restoration of 500 acres of riparian shrublands under Alternatives 1, 2, 4, and 6. Alternative 3 targets the restoration of 1,000 acres of riparian shrublands. Alternative 6 prioritizes the restoration around the WUI areas. However, under any alternative, it is unlikely that this restoration would occur within the vicinity of *Carex bella* occurrences because the headwater systems in this area do not typically lend themselves to alteration, primarily due to rock outcrops, boulders and shallow soil conditions, and is likely functioning similarly to how they functioned historically.

Carex bella is reported to be fire tolerant (Glisson 2003c) and occurs in moist habitats that may limit fire-severity effects. It is uncertain if the shaded conditions at known sites are a habitat requirement for this species in the Black Hills. However, if it is, *C. bella* may be affected by wildfire through the loss of shade (i.e., loss of canopy cover) provided by *Picea glauca*. The increased density of trees that results

from fire suppression could affect the species by reducing groundwater flow into its habitats, however, known occurrences are located at the headwaters of streams and it is expected that increased tree density would have little effect on these headwater locations. Because of potential risks associated with high severity fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of SOLC plant occurrences that could be at risk to high severity wildfires by the creation or maintenance of conditions in the adjacent upland conifer stands that would be expected to increase the likelihood of dropping crown fires to the ground before reaching occurrences. Alternatives 1, 2, and 4 are silent on this objective. Fuel hazard reduction activities associated with this objective would not be permitted in the Wilderness; therefore effects are expected to be the same across all alternatives. From the standpoint of fire-suppression effects, Alternatives 3 and 6 provide more fire suppression related protection to the SOLC through Guideline 4102, and Standard 3200-03. Guideline 4102 in Alternatives 1 and 2 provide for protection of heritage resources, streams, stream banks, shorelines, lakes, and associated vegetation from wildfire-suppression efforts. In Alternatives 3 and 6 the protection is extended to SOLC plants such as *C. bella*. In addition, Standard 3200-03 states that wildfire-suppression camps will not be placed at known mapped SOLC locations (the known *C. bella* locations are mapped). Since this is a new standard, Alternatives 1 and 2 do not contain this standard. This standard is included in Alternative 4. However, *Carex bella* occurrences are located within bouldery, rock outcrop areas high in the watersheds that would not be expected to be selected for fire camps, so this standard likely has limited applicability for this species.

All alternatives target various levels of conservation and protection for SOLC plants from noxious-weed invasion and treatment. The assumption is that Alternatives 3, 4, and 6 would have a greater reduction in risk of indirect and direct impacts to *Carex bella* from noxious weeds and their treatment due. Objective 231 is included in all alternatives to target prevention and reduction of noxious-weed invasion into native plant communities. Similarly, noxious weeds are to be controlled in the Wilderness area (Guideline 1.1A-4301). In Alternatives 1 and 2, the targeted objective is to treat 3,600 acres per year across the Black Hills National Forest. Targeted treatment acres are increased to 6,000 acres per year in Alternatives 3, 4, and 6. Guideline 4303 is revised in Alternatives 3, 4, and 6 to make occurrences of SOLC, along with Region 2 sensitive species, the priority for treatment of noxious weeds. Guideline 4304 (Alternatives 1 and 2) was revised and elevated to a standard in Alternatives 3, 4, and 6. This would be expected to provide more protection to *C. bella* by requiring use of treatment methods that pose the least risk to the species. Standard 4300-01 specifies monitoring of weed control effectiveness at SOLC sites to determine if weeds at those sites need to be re-treated throughout the season to reduce noxious-weed competition, and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to SOLC plant species. Alternatives 1 and 2 are silent on the monitoring of weed control effectiveness at SOLC plant locations. Alternatives 1 and 2 require the use of certified noxious-weed-free seed, feed and mulch on the Forest (Standard 4306). This standard was revised in Alternatives 3, 4, and 6 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. Mitigation of noxious weed invasion into native plant communities by re-vegetating with native species is included as a guideline (1110) in Alternatives 1 and 2. The original guideline was revised and was elevated to a standard in Alternatives 3, 4, and 6 (Standard 1110). Further discussion on Noxious Weeds as related to implementation of the various Phase II Amendment alternatives can be found in Section 3-7.3 of the FEIS.

Monitoring to be completed for these species has been included in Chapter 4 of the LRMP, see Monitoring Item Species of Local Concern. The type and level of information being collected for monitoring this species is available in the Black Hills Monitoring Implementation Guide (USDA Forest Service 2005f). In general, as identified in the design for this species, the focus for the monitoring

seasons immediately following the Phase II Amendment ROD is to attempt to relocate the previously reported locations. If reported areas are relocated, the current design includes the gathering of quantitative and qualitative baseline data and assessing risks at occurrences that are relocated. Monitoring also targets baseline data collection at any newly discovered locations.

Under all Phase II Amendment alternatives, recreation in the Black Elk Wilderness is to be managed to preserve Wilderness values, including natural processes and to provide natural for natural plant succession (existing Management Area Standards 1.1A-2101, 1.1A-5101 and Guideline 1.1A-5102), therefore it is expected that implementation of these standards and guideline would target the basic conservation of SOLC plants, such as *Carex bella*. In addition, if areas of the Black Elk Wilderness are impacted by human-induced changes, they are to be restored to natural conditions to the degree feasible, under all alternatives (existing Objective 1.1A-401, Guideline 1.1A-2102). Alternatives 3 and 6 provide additional conservation direction for emphasis plant species in the Black Elk Wilderness by requiring any newly constructed trails or relocation of existing trails to be routed away from known emphasis plant species occurrences and by prohibiting increases in climbing access over what exists where the species occur at the time the ROD is signed for this amendment (Standard 1.1A-1202). This standard is not included in the Phase II No Action Alternatives (Alternatives 1 and 2) or in Alternative 4.

When there is recreation in an area, there is the potential for plant collecting to become a risk to plant species, however, it is expected that collection risk is limited for this species since it does not really have characteristics associated with a higher collection potential (brightly colored flowers, is an orchid, etc.) and remoteness that limit access. Standard 3119 is included in Alternatives 3 and 6 to restrict the collection of SOLC plants (or parts thereof) to only those needed for scientific or educational purposes, or as recognized for American Indian traditions (Standard 7103). This would prohibit collecting for both personal (other than for American Indian traditional uses) and commercial uses, thereby limiting the associated direct effects of plants removed from occurrences. It is unknown how many plants would be used for American Indian traditional uses; however, they have indicated at meetings that their interests are in maintaining plant species that have traditional uses. Although uncertain, the assumption is that traditional uses and scientific collections may be expected to directly affect individual plants, it is not expected that this type of collection would present much risk to the overall long-term persistence of this species on the Black Hills National Forest. Alternatives 1, 2, and 4 do not include Standard 3119. An additional standard that addresses potential risks to *Carex bella* that could be associated with recreation is Standard 1.1A-1202, which directs (Alternatives 3 and 6) that if trails are to be constructed or relocated to route them away from SOLC plant occurrences and to not increase climbing access over what currently exists (at the time the Phase II ROD is signed) where SOLC plants occur. This would be expected to limit effects and potential risks to the species. Alternatives 1, 2, and 4 do not include this standard.

The *Carex bella* occurrences are not located within any of the candidate RNAs and no beneficial or negative effects is expected to be associated with any that may proposed for designation through the Phase II Amendment decision.

Cumulative Effects

The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (Liggett et al. 2003).

The spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species is smaller than generally encompasses the Black Hills Ecoregion as defined by Bailey (1995). The spatial area used for the cumulative effects analysis for *Carex bella* primarily includes the Black Elk Wilderness and Custer State Park. This area was chosen because it encompasses similar ecosystem components to where the known occurrences are located. A larger area would include lower elevation and warmer and drier ecosystem components which includes a vastly different suite of species.

The only known occurrences of *Carex bella* in South Dakota occur in the Black Elk Wilderness area and in the northern unit of Custer State Park. It has been indicated that trampling by rock climbers and hikers and herbivory by mountain goats may be the most likely risks involved with management activities in Custer State Park. Rock climbing has been increasing in Custer State Park, and associated trail (both designated and user created) are being used to access the climbing areas. One of the Custer State Park occurrences (documented in 1987), has not been relocated and may have been lost due to recreational impacts (Glisson 2003c). In addition to risks associated with the use of recreational trails and climbing, risks are associated with herbivory by mountain goats, which is a non-native species that occupies the area where *C. bella* is located (Allen et al. 2005, Glisson 2003c). Custer State Park occurrences would also be expected to have potential risks associated with noxious weeds and other non-native invasive plants, fire and suppression as well as drought and climatic warming. Commercial harvest of trees occurs within Custer State Park however it is unknown if harvest activities would occur within close proximity to *C. bella* occurrences. However, since *Picea glauca* is not desired commercially and the plants occur in topography and among site features that limits the use of harvest equipment (large rock outcrop formations, boulders, steep slopes), it is expected that few, if any, risks are expected to be associated with harvesting activities in Custer State Park.

Although no occurrences are known from Mount Rushmore National Memorial, similar high elevation associated conditions found in that area may also support *Carex bella* occurrences. Since it is not known if *C. bella* occurs at Mount Rushmore, the effect of activities at the Memorial on this species is not known. Although uncertainty exists as to how low of elevations *C. bella* can occur, there is very little private land in the general vicinity and is located at lower elevations and lower in the watersheds than known *C. bella* occurrences, and therefore it is not expected that *C. bella* would be discovered on those lands.

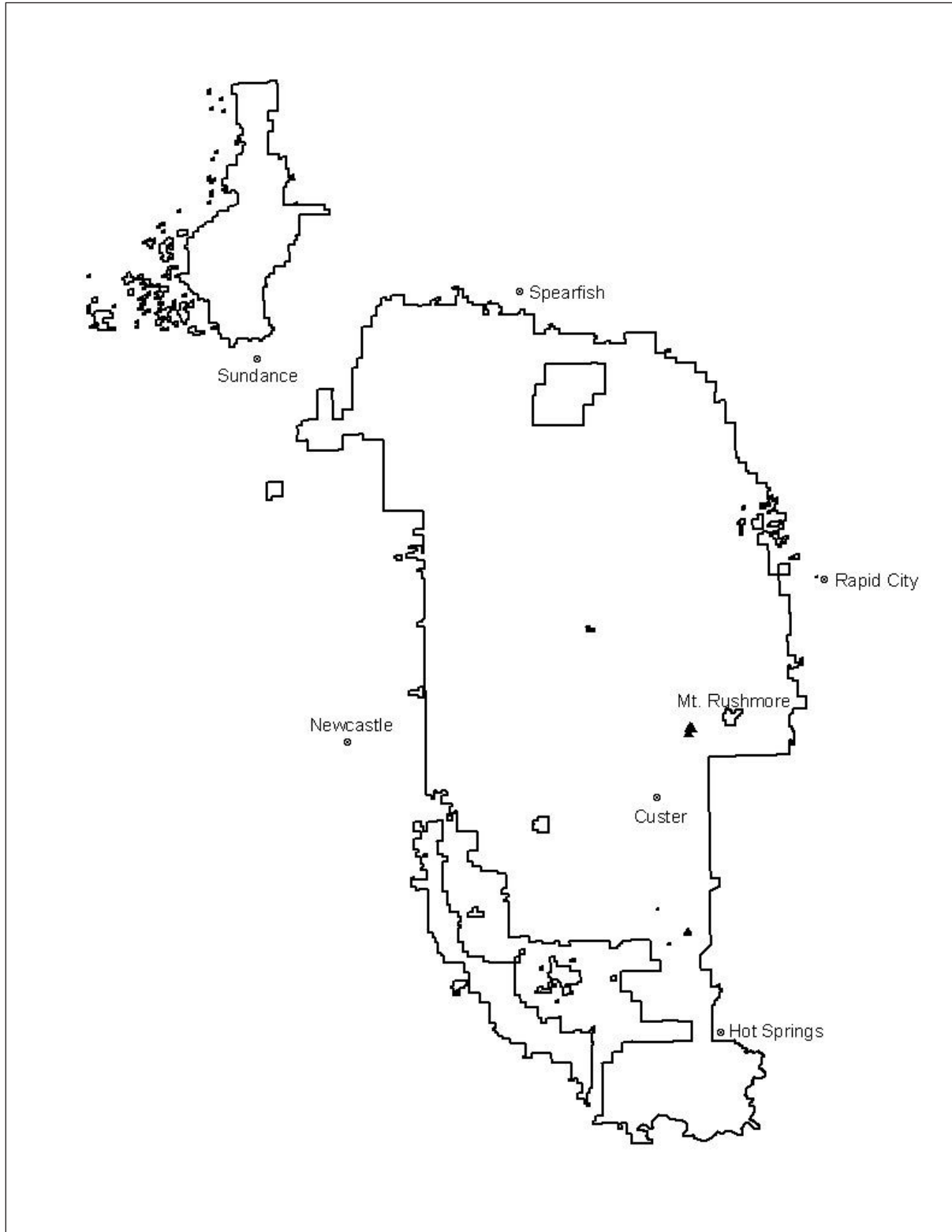
The current list of designated ARC (refer to Appendix B of the FEIS for ARCs and the WUI) is subject to change. However, fuel reduction activities are not expected to take place in the Black Elk Wilderness, therefore no effects would be expected to *Carex bella* with any changes to the ARC list.

Occurrence information from some Black Hills locations indicated that additional habitat is located in the immediate vicinity (Glisson 2003c), therefore it is expected that the number of individuals that have been documented is a conservative number as to what may occur in the Black Hills.

It should be recognized that no matter what management actions take place, persistence of this species is uncertain based on the small number and limited size of occurrences that lends a greater vulnerability to loss from stochastic events (e.g., drought, fire). When all five alternatives and information specific to the species is considered, the most conservation opportunities and protection for *Carex bella* is considered to be afforded under Alternatives 3 and 6, as described above. Therefore it is expected that the least risk to the long-term persistence of this species would be through the full implementation of those alternatives.

Alternative 4 also targets conservation and protection, but the alternative takes a more passive approach (primarily focuses on more natural processes) for species rather than taking more aggressive actions if needed, therefore it is assumed that more risk to the species persistence could be expected to be associated with this alternative. However, actions that can be taken for this species may be limited in scope since occurrences are located within the Black Elk Wilderness. The No Action Alternatives (Alternatives 1 and 2) do not include additional measures for SOLC and it is expected that the reduction of risks to the species long-term persistence would be the lowest in these alternatives, however, monitoring of the species would still be expected to occur.

Figure 3-6. General Distribution Of *Carex Bella* On Lands Administered By The Black Hills National Forest



3-3.2.3.3. Beaked Spikerush (*Eleocharis rostellata*)

Affected Environment

Eleocharis rostellata occurs in British Columbia and eastern Canada and throughout much of the United States. It is also found in northern Mexico, the Greater Antilles (Puerto Rico), and Andean South America. *E. rostellata* is a wetland obligate with a broad ecological range. It occurs in coastal salt marshes and in inland saline, alkaline, or strongly calcareous wetland habitats (e.g., around hot springs) (NatureServe 2005). *E. rostellata* occurs in saturated to inundated conditions and its roots are shallow (Glisson 2003a). *E. rostellata* reproduces from seed or vegetatively by sprouting from short rhizomes or from apical bulbils at the tips of elongated culms (stems) that arch to the ground. Although it does sprout from seed, *E. rostellata* is documented to have low seed production rates, a slow seed spread rate and low seedling vigor, however it is considered to have a moderate vegetative spread rate (USDA Natural Resources Conservation Service 2004).

The occurrence of *Eleocharis rostellata* in the Black Hills was first documented in 1966 along Cascade Creek in Fall River County (Glisson 2003a). Subsequent surveys have documented an expansion of its previously known extent at this location. Year-round flows of warm spring water in Cascade Creek may be an important component of *E. rostellata*'s survival in the Black Hills area.

Eleocharis rostellata occurs on Black Hills National Forest lands, The Nature Conservancy's Whitney Preserve, and other private lands along Cascade Creek. The occurrence of *E. rostellata* along Cascade Creek is comprised of numerous sub occurrences that extend along Cascade Creek (Cascade Springs at J. H. Keith Picnic Ground) to approximately 0.5 mile above its confluence with the Cheyenne River (Glisson 2003a). The Forest Service administers land of only a small percentage (approximately 10 percent) of the larger *E. rostellata* occurrence along Cascade Creek. On the Black Hills National Forest, *E. rostellata* occurs within Forest MA 8.2 – Developed Recreation Complexes (Cascade Complex).

In South Dakota, *Eleocharis rostellata* is currently assigned a rank of critically imperiled because of extreme rarity (S1). Because of the widespread geographic distribution and abundance elsewhere, the global rank for *E. rostellata* is demonstrably secure (G5) (NatureServe 2005).

Direct And Indirect Effects

The only known occurrence of *Eleocharis rostellata* in the Black Hills is located along Cascade Creek. Potential direct impacts to the approximately 10 percent of the *E. rostellata* occurrence at Cascade Creek that occurs on lands administered by the Black Hills National Forest could be expected to be associated with trampling by humans, wildlife, and from collection/harvest (Glisson 2003a).

The only known occurrence of *Eleocharis rostellata* in the Black Hills is located along Cascade Creek. A portion of the much larger occurrence is located on National Forest land at the Cascade Complex. In 1962, this private land was deeded to the Black Hills National Forest. The land deed granted to the Forest specifically requires that the grantee must preserve, develop, care for and maintain the area as a park for the use of the public and for no other purpose (Glisson 2003a; Hornbeck et al. 2003a). Effects associated with ongoing recreational use and invasion by, or treatment of, exotic plant species (including noxious weeds) are currently considered to be the most significant risks to the *E. rostellata* and its habitat on the Black Hills National Forest administered lands (Glisson 2003a).

Recreational use of the area is expected to continue as specified in the land deed. Impementation of Standard 8.2-9106 (Alternatives 2, 3, 4, and 6) prohibits any new developments, including road and trail construction in the Cascade Creek and Cascade Springs area. This standard is not included in Alternative

1. Goal 8.2-201 (Alternatives 3 and 6) targets Cascade Springs (J. H. Keith Picnic Ground) and Cascade Falls (both are high use recreation areas) vegetation be managed in a way to protect the SOLC plants as well as maintain or improve the desired recreation setting and conserve the botanical features. Under Alternatives 1, 2, and 4, Goal 8.2-201 does not include the specific wording for SOLC plants. Standard 8.2-2104 is strengthened in Alternatives 3, 4, and 6. It states that if monitoring of SOLC plant species occurrences documents species are being impacted by recreational use, management is to be implemented to protect the species. Under Alternatives 1 and 2, Standard 8.2-2104 wording is more general to include protection of unique biological features. In an area that receives intensive levels of recreational use, there is always the potential for plant collecting to become a risk to the species. Standard 3119 is included in Alternatives 3 and 6 to restrict the collection of SOLC plants (or parts thereof) to only those needed for scientific or educational purposes, or as recognized for American Indian traditions (Standard 7103). This would prohibit collecting for both personal (other than for American Indian traditional uses) and commercial uses, thereby limiting the associated direct effects of plants removed from occurrences. It is unknown how many plants would be used for American Indian traditional uses; however, they have indicated at meetings that their interests are in maintaining plant species that have traditional uses. Although uncertain, the assumption is that traditional uses and scientific collections may be expected to directly affect individual plants, it is not expected that this type of collection would present much risk to the overall long-term persistence of this species on the Black Hills National Forest. Alternatives 1, 2, and 4 do not include Standard 3119.

Since the species is limited to a single watershed it is vulnerable to high intensity disturbance events such as noxious weed invasion or invasion by other exotic plant species (addressed above), disease, insect infestation, high intensity wildfire, etc. (see Sections 3-7.1 Fire, 3-7.2 Insects, and 3-7.3 Noxious Weeds in Chapter 3 of the FEIS for discussions of these disturbances within the Black Hills). All alternatives target various levels of conservation and protection for SOLC plants from noxious-weed invasion and treatment. The assumption is that Alternatives 3, 4, and 6 would have a greater reduction in risk of indirect and direct impacts to *Eleocharis rostellata* from noxious weeds and their treatment. Objective 231 is included in all alternatives to target prevention and reduction of noxious-weed invasion into native plant communities. In Alternatives 1 and 2, the targeted objective is to treat 3,600 acres per year. Targeted treatment acres are increased to 6,000 acres per year in Alternatives 3, and 4, and 8,000 acres in Alternative 6. Guideline 4303 is revised in Alternatives 3, 4, and 6 to make occurrences of SOLC, along with Region 2 sensitive species, the priority for treatment of noxious weeds. Guideline 4304 (Alternatives 1 and 2) was revised and elevated to a standard in Alternatives 3, 4, and 6. This would be expected to provide more protection to *E. rostellata* by requiring use of treatment methods that pose the least risk to the species. Standard 4300-01 specifies monitoring of weed control effectiveness at SOLC sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed competition, and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to SOLC plant species. Alternatives 1 and 2 do not include on the monitoring of weed control effectiveness at SOLC plant locations. Alternatives 1 and 2 require the use of certified noxious-weed-free seed, feed and mulch on the Forest (Standard 4306). This standard was revised in Alternatives 3, 4, and 6 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. Prevention of noxious weed invasion into native plant communities is further targeted by revegetating with native species as included as a guideline (1110) in Alternatives 1 and 2. The original guideline was revised and was strengthened to a standard in Alternatives 3, 4, and 6 (Standard 1110). Objective 8.2-208 (Alternatives 3 and 6) targets the monitoring of and treatment of *Tamarix* spp. (salt cedar) and *Lythrum salicaria* (purple loosestrife) along Cascade Creek. These two species could outcompete *E. rostellata* should they become established in the area. Alternatives 1, 2, and 4 do not address these two non-native invasive species (see Section 3-7.3 Noxious Weeds for further discussion by alternative).

Although the risk of crown-fire events occurring at Cascade Creek is limited by the vegetation systems located there, Objective 200-05 (Alternatives 3 and 6) addresses the fire risk targeting the maintenance or creation of a moderate (Alternative 6) to low (Alternatives 3 and 6) crown fire-hazard adjacent to occurrences of SOLC plants. Alternatives 1, 2, and 4 do not address the issue of fire risk for these species. Objective 200-04 (Alternatives 3, 4, and 6) addresses the collection of seeds, spores, or other plant material from SOLC plant species to target the availability of material for the reintroduction of the species should the existing occurrence be lost. Alternatives 1 and 2 do not address the issue. Guideline 4102 (Alternatives 1 and 2) provides direction for protecting heritage resources, streams, stream banks, shorelines, lakes and associated vegetation from degradation by wildfire-suppression efforts. In Alternatives 3 and 6, the direction for protection is extended to SOLC such as *Eleocharis rostellata*. In addition, Standard 3200-03 states that wildfire-suppression camps will not be placed at known mapped SOLC plant locations (the *E. rostellata* occurrence is known and mapped). Alternatives 1 and 2 do not contain this standard. This direction is intended to reduce the effects associated with wildfire and suppression and if fully implemented, the least risk to the long-term persistence from fire and suppression would be expected through the selection of Alternatives 3, 4, or 6.

Additional potential risks to the species could include alterations to the habitat by hydrologic or geologic modifications, or from erosion (Glisson 2003a). Management Area Goal 8.2-207 (Alternatives 3 and 6) targets implementation of additional measures to prevent and control erosion, including erosion associated with or created by recreational use at locations along Cascade Creek where known *Eleocharis rostellata* individuals exist, if monitoring reveals that the existing measures are not adequate. Alternatives 1, 2, and 4 do not include Goal 8.2-207.

Livestock use is not permitted at Cascade Springs or Cascade Falls therefore no effects are expected from that activity under any of the alternatives. There are no timber harvest activities or other vegetation management activities planned on land administered by the Forest in the immediate area, other than suppression of noxious weeds or other exotic plants (Hornbeck et al. 2003a).

In recent years (primarily since 2000), more emphasis has been placed on targeting and reporting *Eleocharis rostellata* occurrences during plant surveys completed on the Forest. Monitoring Item Species of Local Concern has been included in Chapter 4 of the LRMP. The type and level of information to be collected for monitoring this species is available in the Black Hills Monitoring Implementation Guide (USDA Forest Service 2005f). In general, as identified in the design for this species, the focus for the monitoring season immediately following the Phase II Amendment ROD will be to gather quantitative and qualitative baseline data and to assess risks at the Cascade Creek occurrence.

The *Eleocharis rostellata* occurrence is not located within any of the candidate RNAs and no beneficial or negative effects is expected to be associated with any that may proposed for designation through the Phase II Amendment decision.

Since the only *Eleocharis rostellata* occurrence on the Black Hills National Forest is located within the estimated 1.5-mile WUI circumference area of an At Risk Community, it is likely that Objective 200-05 could be achieved near the site in conjunction with fuels reduction efforts near ARCs (refer to Appendix G, Map G-6: At-risk Communities and Wildland-urban Interface) that has been included in Alternative 6. However, in all reality, various areas can be expected to receive treatment under all alternatives because of the tie to the legislation (refer to Appendix B of the FEIS for discussion of ARCs and the WUI for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARCs and *E. rostellata* because without a priority system or a map indicating which ARCs are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of the occurrence. In addition, as mentioned earlier, the vegetation systems (riparian and grassland) on the Forest parcels at Cascade Springs and Cascade Falls would not be expected to lend themselves to

high intensity crown-fire events. The Cascade Springs area has a limited number of encroaching conifers. When all five alternatives are considered, the most conservation opportunities and protection for *E. rostellata* is afforded under Alternatives 3 and 6, as described above.

Cumulative Effects

The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (Liggett et al. 2003).

The spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species is smaller than generally encompasses the Black Hills Ecoregion as defined by Bailey (1995). The spatial area used for the cumulative effects analysis for *Eleocharis rostellata* primarily includes the Cascade Creek watershed. This area was chosen because it encompasses the ecosystem components to where the known occurrence is located. A larger area would include higher elevation and cooler ecosystem components which includes a vastly different suite of species than what occurs along Cascade Creek.

Approximately 10 percent of the Cascade Creek *Eleocharis rostellata* occurrence occurs on land administered by the Black Hills National Forest. As noted in a previous section, *E. rostellata* was first documented along Cascade Springs in 1966 (Glisson 2003a). With the exception of approximately 4 acres in a central portion of the occurrence, the rest of the *E. rostellata* occurrence site is either administered by the Forest or else owned or under a conservation agreement with The Nature Conservancy (Whitney Preserve) (Glisson 2003a). The effect of activities on adjacent private lands is unknown; however, the Cascade Creek occurrence has persisted since it was first documented in 1966, indicating that in spite of the type or levels of activities have taken place, the species has been documented to persist for close to 50 years. The recent acquisition and conservation easements on lands along Cascade Creek by The Nature Conservancy is expected to contribute to the conservation of the single occurrence of *E. rostellata* in the Black Hills as The Nature Conservancy initiates management to conserve the species, since the majority of the occurrence is located within the boundary of the Whitney Preserve.

The area along Cascade Creek and Cascade Springs has historically received intensive levels of recreational use. The resort town of Cascade Springs was founded in 1888 just south of the springs, which were used as commercial mineral spas until shortly after the turn of the century. Both Cascade Springs and Cascade Falls have continued to be used as recreational areas by the public since that time. The long history of natural and human disturbance at Cascade Creek suggests that *E. rostellata* is tolerant of, or perhaps able to exploit disturbances. Although the species has persisted during periods of heavy human use in the past, and may even benefit from intense episodic disturbance, there is a concern that recreational effects might be insidious until a threshold is reached that could result in the local occurrence being decimated.

The constant flow of warm water from Cascade Springs is expected to be essential to the persistence of *E. rostellata* in the Black Hills. Due to the springs' deep source in Hell Canyon, the quality and quantity of its water is not expected to be greatly affected by alteration of surrounding lands. However, local disturbances may affect sediment levels and have the potential to increase non-point source pollutants (Glisson 2003a, Hornbeck et al. 2003a). Of recent (March 2005) concern for this species persistence is a new project that is being proposed in the southern Black Hills. The Southern Hills Water Project (being proposed by local city and county governments) is currently in the initial stages with few site specific details available, however, included in the proposal is that some large capacity wells are to be created and developed in areas that may affect the water source at Cascade Springs. General sites for a couple of

the wells that could affect Cascade Creek include a potential well location in the Minnekahta area and a potential well placed in the general vicinity of Cascade Creek. If these wells decrease the amount of available water supplying Cascade Springs and Cascade Creek, it is likely that an adverse effect to the species persistence of *E. rostellata* could be expected.

The close proximity of South Dakota Highway 71 is a concern due to the potential for contamination of the springs and Cascade Creek with toxic substances or introduction of noxious weeds or other non-native invasive plant species by vehicles, or what they may be hauling.

Private land development is occurring in many areas of the Black Hills, including the area above Cascade Springs. Development could result in conditions that can contribute to increased water runoff, erosion, increase the nutrient load in the creek and riparian habitats, and introduce pollutants or invasive plant species to the Cascade Springs system. Increased development in the area could also lead to contribute to increases of recreational use along Cascade Creek. Such alterations could likely increase risks to the species long-term persistence. As described in the earlier section, livestock use is not permitted on Forest parcels at Cascade Springs and Cascade Falls, but may occur on bordering private lands, and on The Nature Conservancy's Whitney Preserve. There is no evidence of livestock grazing in the past, when the J. H. Keith Picnic Ground (Cascade Springs) was a public park, and there are no plans to permit livestock grazing at Cascade Springs or Cascade Falls in the future (Hornbeck et al. 2003a).

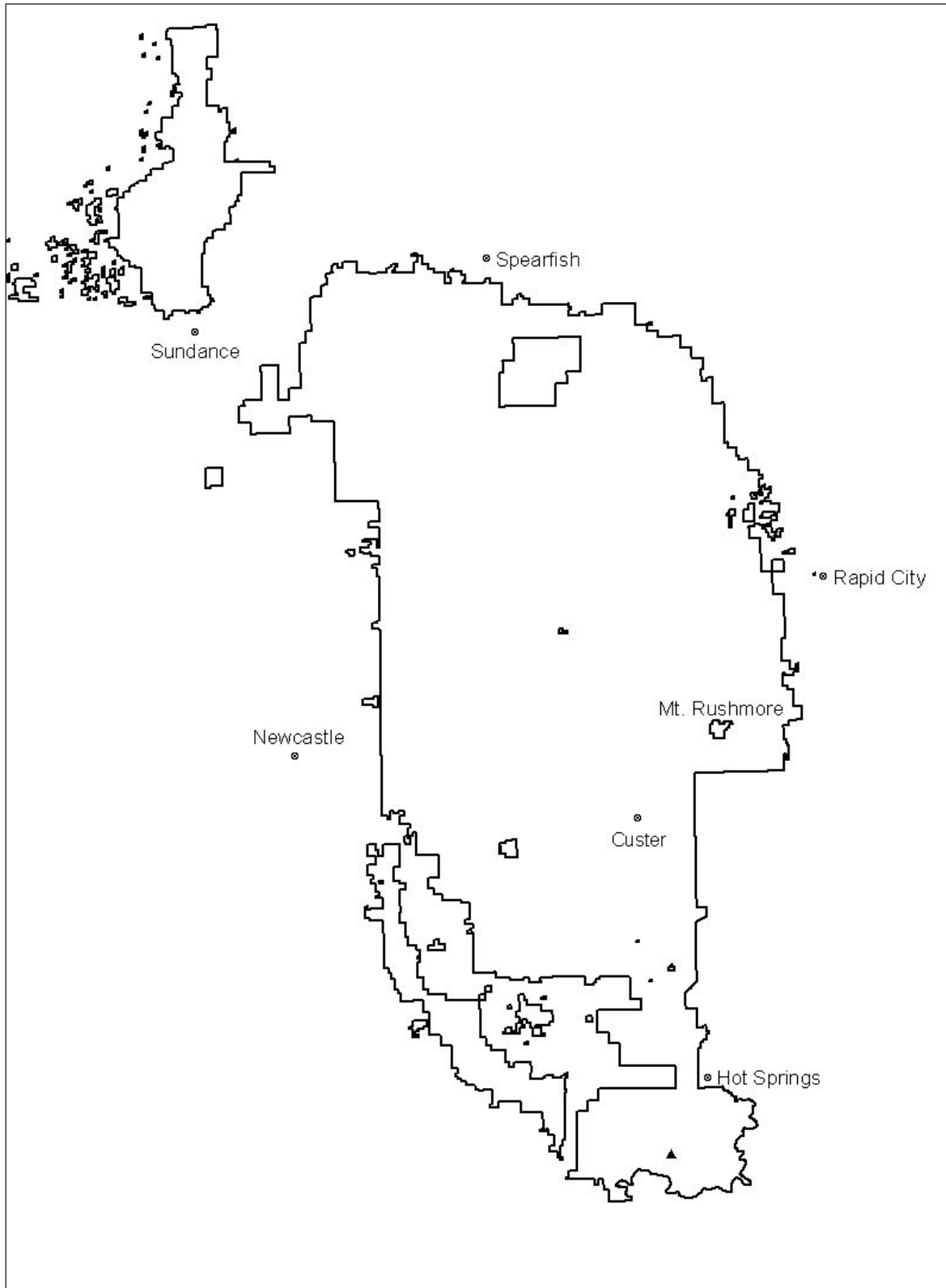
Activities and effects on *Eleocharis rostellata* were discussed in the section based on the current locations of designated ARCs (Refer to Map G-6 in Appendix G: At-Risk Communities and Wildland-urban Interface). This map is subject to change, with the potential that more areas could likely be designated as ARCs (refer to Appendix B of the FEIS for discussion of ARCs and the WUI for more information), with fuel reduction actions to occur within an estimated 1.5-mile WUI circumference area around those designated areas. It is uncertain how this expected revision of the list will result in changes in placement of, or levels of treatments around species occurrences, and how effects would be expected to change.

There has been some degradation and alterations to the Cascade Creek riparian habitat and it is expected that there has likely been a loss of some *Eleocharis rostellata* individuals due to the recreational developments in the past, but recent conservation actions on private land, as well as by the Forest plus increased attention in the foreseeable future by full implementation of Phase II alternatives, are indicators that *E. rostellata* would be expected to persist if the water source would remain stable. Based on a single occurrence and limited habitat, no matter what conservation management occurs for this species, the species will be vulnerable to stochastic events. It is important to recognize that natural catastrophic events, such as droughts, or human development on adjacent private lands that could affect the water supply (see Southern Hills Water Project discussion above) could offset or negate the effects of the current management actions, or actions as they would occur under the Phase II Amendment alternatives.

It should be recognized that no matter what management actions take place, persistence of this species is uncertain based on a single occurrence that lends a greater vulnerability to loss from stochastic events (e.g., drought, fire). When all five alternatives are considered as compared to information about this species, the most conservation opportunities and protection for *Eleocharis rostellata* is considered to be afforded under Alternatives 3 and 6, as described above, therefore the least risk to the species long-term persistence is expected to be associated with full implementation of those alternatives. Alternative 4 also targets conservation and protection, but the alternative takes a more passive approach (primarily focuses on more natural processes) for species rather than taking more aggressive actions if needed, therefore it is assumed that more risk to the species persistence could be expected to be associated with this alternative.

The No Action Alternatives (Alternatives 1 and 2) do not include additional measures for SOLC and it is expected that the reduction of risks to the species long-term persistence would be the lowest in these alternatives, however, monitoring of the species would still be expected to be targeted.

Figure 3-7. General Distribution Of *Eleocharis Rostellata* On Lands Administered By The Black Hills National Forest



3-3.2.3.4. Pleated Gentian (*Gentiana affinis*)

Affected Environment

In North America, *Gentiana affinis* occurs in states west of Minnesota, Nebraska, Kansas, and Oklahoma and in provinces west of Ontario, Canada (NatureServe 2004). Occurrences of *G. affinis* in South Dakota have been reported from Pennington and Harding counties (USDA NRCS 2004). In Wyoming, occurrences are reported to be *G. affinis* var. *bigelovii* and are documented from Albany and Laramie counties (Keinath et al. 2003). Six occurrences have been documented on the Forest and one on private land.

The Forest occurrences primarily occur in limestone areas (Larson and Johnson 1999) at elevations from approximately 5,000 to approximately 6,500 feet of elevation on the Mystic and Northern Hills Districts (Allen et al. 2005, USDA Forest Service 2005d). These sites were reported from observances in 1994, 1996, and 2002 (USDA Forest Service 2004i). It is unknown if *Gentiana affinis* may be more widely distributed on the Forest than is currently known, however if it suspected that it is likely under reported on the limestone plateau (Allen et al. 2005). The sites are located within four sixth-order watersheds and are located in Pennington and Lawrence Counties, South Dakota. There is limited occurrence, abundance, and distribution information available for the Black Hills; however, eight reports are from Forest Service administered lands (Allen et al. 2005, USDA Forest Service 2005d). The reports are from Management Areas (MA): MA 5.1 - Resource Production Emphasis (seven occurrence reports) and M.A. 3.1 - Botanical Area (McIntosh Fen) (1 occurrence report).

Gentiana affinis is a perennial forb with fleshy fibrous roots, is 4 to 16 inches tall, and has clustered and stalkless purple flowers at the top of its stems. It flowers from August through September and produces seeds in capsules from September through October (Larson and Johnson 1999). It is considered a facultative upland species in South Dakota and eastern Wyoming, meaning that it can occur in wetland habitats but typically occurs in upland areas (USDA NRCS 2004). In the Black Hills, this gentian is considered to be uncommon at low to mid elevations and primarily occurs in moist (not saturated) areas in open conditions (no tree canopy) sometimes near wet meadows, fens, and stream margins in limestone areas (Larson and Johnson 1999, Allen et al. 2005). One report is associated with varying levels of an aspen component (USDA Forest Service 2004i).

Throughout its range, *Gentiana affinis* is considered to be globally secure (G5). In Wyoming, its currently assigned conservation rank is listed as apparently secure (S4); while in South Dakota the currently assigned rank is listed as imperiled (S2) (NatureServe 2005).

Direct And Indirect Effects

At this time, it is considered likely that the species is under reported on the limestone plateau of the Black Hills (Allen et al. 2005). However, based on what is currently known limits to persistence could be expected to include small occurrence size, a limited distribution, and limited ability to disperse (small wind-dispersed seeds). The primary risks for *Gentiana affinis* are expected to be related to intensive grazing or trampling by livestock since it is considered to be a decreaser species, and from activities associated with private land development (lands in other ownership) (Allen et al. 2005). This species is primarily reported to occur in areas without tree canopies, or in areas of full or almost full sun conditions. Therefore, conifer encroachment is expected to present a risk to this species. As with other emphasis species, other risks likely include invasion by noxious weeds or other non-native invasive plant species, drought and wildfire and suppression activities (see Sections 3-7.1 Fire, 3-7.2 Insects, and 3-7.3 Noxious Weeds in Chapter 3 of the FEIS for discussions of these various disturbances within the Black Hills).

Some of the associated habitat condition areas (near riparian areas and wetlands) in which *Gentiana affinis* occurrences have been located on the Forest are generally targeted for conservation. Consequently, implementation of the Phase II Amendment alternatives may be expected to generally benefit the species though the level of targeted conservation actions varies among alternatives.

It is expected that fire suppression has contributed to conifer encroachment and a reduction in open areas in the Black Hills, such as meadows (see Sections 3-2.2 Grassland/Shrubland Ecosystems and 3-7.1 Fire). Objective 205 under Alternatives 1, 2, and 4 directs the restoration of 10 percent of meadows and prairie across the Forest over 1995 conditions. Under Alternative 3, this objective targets the restoration of 2,400 acres of meadow (approximately triple the current meadow acreage) during the life of the LRMP. Alternative 6 basically targets the same restoration figure for meadows, but is worded to reflect managing 3,600 acres of meadow during the life of the Plan. It is expected that the ongoing removal of conifer encroachment from and restoration of meadows to herbaceous conditions under the action alternatives would benefit the species and reduce the risks associated with conifer encroachment to *Gentiana affinis*. Objective 214 targets the restoration of 500 acres of riparian shrublands under Alternatives 1, 2, 4, and 6. Alternative 3 targets the restoration of 1,000 acres of riparian shrublands. If riparian shrubland activities occur near *G. affinis* occurrences successful restoration could be expected to help conserve adjacent mesic soil conditions that could be expected to benefit this species. In terms of specific restoration treatments for aspen (Objective 201), a species that often occurs near riparian and open canopy meadow areas is expected to contribute to the conservation of adjacent mesic conditions for *G. affinis*, Alternatives 3 and 6 exceed the other alternatives. Objective 201 targets a minimum of 46,000 acres of aspen restoration for Alternative 3 and 92,000 acres in Alternative 6. In comparison, the other alternatives call for a 10-percent increase of hardwoods (not limited to aspen) as compared to 1995 conditions.

All alternatives contain a substantial number of measures to avoid and minimize direct and indirect impacts to riparian and wetland systems, however, Alternatives 3 and 6 contain additional conservation measures for these systems. One of the *Gentiana affinis* occurrences is located within the McIntosh Fen Botanical Area and there is no cattle use currently authorized within the fenced portion of this Botanical Area, therefore no effects would be associated with cattle at that location. No livestock use was evident at *G. affinis* site number 02CA17A. No information is available on grazing activities that may be occurring at the other reported locations. Therefore, at least two of the locations are not known to have any risks associated with grazing. Guidelines 2505 and 2507 (Alternatives 1, 2, and 4) target the management of grazing in riparian areas to a residual objective; under Alternatives 3 and 6 these guidelines are strengthened to standards to target the objective of conserving or enhancing riparian habitats. Therefore, it is expected that indirect and direct effects to *G. affinis* from livestock use would be the least under Alternatives 3 and 6.

Little is known about the response of *Gentiana affinis* to wildfire. However, its occurrence in moist meadows with no to sparse canopy conditions, riparian areas, and aspen stands, where fuels are generally moister and less combustible, suggest high intensity wildfires may be less likely to directly burn into some occurrences (see Section 3-7.1 Fire). In addition, since this species is primarily located within open meadow conditions, fire could also potentially create suitable habitat conditions for colonization by removing tree canopies. However, if high-density conifer stands are located immediately adjacent to occurrences, then high intensity fires could still occur, with the greatest likelihood of occurring during drought years. Objective 200-05 targets conservation of emphasis species occurrences from risks associated with fire through creating a low crown-fire hazard near occurrences in Alternative 3, or a moderate-to-low crown-fire hazard in Alternative 6. However, focus for fuel reduction is prioritized around ARCs and the WUI over those of emphasis species and other resources (Goal 10-01); therefore, implementation of Alternative 3 could be expected to result in a greater reduction of risk to species from fire as compared to Alternative 6. Alternatives 1, 2, and 4 do not include Objective 200-5 and do not

prioritize treatment around ARC and the WUI. Botanical Area Standard 3.1-4101 specifies the use of fire-and-fuel control practices to protect values of Botanical Areas in Alternatives 1 and 2. For Alternatives 3, 4, and 6, Minimum Impact Suppression Tactics (MIST) is specified for use over more aggressive actions that could still be used for Alternatives 1 and 2. The assumption is that MIST fire-suppression efforts would be expected to result in less intensive disturbances if a fire would occur within the McIntosh Fen Botanical Area, and would be expected to result in fewer direct and indirect effects to the *G. affinis* individuals that are located there.

All alternatives target various levels of conservation and protection for SOLC plants from noxious-weed invasion and treatment. The assumption is that Alternatives 3, 4, and 6 would have a greater reduction in risk of indirect and direct impacts to *Gentiana affinis* from noxious weeds and their treatment. Objective 231 is included in all alternatives to target prevention and reduction of noxious weed invasion into native plant communities. In Alternatives 1 and 2, the targeted objective is to treat 3,600 acres per year. Targeted treatment acres are increased to 6,000 acres per year in Alternatives 3 and 4, and increased to a minimum target of 8,000 acres per year in Alternative 6. Guideline 4303 is revised in Alternatives 3, 4, and 6 to specify that occurrences of SOLC, along with Region 2 sensitive species, are the priority for treatment of noxious weeds on the Forest. Guideline 4304 (Alternatives 1 and 2) was revised and strengthened to a standard in Alternatives 3, 4, and 6. This would be expected to provide more protection to *G. affinis* by requiring use of treatment methods that pose the least risk to the species. Standard 4300-01 specifies monitoring of weed control effectiveness at SOLC sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed competition, and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to SOLC plant species. No Action Alternatives (Alternatives 1 and 2) do not include monitoring weed treatment effectiveness at SOLC plant locations. Alternatives 1 and 2 require the use of certified noxious weed-free seed, feed and mulch on the Forest (Standard 4306). This standard was revised in Alternatives 3, 4, and 6 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. Prevention of noxious weed invasion is further targeted in native plant communities by revegetating with native species and is included as a guideline (1110) in Alternatives 1 and 2. The original guideline was revised and was strengthened to a standard in Alternatives 3, 4, and 6 (Standard 1110). Further discussion on Noxious Weeds as related to implementation of the various Phase II Amendment alternatives can be found in Section 3-7.3 of the FEIS.

Monitoring to be completed for species identified as a SOLC (USDA Forest Service. 2005c) has been included in Chapter 4 of the LRMP. The type and level of information being collected for monitoring this species is available in the Black Hills Monitoring Implementation Guide (USDA Forest Service 2005f). In general, as identified in the design for this species, the focus for the monitoring seasons immediately following the Phase II Amendment ROD is to attempt to relocate the previously reported locations. If reported areas are relocated, the current design includes the gathering of quantitative and qualitative baseline data and assessing risks at occurrences that are relocated. Monitoring also targets baseline data collection at any newly discovered locations.

Objective 200-04 in Alternatives 3, 4, and 6 targets the concerns associated with the potential loss of emphasis plant species occurrences (such as by fires) by collection of their seed or other genetic material to attempt to recolonize occurrences if microsite conditions are still available to support the species.

Candidate RNAs are included in Action Alternatives 3, 4, and 6. The Lemming Draw candidate RNA includes a montane grassland meadow, with areas of mesic soils and aspen areas with some similar conditions to associated conditions where *Gentiana affinis* has been located in other areas of the Forest. Lemming Draw is included as a candidate RNA under Alternative 4. If ultimately proposed as an RNA, the establishment record and management plan completed for a designation of the site would be

expected to include prohibiting motorized travel, restricting forms of other public access, restricting or removing grazing, prioritizing the area for noxious weed and other invasive non-native plant treatments as well as taking actions for perpetuating a high condition of the grassland ecosystem that is located there (see Appendix D Management Area 2.2 and FEIS Section 3-6.2 Research Natural Areas). Although uncertainties exist, in general, if any RNA management plan that targets specific actions to remove the conifer encroachment and target perpetuating the Lemming Draw grassland with native species would be fully implemented, and that *G. affinis* may eventually be discovered to occur there, it could be possible there could be benefits to the species.

Cumulative Effects

The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (Liggett et al. 2003).

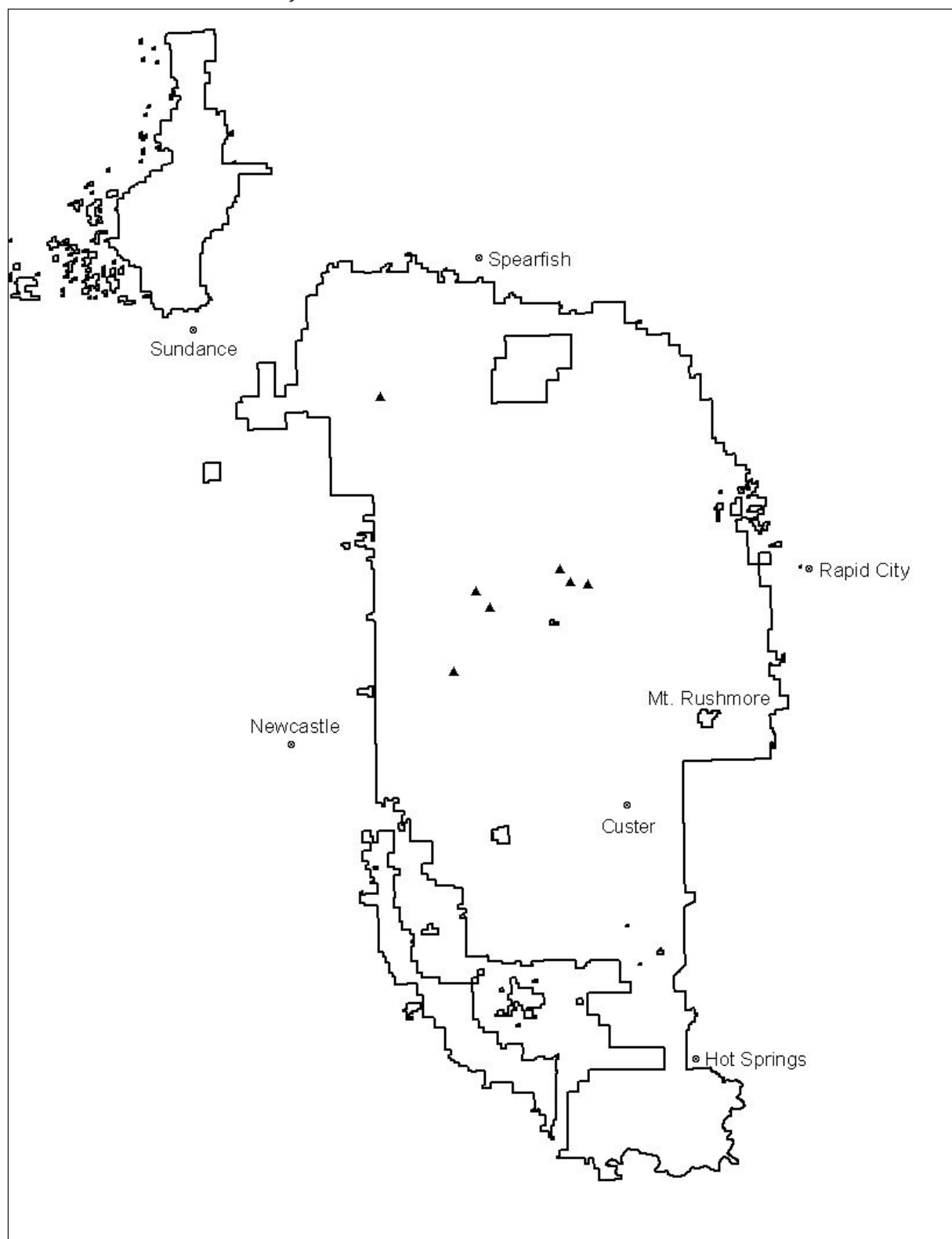
The spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species is smaller than generally encompasses the Black Hills Ecoregion as defined by Bailey (1995). The spatial area used for the cumulative effects analysis for *Gentiana affinis* primarily includes the limestone plateau region of the Black Hills. This area was chosen because it encompasses the ecosystem components of where the known occurrences are located. A larger area would include other geologic types and lower elevation and warmer ecosystem components which includes a vastly different suite of species than what occurs on the limestone plateau of the Black Hills.

As mentioned previously, *Gentiana affinis* is currently known to primarily be associated with open canopy mesic meadow conditions that may be located near riparian areas or wetlands in the Black Hills. Past activities and results of fire suppression allowing for conifer encroachment into associated habitat conditions, private land development, intensive grazing, noxious weed and other non-native plant invasions, beaver reduction and road construction have all contributed to altered conditions or resulted in a loss of amounts of meadow and riparian habitat in the Black Hills (see Sections 3-2.2 Grassland/Shrubland Ecosystems and 3-2.3 Riparian and Wetlands Ecosystems in Chapter 3 of the FEIS) and it is considered likely that this species associate of those systems has also likely declined (Allen et al. 2005). Noxious weed invasion and invasion by other non-native plant species continues to occur within the Black Hills on lands of various ownerships and is expected to continue and likely increase in the future (see Section 3-7.3 Noxious Weeds in Chapter 3 of the FEIS). Intensive levels of private land development are occurring in various locations in the Black Hills and this trend continues (see Section 3-9 Social Environment in Chapter 3 of the FEIS). A majority of the private land within the Hills is located along meadows and streams (see Section 3-2.3 Riparian and Wetlands Ecosystems in Chapter 3 of the FEIS); development is considered a primary risk to the species persistence in the Black Hills (Allen et al. 2005). In addition, various levels of grazing have been observed on private land on the limestone plateau and could be presenting risks to unknown occurrences of *G. affinis* on those lands.

Alternatives 3 and 6 take a more active approach to targeting conditions for the species (such as taking more aggressive actions at removing conifer encroachment from meadows and grasslands) than Alternative 4 that takes a more passive approach (e.g., less targeted meadow and hardwood restoration). When all five alternatives and information specific to the species is considered, the most conservation opportunities and protection for *Gentiana affinis* is considered to be afforded under Alternatives 3 and 6, as described above. Therefore it is expected that the least risk to the long-term persistence of this species would be through the full implementation of those alternatives. Alternative 4, targets less specific actions

at SOLC and lends itself to later successional conditions, therefore it is assumed that more risk to the species persistence could be expected to be associated with this alternative. The No Action Alternatives (Alternatives 1 and 2) do not include additional measures for SOLC and it is expected that the reduction of risks to the species long-term persistence would be the lowest in these alternatives, however, monitoring of the species would still be expected to be targeted.

Figure 3-8. General Distribution Of *Gentiana Affinis* On Lands Administered By The Black Hills National Forest



3-3.2.3.5. Broadlipped Twayblade (*Listera convallarioides*)

Affected Environment

Listera convallarioides is widespread across the northern part of North America and extends southward only at high elevations (Flora of North America Editorial Committee 1993). The species is widespread through the Rocky Mountain Region (Allen et al. 2005). In Wyoming, occurrences of *L. convallarioides* have been documented in Albany, Converse, Sheridan, and Teton counties (Keinath et al. 2003). In the Black Hills, *L. convallarioides* was first discovered in 1970 at Englewood Springs and a second site was located in 1994, along West Strawberry Creek (USDA Forest Service 2005a). Both sites are located in Lawrence County. Both were thought to occur on land administered by the Black Hills National Forest; however recent availability of technical mapping equipment (Global Positioning System) at West Strawberry Creek location revealed that the plants are located on land administered by the Bureau of Land Management (Zacharkevics, personal communication 2005); however further investigation of immediate adjacent areas of Strawberry Creek on the Forest may result in locating additional individuals. The currently documented Forest occurrence is located within the Englewood Springs Botanical Area (MA 3.1).

The Englewood Springs *Listera convallarioides* occurrence has been visited multiple times with the most recent observation data collected on June 10, 2004. At that time greater than 1,000 individuals were estimated to occur at a small portion of the site with documentation indicating that no data were collected at the main portion of the occurrence at this location (USDA Forest Service 2005a). The elevation of the sites administered by Forest Service and Bureau of land Management range from 5,800 to 6,200 feet and individuals are located growing in saturated soil conditions adjacent to springs, and located under tree overstories composed mostly of *Picea glauca* (white spruce) (USDA Forest Service 2005a).

Throughout its range, *Listera convallarioides* flowers from June through September, typically occurs on rich humus in open woods and boggy meadows, and prefers cool soil (Flora of North America Editorial Committee 1993). In South Dakota and eastern Wyoming, this species is considered a facultative-wetland species and has a high tolerance to anaerobic conditions (USDA Natural Resources Conservation Service 2004). *L. convallarioides* is also considered to be highly tolerant to fire and shade. As with many orchid species, *L. convallarioides* has a slow seed spread rate, low seedling vigor, and a slow vegetative spread rate (USDA Natural Resources Conservation Service 2004).

The assigned global conservation rank for this northern species is demonstrably secure (G5) (NatureServe 2005), although it may be rare at the edges of its range where microhabitat requirements are met less often. The southern occurrences of northern species are often more disjunct and smaller in size than northern occurrences, often limited by the availability of cooler and moister conditions. This may be the case with the occurrences of *Listera convallarioides* in the Black Hills. *L. convallarioides* is currently assigned a conservation rank of critically imperiled due to rarity (S1) in both South Dakota and Wyoming (NatureServe 2005). This rank is assigned to several boreal species in the Black Hills that are similarly limited to a low number of disjunct occurrences at the southern end of their ranges.

Direct And Indirect Effects

Potential risks to the species include invasion by noxious weeds or other non-native invasive plant species, grazing or trampling by livestock or wildlife, collection, loss of riparian habitat or alteration of hydrologic function where the species occurs (Allen et al. 2005). Although not included in Allen et al. (2005), there may be other risks that are more significant to the species long-term persistence on the Black Hills. The most recent documentation indicates the greatest risk to the species may be that it is limited to two currently known occurrences and therefore high intensity disturbance events, such as a crown fire

during drought or sediment covering the site, could result in the loss of the occurrences. Another risk identified for other northern boreal plant species is that of a climatic trend towards warming and drying conditions. This species may not be able to persist in the Black Hills following this type of trend. The extent and distribution of *Listera convallarioides* on the Forest based on recent data, is that it is currently limited to the Englewood Springs Botanical Area location. If there are other unknown occurrences of this orchid species on Forest administered land, it is expected that they would be located in areas with similar boreal, saturated *Picea glauca* (white spruce) associated habitat conditions. This ecological type is not typically targeted for commercial timber harvest in the Black Hills; therefore it is generally assumed that there would be little risk to this species long-term persistence associated with that Forest activity.

Due to the association with saturated soil conditions, high intensity crown fires may not be expected to affect the occurrences except during drought conditions. During drought conditions high densities of adjacent conifer stands could contribute to high intensity crown fires that could result in the loss of the Forest occurrence. Indirectly, this *Listera convallarioides* may be affected by wildfire through loss of shade (i.e., loss of canopy cover) that could contribute to drying of the microhabitat conditions it is associated with. Under Alternatives 3, Objective 200-05 targets the creation or maintenance of a low crown-fire hazard around emphasis plant species. Under Alternatives 6, Objective 200-05 targets the creation or maintenance of a moderate-to-low crown-fire hazard around emphasis plant species, however, Alternative 6 places priority of fuel treatments around At Risk Communities. The effect of this targeted management action is expected to reduce the likelihood that crown fires would result in the loss of the Englewood Springs *L. convallarioides* occurrence. Alternative 3 would be the alternative that targets implementation of the most aggressive action at reducing the risk to the species from high intensity fires, followed by the lower priority by Alternative 6. Alternatives 1, 2, or 4 do not include the targeted objective of reducing the likelihood of high intensity fires around emphasis plant species occurrences therefore risks of the loss of occurrences associated with implementation of those alternatives are expected to be higher.

The closest known occurrences of this orchid are over 100 miles away in Wyoming, and the expectations are that it would be unlikely that natural recolonization would occur if the Forest occurrences were extirpated. Recognizing concerns with the risks from potential stochastic events to the long-term persistence of plant species with a very limited number of occurrences, such as *Listera convallarioides*, Objective 200-04 was included in Action Alternatives 3, 4, and 6 to target the collection of seed or other plant material from Black Hills occurrences (Objective 200-04). The assumption is that collection and storage of this material could be expected to aid in recolonization of a site provided the species characteristics and associated microsite conditions lend themselves to successful recolonization.

Noxious weeds have been documented to occur at the Englewood Springs *Listera convallarioides* occurrence location. All alternatives target various levels of conservation and protection for SOLC plants from noxious weed invasion and treatment. The assumption is that Alternatives 3, 4, and 6 would be expected have a greater reduction in risk of indirect and direct effects to *L. convallarioides* from noxious weeds and their treatment. Objective 231 is included in all alternatives to target prevention and reduction of noxious weed invasion into native plant communities. In Alternatives 1 and 2 the targeted objective is to treat 3,600 acres per year. Targeted treatment acres are increased to 6,000 acres per year in Alternatives 3 and 4, and increased to a minimum target of 8,000 acres per year in Alternative 6. Guideline 4303 is revised in Alternatives 3, 4, and 6 to specify that occurrences of SOLC, along with Region 2 sensitive species, are the priority for treatment of noxious weeds on the Forest. Guideline 4304 (Alternatives 1 and 2) was revised and strengthened to a standard in Alternatives 3, 4, and 6. This would be expected to provide more protection to *L. convallarioides* by requiring use of treatment methods that pose the least risk to the species. Standard 4300-01 specifies monitoring of weed control effectiveness at SOLC sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed

competition, and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to SOLC plant species. No Action Alternatives (Alternatives 1 and 2) do not include monitoring weed treatment effectiveness at SOLC plant locations. Alternatives 1 and 2 require the use of certified noxious weed-free seed, feed and mulch on the Forest (Standard 4306). This standard was revised in Alternatives 3, 4, and 6 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. Prevention of noxious weed invasion is further targeted in native plant communities by revegetating with native species and is included as a guideline (1110) in Alternatives 1 and 2. The original guideline was revised and was strengthened to a standard in Alternatives 3, 4, and 6 (Standard 1110). Further discussion on Noxious Weeds as related to implementation of the various Phase II Amendment alternatives can be found in Section 3-7.3 of the FEIS.

All alternatives contain several measures to avoid and minimize direct and indirect impacts to riparian and wetland habitats; however, implementation of Alternatives 3 and 6 direction targets additional conservation measures for these habitats. Objective 214 in Alternative 3 targets the restoration of 1,000 acres of riparian shrubland habitat on the Forest and in Alternatives 1, 2, 4 and 6 500 acres are targeted. Although this would not be targeted directly at the occurrences where *Listera convallarioides* is located since the occurrence is located within a spruce system, if successful shrubland restoration would be able to be targeted upstream or along side drainages and could contribute to continued saturated conditions at the site then indirect benefits could be expected. Alternatives 3 and 6 include Objective 215, which targets the rehabilitation of at least five stream reaches of systems that has changed due to human activities. The rehabilitation of three stream reaches is targeted in Alternatives 1, 2, and 4. Since the *L. convallarioides* occurrence is within the WUI zone of the Englewood ARC and is also in close proximity to private land it is unknown whether any of the stream reach rehabilitation efforts would take place near this location. If they would take place and were successful near the occurrence these could potentially contribute to saturated conditions at the site, thereby likely being a benefit to the species.

It is unknown if microsite conditions exist for additional occurrences of *Listera convallarioides* on the Forest. However, in recent years (primarily since 2000), more emphasis has been placed on targeting and reporting *L. convallarioides* occurrences during plant surveys completed on the Forest and no additional occurrences have been discovered. Monitoring to be completed for Forest SOLC (USDA Forest Service 2005c) has been included in Chapter 4 of the LRMP (see Monitoring Item Species of Local Concern). The type and level of information being collected for monitoring this species is available in the Black Hills Monitoring Implementation Guide (USDA Forest Service 2005f). In general, as identified in the design for this species, the focus for the monitoring seasons immediately following the Phase II Amendment ROD is to attempt to relocate the previously reported locations (includes the BLM occurrence to determine if it extends onto NFS land). If reported areas are relocated, the current design includes the gathering of quantitative and qualitative baseline data and assessing risks at occurrences that are relocated.

Cumulative Effects

The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (Liggett et al. 2003).

The spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species is smaller than generally encompasses the Black Hills Ecoregion as defined by Bailey (1995). The spatial area used for the cumulative effects analysis for *Listera convallarioides* primarily includes the watershed areas where the Englewood Springs and Strawberry Creek occurrences are located near Deadwood and Lead, South Dakota. This area was chosen because it encompasses the ecosystem and geologic components of where the known occurrences are located. A larger area would include other geologic components and ecosystem components which includes a different suite of associated species.

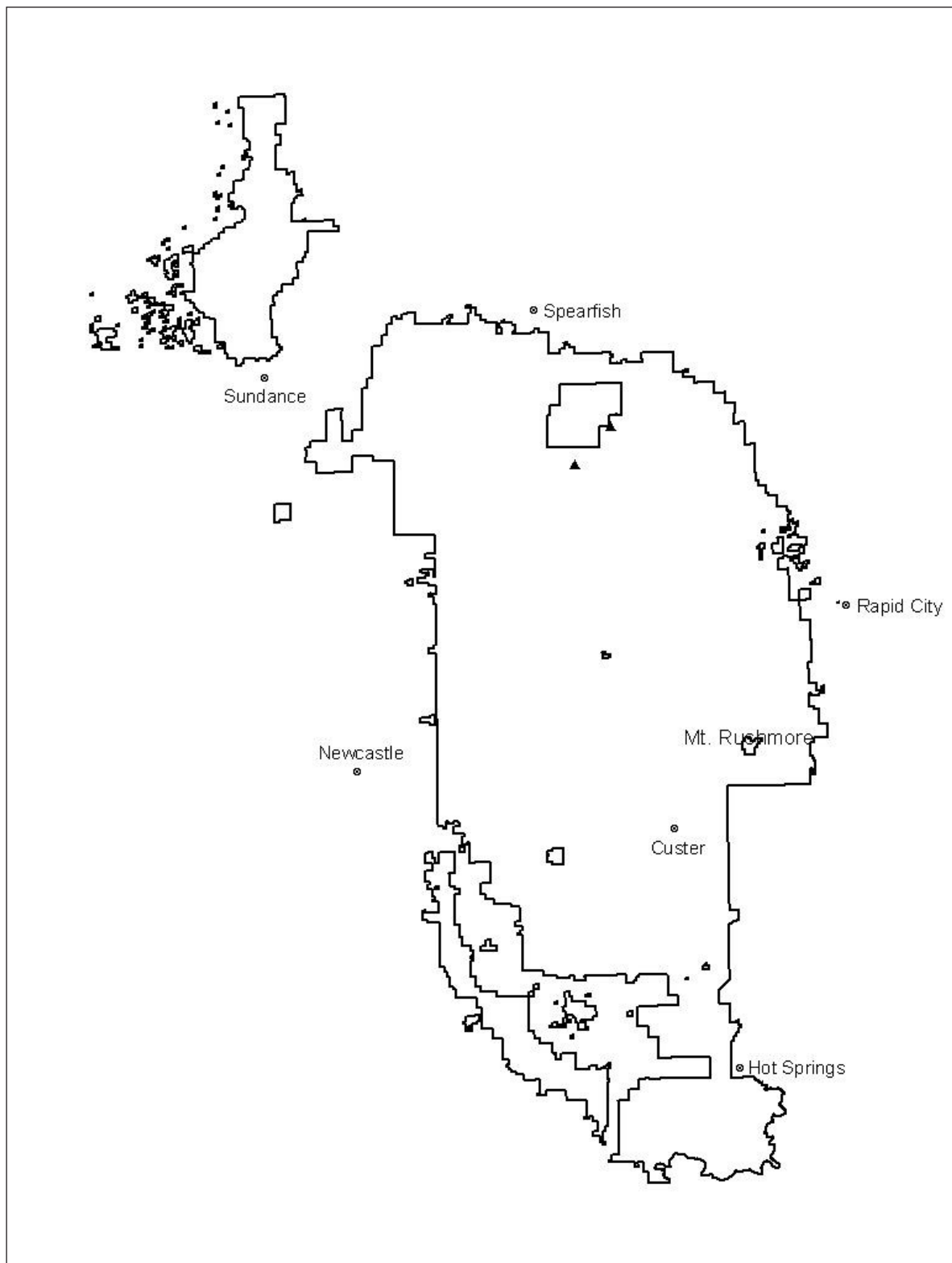
The Englewood Springs occurrence was documented in 1970. The area surrounding and including this occurrence was designated as a Botanical Area (MA 3.1) in the 1997 ROD for the revised LRMP. The Englewood Springs occurrence was documented to be extant in 2004.

Potential risks that had been identified for this species at the Bureau of Land Management West Strawberry Creek location had included potential risks similar to Englewood Springs but also included sedimentation issues with the recent (in the early 2000s and was recently completed) reconstruction activities of Highway 385 (Allen et al. 2005). However no sedimentation was observed at this location, either from highway reconstruction activities or from the 2002 Grizzly Gulch Fire during a recent visit to the site (Zacharkevics personal comm. 2005). It is also known as of 2005 that this occurrence is still extant.

The majority of the land around the two occurrences is not administered by the Forest Service, but is primarily administered by the Bureau of Land Management near Lead and Deadwood, administered by the state, or is in private land ownership. Therefore, it is expected that those lands may have a greater likelihood of associated habitat conditions suitable for *Listera convallarioides*. However, occurrences of *L. convallarioides* on these adjacent lands are not known, and any effects are also unknown.

It should be recognized that no matter what management actions take place, persistence of this species is uncertain based on two occurrences and this limited number of occurrences lends a greater vulnerability to loss from stochastic events (e.g., drought, fire). Through full implementation, Alternatives 3 and 6 targets the greatest number of conservation measures for species such as *Listera convallarioides*, including riparian habitat restoration (greatest in Alternative 3), prioritizing noxious weed control efforts around emphasis plant species that would be expected to provide benefits with the least risk to the long-term persistence of *L. convallarioides*. Alternative 4 targets conservation of species through greater emphasis on natural disturbance processes with less active measures, such as it does not include measures to protect occurrences from high intensity fires, therefore it is expected that risks to the species long-term persistence could be greater in this alternative as compared to Alternatives 3 and 6. The No Action Alternatives (Alternatives 1 and 2) do not include additional measures for SOLC and it is expected that the reduction of risks to the species long-term persistence would be the lowest in these alternatives, however, monitoring of the species would still be expected to be targeted.

Figure 3-9. General Distribution Of *Listera Convallarioides* On Lands Administered By The Black Hills National Forest And The Bureau Of Land Management Within The Black Hills National Forest



3-3.2.3.6. Stiff Clubmoss (*Lycopodium annotinum*)

Affected Environment

Lycopodium annotinum occurs from Alaska to Newfoundland, south in the Rocky Mountains to Arizona and New Mexico. It also occurs in the Appalachians south to South Dakota, Wyoming, Kentucky and North Carolina (Hornbeck et al. 2003b).

Lycopodium annotinum is an evergreen, perennial herb with branched upright stems and needle-like leaves (Hornbeck et al. 2003b). The species reproduces sexually through spores and vegetatively through creeping rhizomes that allow rapid clonal expansion. It is circumboreal and widely distributed in boreal habitats of North America. Elsewhere within its range, *L. annotinum* also occurs in swampy or moist coniferous forests, mountain forests, and exposed grassy or rocky sites (Flora of North America Editorial Committee 1993).

Currently, little is known about the basic ecology of this species on the Forest, and it is questionable if persistent occurrences exist (Hornbeck et al. 2003b). Known occurrences of *Lycopodium annotinum* are associated with high moisture microhabitats within remnant boreal *Picea glauca* (white spruce) and *Betula papyrifera* (paper birch)/*Corylus cornuta* (beaked hazelnut) communities. These sites are sheltered microsites that are considerably cooler and moister than surrounding areas and are likely associated with isolated frost pockets (Hornbeck et al. 2003b). The currently known sites are located at elevations from 5,100 feet to approximately 6,300 feet (USDA Forest Service 2005d)

Lycopodium annotinum reported locations are reported within the following designated Management Areas (MA):

MA 3.1 – Botanical Areas – Approximately 18 percent of the total reports are from the Sand Creek (9 percent) and Higgins Gulch (9 percent) Botanical Areas.

MA 4.1 – Limited Motorized Use and Forest Product Emphasis – Approximately 9 percent of the reports are located within a portion of this management area.

MA 5.1 – Resource Production Emphasis – Approximately 45 percent of the reports are located within this management area.

Private land – Approximately 27 percent (three reports) of the total number of reports entered in the Forest database are from private land.

At the time a recent assessment was prepared for the species only two occurrences were included in the Forest database for the species. Since that time, additional occurrences have been discovered and additional information has become available. Some of these reports are located very close to each other and once baseline data are gathered, some reported locations could potentially be combined into single larger occurrences composed of smaller sub-components.

The global conservation rank of *Lycopodium annotinum* is secure (G5). *Lycopodium annotinum* is widespread throughout the boreal regions of North America from Maine to Alaska, and throughout Canada. As is common with other boreal species, habitat becomes less common at the warmer and drier southern limits of their ranges; therefore the species also become less common. At the southern limits for this species in South Dakota and Wyoming, *Lycopodium annotinum* is currently ranked as critically imperiled (S1) and imperiled (S2), respectively.

Direct And Indirect Effects

The persistence of *Lycopodium annotinum* in the Black Hills is at risk due to both the small number and size of the populations, which makes it vulnerable to random stochastic events and invasion by noxious weeds and other invasive plants. Livestock use, timber harvest and road building are precluded at sites known at the time the assessment was prepared, or the occurrences are in topographic positions that provide natural barriers to these activities (Hornbeck et al. 2003b).

Possible direct impacts to *Lycopodium annotinum* could result from fire-line creation that may cross one of the occurrences, fuels reduction activities within the WUI (see Phase II DEIS glossary), vegetation treatment to remove encroaching conifers to conserve and target regeneration of conifer-hardwood habitats, and herbicide treatments. The presence of *L. annotinum* on steep slopes precludes direct effects of disturbance from most activities, such as livestock use and recreation impacts. Indirect impacts to individuals or entire occurrences can include alteration or degradation of habitat conditions by invasion of noxious weeds and other invasive plant species, catastrophic fire, fire suppression, and the resulting increased density of conifers and decrease in light reaching the forest floor.

Lycopodium annotinum occurrences in the Black Hills National Forest are generally unlikely to be impacted by timber harvesting or other management activities. Timber harvest is unlikely to directly impact *L. annotinum* habitat for two primary reasons. First, spruce habitats in the Black Hills are rarely selected for timber harvest because of the low commercial value of this species (Hornbeck et al. 2003b). Second, most of the sites where *L. annotinum* occurrences are located, or would be expected to occur, would be difficult to log due to their steep slopes or narrow canyons. However, if timber was harvested from *L. annotinum* sites or immediately adjacent to these sites, the construction of roads, skid trail, or log decks could have the potential to directly or indirectly impact *L. annotinum* and its habitat. Additionally, National Environmental Policy Act (NEPA) of 1969 analysis for proposed management, including project-level management, is expected to include an assessment of known locations of SOLC. It is expected that known sites will be avoided to the extent possible unless activities are designed to enhance conditions at known occurrences. Therefore, it is expected that the likelihood of direct or indirect impacts from timber harvest will be low or unlikely to occur.

No evidence of livestock use had been noted to date (Hornbeck et al. 2003b) at any of the occurrences that were known at the time the assessment was prepared. All sites are either too steep (greater than 30-percent slope) for livestock to generally access, or are restrictive to livestock access by dense shrub thickets. No cattle use was evident at sites discovered in 2004. For this reason, cattle are currently not expected to pose any risks to any of the known occurrences.

Exotic, invasive plants are not currently considered an immediate risk to *Lycopodium annotinum*. No noxious weeds have been documented at the known *L. annotinum* sites, except that *Cynoglossum officinale* (Houndstongue) was observed in very limited numbers at one site, with greater abundance downslope of the occurrence (USDA Forest Service 2004a). However, because *L. annotinum* becomes established on disturbed soil, competition from potential colonizing weeds could inhibit their establishment (Hornbeck et al. 2003b). All alternatives propose various levels of protection for SOLC plants from noxious weed invasion and treatment. Objective 231 is included in all alternatives for the prevention and reduction of noxious weed invasion into native plant communities. In Alternatives 1 and 2 the objective is to treat 3,600 acres per year. Targeted treatment acres are increased to 6,000 acres per year in Alternatives 3 and 4, and increased to a minimum of 8,000 acres per year in Alternative 6. Guideline 4303 revised the priority order for treatment of weeds, and first priority for treatment in action alternatives is to occur at Region 2 Sensitive and SOLC plants and snails. Guideline 4304 (Alternatives 1 and 2) was revised and strengthened to a standard in Alternatives 3, 4, and 6, to require treatment methods that pose the least risk to the species being protected. Alternative 1 and 2 do not include the monitoring of weed

control effectiveness at SOLC sites to determine if weeds at those sites need to be re-treated throughout the season to reduce noxious weed competition. Standard 4300-1 specifies implementation of this type of monitoring and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to SOLC such as *L. annotinum*. Alternatives 1 and 2 require the use of certified noxious weed free seed, feed and mulch on the Forest (Standard 4306). This standard was revised in action alternatives to require that the seed be tested at time of purchase to confirm that the seed is weed free. Prevention of noxious weed invasion into native plant communities is further targeted by revegetating with native species is included under Guideline 1110 in Alternatives 1 and 2. The original guideline was revised and was strengthened to Standard 1110 in Alternatives 3, 4, and 6. Standard 4301 provides for assessing the risk of noxious weed introduction or spread and requires appropriate mitigations. Alternatives 3 and 6 include language to implement treatments. Since noxious weed occurrences and various other invasive species are becoming more prevalent on the Forest (USDA Forest Service 2002b) and other land ownership, as well as being a potential risk to *L. annotinum* (Hornbeck et al 2003b), Alternatives 3, 4, and 6 are expected to have the lowest risk of indirect and direct negative impacts to *L. annotinum* from noxious weeds and their treatment. Further discussion on noxious weeds as related to implementation of the various Phase II Amendment alternatives can be found in Section 3-7.3 of the FEIS.

Lycopodium annotinum occurrences are characterized as spruce forest intermingled with birch and shrubs; suggesting they are transitional between birch and spruce habitat types (Hornbeck et al. 2003b). Management for mature spruce habitats in the Black Hills would likely be expected to conserve existing associated *L. annotinum* habitat conditions in the short term, but in the long term may reduce boreal hardwood forest components that *L. annotinum* may likely need for any potential colonization and establishment of new occurrences to contribute towards the species long-term persistence within the Black Hills. Objective 204 (Alternatives 1, 2, and 4) benefits emphasis species associated with white spruce by conserving and managing white spruce. Alternatives 3 and 6, however, conserve and manage birch/hazelnut, as well. The birch/hazelnut community type is emphasized because it is less abundant, is often encroached upon by spruce, and provides habitat conditions associated with several emphasis species. Objective 200-1 (Alternatives 3 and 6) manages for mature and late successional spruce acres (except within 300 feet of buildings in Alternative 3 and 200 feet in Alternative 6, where spruce has encroached into hardwoods or where implementing emphasis species management). Alternative 3 adds an additional exception in areas where beaver reoccupation is desired for conservation of other emphasis species. In Alternative 3, hardwood restoration is favored where spruce has encroached upon hardwoods and spruce is favored where it is encroaching into pine stands. Implementation of Alternative 6 manages for 20,000 acres of spruce, which could be at the expense of hardwood maintenance or restoration. In summary, regarding Objective 204 and Objective 200-1, Alternatives 1, 2, and 4 target retention of existing spruce at the expense of losing other types of communities. Alternative 3 can be interpreted to basically place similar emphasis on hardwoods in relation to spruce, whereas interpretation of Objective 200-01 places more emphasis on managing for spruce rather than hardwoods (by managing for 20,000 acres of spruce), although emphasis is also to be placed on hardwoods and emphasis species. Under Alternatives 1, 2, and 4, it is expected that existing *L. annotinum* habitat would likely be conserved in the short term, but in the long term it is expected that boreal hardwood forests for future colonization could be lost. Under Alternative 6, it is expected that even though some future colonization habitat could be expected for *L. annotinum*, that managing for spruce would take precedent. It is expected that full implementation of Alternative 3 would be expected to better provide for conservation of existing *L. annotinum* occurrences as well as targeting a mix habitat conditions for potential future colonization areas.

Although dense spruce cover may enhance shade and longer snow and moisture retention at the currently known occurrences, the continuity of highly flammable, dense conifer stands (pine and spruce) adjacent to *Lycopodium annotinum* sites is of concern. Large tracts of dense conifers may lead to widespread, high intensity wildfires that could negatively affect *L. annotinum* sites. Prescribed fire or fuel reduction activities are subject to environmental (NEPA) analysis at the project level. Wildfire and fire containment measures are a potential risk to *L. annotinum* (Hornbeck et al. 2003b). Where currently known occurrences are bordered by continuous, dense conifer stands, cutting firebreaks and implementing other fuel reduction activities that would result in crown fires dropping to the ground before fires burn into known sites would be expected to benefit the species by reducing the likelihood that catastrophic events would extirpate those occurrences. This fuel reduction approach could also provide a range of seral stages for later colonization, which might benefit the species' persistence in the long term. Tree removal in surrounding uplands could have the added benefit of providing increased moisture to the sites (Hornbeck et al. 2003b). Objective 200-5 was included in Alternative 3 to create or maintain a low crown-fire hazard adjacent to occurrences of Region 2 Sensitive and SOLC plants and Botanical Areas bordered by continuous, dense conifer stands where long-term persistence is at risk from a single high intensity fire. Implementation of this objective near *L. annotinum* occurrences is expected to decrease fire effects and benefit occurrences during fire events. Based on other priority emphasis, Alternative 6 is less aggressive in terms of this conservation measure by only targeting creation or maintenance of a moderate-to-low crown-fire hazard adjacent to these species occurrences so the risk of crown fire that could reach occurrences would be expected to be greater. Alternatives 1, 2, and 4 do not include an objective to reduce fire hazard around occurrence locations and the risk of occurrence loss is highest in these alternatives. Therefore it is expected that full implementation of Alternative 3 would be expected to reduce fire risk in proximity to occurrences to the greatest extent of any of the Phase II Alternatives.

Since four of the *Lycopodium annotinum* reported locations are located within the estimated 1.5-mile WUI circumference area of the Galena ARC, it is likely that Objective 200-5 could be achieved near those sites in conjunction with fuels reduction efforts near ARCs (refer to Appendix G, Map G-6: At-risk Communities and Wildland-urban Interface) that has been included in Alternative 6. However, various areas can be expected to receive treatment under all alternatives because of the tie to the legislation (refer to Appendix B of the Final EIS for discussion of ARCs and the WUI for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARCs and *L. annotinum* because without a priority system or a map indicating which ARCs are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of occurrences.

Objective 200-4 was designed into Alternatives 3, 4, and 6 for conservation of species expected to be at risk from catastrophic events, whether natural or human induced. This objective provides for the collection of emphasis plant species material from the Black Hills for reintroduction efforts if needed. If successful it is expected that this conservation measure would provide material to target the future long-term persistence of the species on the Black Hills under these alternatives. No direction for collection of such material as a conservation measure is included in the No Action Alternatives (Alternatives 1 and 2) so any recolonization of a site would rely on what is available for natural recolonization.

While reporting occurrences of rare plants has been an ongoing for many years, more recent emphasis (primarily since 2000) has been placed on targeting and reporting *Lycopodium annotinum* occurrences during plant surveys completed on the Forest. Monitoring to be completed for Forest SOLC (USDA Forest Service 2005c) has been included in Chapter 4 of the LRMP (see Monitoring Item Species of Local Concern). The type and level of information being collected for monitoring this species is available

in the Black Hills Monitoring Implementation Guide (USDA Forest Service 2005f). In general, as identified in the design for this species, the focus for the monitoring seasons immediately following the Phase II Amendment ROD is to attempt to relocate the previously reported locations. If reported areas are relocated, the current design includes the gathering of quantitative and qualitative baseline data and assessing risks at occurrences that are relocated.

Several species of *Lycopodiums* are widely collected as non-timber, special forest products for use in seasonal decorations and floral displays. There is no indication that clubmosses have ever been collected from the Black Hills National Forest (Hornbeck et al. 2003b). The remote locations and difficult access to known *Lycopodium annotinum* occurrences generally makes collection unlikely. Standard 3119 is included in Alternatives 3 and 6 to reduce the effects associated with collection activities by restricting the collection of SOLC plants (or parts thereof) to only those needed for scientific or educational purposes, or as recognized for American Indian traditions (Standard 7103). This would prohibit collecting for both personal (other than for American Indian traditional uses) and commercial uses, thereby limiting the associated direct effects of plants removed from occurrences. It is unknown if this species is traditionally collected in the Black Hills. However, indications at meetings are that local American Indian interests are in maintaining plant species persistence for those species that have traditional uses. Although uncertain, the assumption is that traditional uses and scientific collections may be expected to directly affect a limited number of individual plants. Another assumption is that it would likely not be expected that if a very limited number of plants were collected that traditional collection would present a significant risk to the overall long-term persistence of this species on the Black Hills National Forest. Alternatives 1, 2, and 4 do not include Standard 3119, however, those alternatives do have a version of Standard 7103; however, the version in those alternatives does not specify consulting on SOLC collection.

A number of occurrences are located within MAs 4.1 and 5.1. Most changes for the conservation of species long-term persistence is provided in the overall Forest-wide direction rather than in specific management area direction such as for those where the occurrences are located. Most changes in management area direction for MAs 4.1 and 5.1 affect ponderosa pine structural stage direction. The assumption is that these would be designed to occur across planning unit areas, such as watersheds, and would not be expected to conflict with targeting reduction of fire risk near *Lycopodium annotinum* occurrences. Therefore these structural stage change objectives associated with ponderosa pine stands (a different ecological type than what the species is associated with) would generally be expected to have little change in beneficial or negative effects to *L. annotinum* as compared to existing Forest Plan direction.

None of the *Lycopodium annotinum* occurrences are located within any of the candidate RNAs, therefore no beneficial or negative effects are expected to be associated with any that may be proposed for designation in the Phase II Amendment decision.

Cumulative Effects

The indirect and cumulative effects analysis for species persistence is bounded in time as the next 50 years. This temporal scale is based on: a) the planning horizon (usually 50 years for a Forest plan); b) the biology of the species (e.g., generation time, response time to changed conditions, recolonization capability); and c) the time needed for the overall ecosystem to respond to proposed management (Liggett et al. 2003).

The spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species is smaller than generally encompasses the Black Hills Ecoregion as defined by Bailey (1995). The spatial area used for the cumulative effects analysis for *Lycopodium annotinum* primarily includes areas above 5,000 feet elevation in the central portion of the Black Hills from Spring Creek watershed (north of

Custer, South Dakota) on the south to the Strawberry Creek watershed (south and east of Deadwood and Lead, South Dakota) in the northeast and the Sand Creek watershed (Wyoming and South Dakota state line area) in the northwest. This area was chosen because it encompasses the ecosystem components of where the known occurrence is located. A larger area would include lower elevation and warmer ecosystem components which includes a vastly different suite of species than what is documented to occur with the species.

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 (Hornbeck et al. 2003b). Therefore, the amount of potential habitat for *Lycopodium annotinum* may have increased; however, it is not known if microhabitat conditions needed by *L. annotinum* are present in the spruce expansion locations.

Three sites of *Lycopodium annotinum* are included in the Forest database as occurring on lands in private ownership in the Black Hills. Occurrences on private land could be expected to be potentially impacted by urban development or mining. The status of other sites of *L. annotinum* on private land is unknown, and the likelihood of finding additional occurrences is low; therefore the persistence of this species in the Black Hills is contingent on conserving the known occurrences on public land (Hornbeck et al. 2003b).

Little is known regarding any impacts that may be associated with wildlife browsing, disease, or insects, however, no impacts were observed to be associated with those agents during monitoring of another *Lycopodium* (*Lycopodium complanatum*) within the Black Hills. Insect predation is uncommon on clubmosses (Lycopodiaceae) and fern allies in general (Hornbeck et al. 2003b).

The Lead, Deadwood, and Galena areas in the northern Black Hills have been at the center of both recent and historic gold mining activity (Hornbeck et al. 2003b). There is evidence of past mining disturbance (old test pits on slopes) in the northern Black Hills. The current trend for mining permit requests are for placer mining, which occur in drainage bottoms, and it is anticipated that there would not be any direct impacts to *Lycopodium annotinum* occurrences on slopes. Surface mining activities in or near known sites could impact the species and their habitats, and future mining activity is likely to occur in the general area (Hornbeck et al. 2003b).

Elsewhere in their range, several species of *Lycopodiums* have been widely collected as non-timber, special forest products for use in seasonal decorations and floral displays. There is no indication that clubmosses have ever been collected from the Black Hills National Forest (Hornbeck et al. 2003b). The remote locations and difficult access to known *Lycopodium annotinum* occurrences makes collection unlikely.

Activities and effects on *Lycopodium annotinum* were discussed in the section based on the current locations of designated ARCs (refer to Map G-6 in Appendix G: At-Risk Communities and Wildland-urban Interface). This map is subject to change with the potential that more areas could likely be designated as ARCs (refer to Appendix B of the FEIS for discussion of ARCs and the WUI for more information), with fuel reduction actions to occur within an estimated 1.5-mile WUI circumference area around those designated areas. It is uncertain how this expected revision of the list will result in changes in placement or levels of treatments around species occurrences and how effects would be expected to change.

When all five alternatives and information specific to the species is considered, the most conservation opportunities and protection for *Lycopodium annotinum* is considered to be afforded under Alternatives 3 and 6, as described above. Therefore it is expected that the least risk to the long-term persistence of this species would be through the full implementation of those alternatives. Alternative 4 also targets conservation and protection, but the alternative takes a more passive approach (primarily focuses on

more natural processes) for species rather than taking more aggressive actions if needed, such as actively reducing the higher fire-hazard conditions near occurrences, therefore it is assumed that more risk to the species persistence could be expected to be associated with this alternative. The No Action Alternatives (Alternatives 1 and 2) do not include additional measures for SOLC and it is expected that the reduction of risks to the species long-term persistence would be the lowest in these alternatives, however, monitoring of the species would still be expected to be targeted.