achieved has been added to the objective. In McIntosh Fen, this objective is tied closely with the monitoring that is specifically occurring for *Salix candida*.

- Standard 3.1-4101 manages fire and fuel through control practices to protect values of BAs in Alternatives 1 and 2. For Alternatives 3, 4, and 6, Minimum Impact Suppression Tactics (MIST) must be used over more aggressive actions that could still be used for Alternatives 1 and 2. MIST fire suppression efforts are expected to result in less intensive disturbances if a fire would occur within the McIntosh Fen BA and would be expected to result in fewer direct and indirect impacts to *Salix serrisima*.
- Guidelines 3.1-9101, 9102, and 9103 restrict vehicle use (including snowmobiles) to designated routes and prohibit off-road travel in all alternatives. For Alternatives 3, 4, and 6, these have been reworded to allow emergency and administrative uses and elevated to standards. Although current authorized snowmobile use is not documented to occur within the same area as *Salix candida* individuals, the potential risk of impacts from snowmobiles leaving the designated route were recognized, and the guideline was elevated to a standard to reduce the risk of impacts to *Salix candida*.
- Standard 3.1-2501 allows livestock grazing only if it does not conflict with values for which the area was designated. Livestock grazing is not authorized within the McIntosh Fen BA and is not resulting in any direct effects to the species.
- Guideline 3.1-2502 is included in all alternatives and allows new improvements only when necessary to maintain, restore, or enhance the values for which the area was designated; therefore, minimal if any effects to *Salix candida* from new improvements would be expected.
- Standard 3.1-2503 protects plants in Botanical Areas through the restriction of access by livestock (new standard in the action alternatives). Livestock grazing is not authorized within the McIntosh Fen BA and is not resulting in any direct effects to the species.
- Standards 3.1-5101 and 5102 and Guideline 3.1-5103 provide for limited recreational uses of BAs when they do not threaten the values the BA features. Standard 3.1-9104 limits new road and trail construction to those needed for interpretive or education purposes or when needed to correct resource damage occurring from existing roads, trails, or other uses. These standards provide for action reducing the likelihood of adverse effects to long-term persistence if identified as risks during monitoring of *Salix candida*.

4-1.6.2 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 then generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995). The spatial area used for the cumulative effects analysis for *Salix candida* primarily includes the Castle Creek watershed above Deerfield Reservoir. This area was chosen because it encompasses the ecosystem components to where the known occurrence is located. A

larger area would include other geologic, lower elevation and warmer ecosystem components which includes a different suite of species than what occurs within McIntosh Fen and upper portion of Castle Creek.

The fen meadow complex at McIntosh Fen, where *Salix candida* is located, was privately owned from the 1930s until 1980 when it was acquired by the Black Hills National Forest. It was subsequently designated as a BA in 1997.

With a single occurrence known on land administered by the Forest and no occurrences documented from lands of other ownership in the Black Hills, the species' future is precarious. Past and ongoing Forest activities targeting the conservation of the McIntosh Fen occurrence of both *Salix candida* and *Salix serissima* include purchasing the land from private ownership, restricting livestock use, planting rooted willow cuttings from McIntosh Fen material, treating noxious weeds, filling of drainage ditches (created while in private ownership) with organic material, burning adjacent lower side slope drainage margins to remove conifers and stimulate aspen regeneration, installation of metal gates to prevent trespass livestock and off-road vehicle use, and the implementation of monitoring.

The sources of water for McIntosh Fen are from underground springs and adjacent Castle Creek. A significant issue for the species' long-term persistence at McIntosh Fen is that well over 50 percent of the perennial portion of Castle Creek, upstream of the fen, is privately owned. Various levels of private land development is occurring in many areas of the Black Hills, and is occurring close to Deerfield Reservoir, which is within a few miles of private land above McIntosh Fen. If upstream human activities or private land development or diversions occur at levels that result in alterations to the hydrology above McIntosh Fen that could reduce the levels of saturated conditions at the Fen or limit successful beaver reoccupation of Castle Creek, the long-term persistence of *Salix candida* on the Black Hills could be at risk. It is important to recognize that natural disturbance events, such as droughts, could offset or negate the effects of the current management conservation actions or actions as they would occur under the Phase II Amendment alternatives.

Activities and effects on *Salix candida* were discussed in the section based on the current locations of designated ARC (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 ARC (refer to Appendix B of the FEIS for At-risk Communities and the Wildland-Urban Interface), with fuel reduction actions to occur within an estimated 1.5 mile WUI circumference area around designated ARCs. 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.

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Salix candida*. Therefore the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *S. candida* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.6.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Salix candida* for all Phase II alternatives**.** The rationale for this determination is that several standards and guidelines under each alternative address the various potential risks to this species, as described earlier. Other conservation strategies and measures that vary by alternative provide for conservation or enhancement of *S. candida* habitat conditions, and *ex situ* collections of plant material are expected to be available for re-introduction, if needed. Specifically, the above determination for *S. candida* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations to be re-evaluated during any future amendments or revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard and guideline direction listed above for the various alternatives will be applied or implemented as written.

3. Regardless of which alternative is selected, the currently fenced portion of McIntosh Fen Botanical Area that restricts livestock will not be authorized for livestock use in the future.

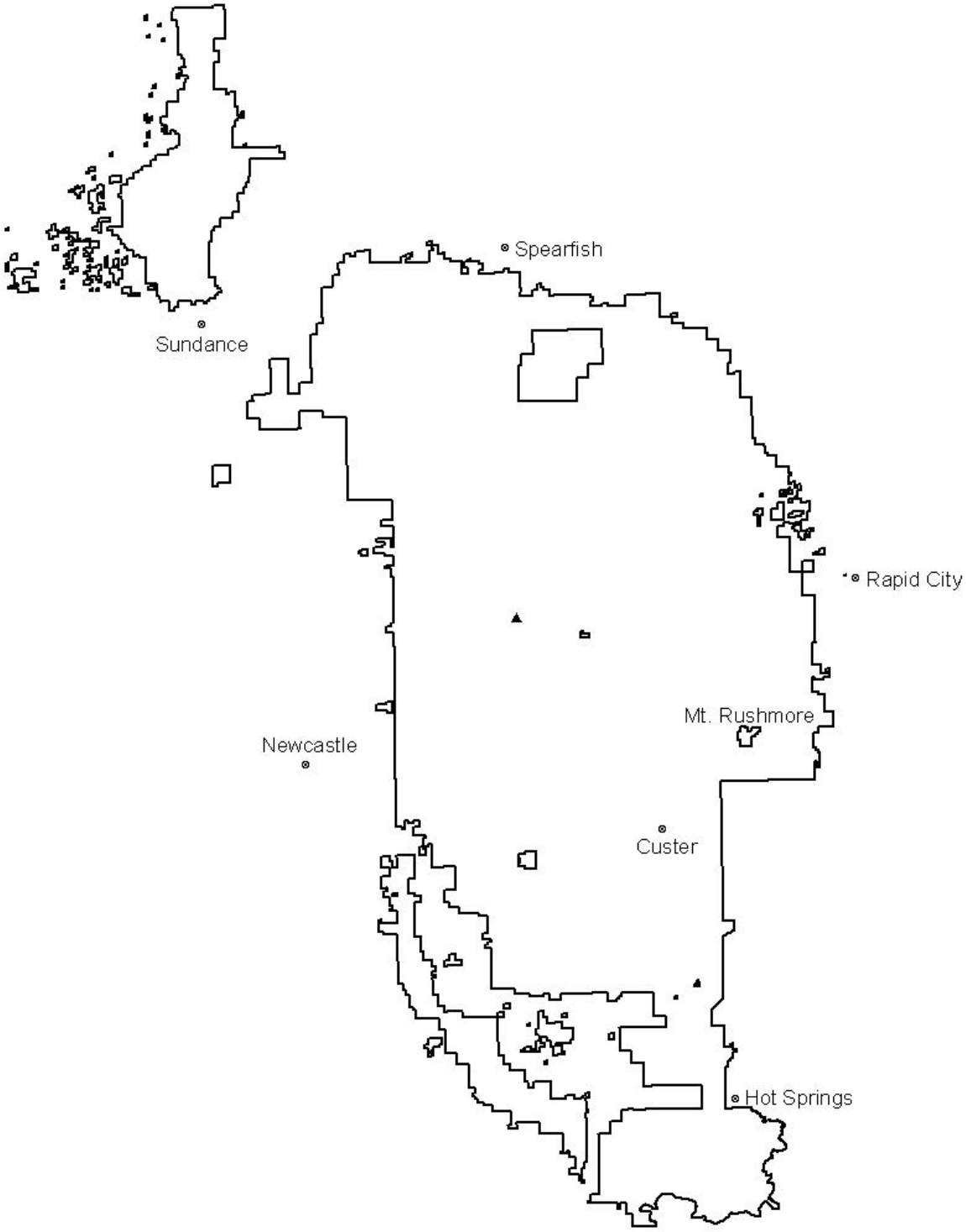
4. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as *Salix candida* are the first priority for treating noxious weeds.

5. That under any of the selected alternatives the species will be monitored according to the current monitoring strategy (or as altered through reassessment with the Rocky Mountain Research Station), which is designed to detect and respond in a timely manner to changes in the extent and condition of *Salix candida* and habitat at McIntosh Fen Botanical area (USDA Forest Service 2005b).

6. Plant material collected on the Forest can be used to successfully re-colonize the McIntosh Fen occurrence in the event the site is lost.

7. A limited number of individuals may be impacted from various disturbances, including but not limited to the following: long-term occurrence conservation efforts, conservation efforts targeted for other species, or catastrophic events.

Distribution of *Salix candida* (Sageleaf Willow) on lands administered by the Black Hills National Forest



4-1.7. *Platanthera orbiculata* (Lesser Roundleaved Orchid)

The Revised Forest Land and Resource Management Plan (LRMP) Biological Evaluation (BE) (USDA Forest Service 1996a) and the LRMP Phase I Amendment BE (USDA-Forest Service 2001c) give an overview of *Platanthera orbiculata* (large round-leaved orchid) distribution and natural history, and this information is incorporated by reference. Based on the location of a number of new occurrences and baseline data collection and monitoring efforts that have occurred since 2000, more is known about the species occurrences and distribution in the Black Hills. An assessment of *P. orbiculata* on the Forest has recently been completed. This assessment (Hornbeck et al. 2003f) provides detailed information on this species and serves as a primary reference source for the following analysis.

Platanthera orbiculata (also known as large roundleaved orchid in addition to the common name listed above) is endemic to the boreal regions of northern North America from Newfoundland to southern Alaska, with a more southern distribution in the eastern United States into the Appalachians and Great Lakes. *P. orbiculata* occurs as sparse, intermittent occurrences throughout its range (Hornbeck et al. 2003f). In the Black Hills, it primarily occurs as disjunct occurrences in remnant boreal/hardwood forest, in the Bearlodge Mountains of Wyoming and the northwestern limestone plateau and Black Elk Wilderness in South Dakota. There is a conservative total estimated occurrence of over 700 individuals on the Forest (Hornbeck et al. 2003f). Although most occurrences are small and sparsely distributed, the species is more abundant and widely distributed on the Forest than was previously believed (USDA Forest Service 2000a). At the time the assessment was developed, 31 occurrences of *P. orbiculata* were known: 25 in the northwestern limestone plateau, three in the Bearlodge Mountains, and three in the Black Elk Wilderness (Hornbeck et al. 2003f). Between one and 126 individuals were documented at these occurrences on areas of up to approximately three acres.

Platanthera orbiculata occurrences are distributed within the following Forest Management Areas (MA) on the Black Hills National Forest:

MA 1.1A– Black Elk Wilderness – Approximately 10 percent of the reports are from within this MA.

MA 3.1 – Botanical Areas – Approximately 10 percent of the reports are from within this MA.

MA 4.2A- Spearfish Canyon – Approximately 6 percent of the reports are from within this MA.

MA 5.1 – Resource Production Emphasis – Approximately 13 percent of the reports are from within this MA.

MA 5.4 – Big Game Winter Range Emphasis – Approximately 19 percent of the reports are from within this MA.

MA 5.6 – Forest Products, Recreation, and Big Game – Approximately 42 percent of the reports are from within this MA.

Platanthera orbiculata is currently assigned a rank of critically imperiled due to extreme rarity (S1) in Wyoming; imperiled due to rarity (S2) in South Dakota; and globally ranked as secure (G5) (NatureServe 2005a).

Platanthera orbiculata is a terrestrial herbaceous perennial characterized by two round, opposite, shiny leaves three to four inches wide that lie flat along the ground and a single flowering stem 12 to 24 inches high that bears five to 20 whitish-green flowers. Flowering in the Black Hills occurs from late June to August; the flowers produce a light fragrance at night, attracting moth pollinators (*Lepidoptera*) (Hornbeck et al. 2003f).

Platanthera orbiculata reproduce by tiny seeds primarily dispersed by wind. Little is known about the germination requirements of *P. orbiculata*, but germination may be episodic and coincident with high soil moisture. Seed germination, initial plant development, and survival of mature plants during seasonal dormancy are dependent upon an association with mycorrhizal fungi (Hornbeck et al. 2003f).

In the Black Hills, scattered occurrences are located in sheltered, north-facing, forested slopes in damp humus-rich soil at elevations from 4,300 to 6,000 feet. This species is often associated with dense understory vegetation in mid- to late-successional paper birch/hazelnut forest, often with an overstory component of white spruce. Historically in the Black Hills, periodic fires likely maintained the successional paper birch/hazelnut forests where *Platanthera orbiculata* occurs. Within appropriate habitat, the sparse and patchy distribution of this species may be due to its specialized interactions with mycorrhizal fungi and insect pollinators and other micro-habitat conditions (Hornbeck et al. 2003f).

4-1.7.1 Direct and Indirect Effects

Platanthera orbiculata is relatively secure in the Black Hills based on the large number of occurrences (31) distributed in three geographically separated regions on Forest-administered land, each within a different geological type: Bearlodge Mountains; Northwestern Black Hills (contains the largest cluster of sites); and Black Elk Wilderness (Hornbeck et al. 2003f). The species is present in patchy, scattered occurrences on shady, northwest to northeast facing slopes and draws in strong association with paper birch/hazelnut and white spruce forests. The species' persistence in the Black Hills is primarily limited by the small extent of cool, moist boreal habitat although it appears to be secure on the Forest at this time. Long-term drought or dramatic climate changes characterized by drier and warmer conditions may present the greatest risk to *P. orbiculata* and its habitat (Hornbeck et al. 2003f). All currently known occurrences are within grazing allotments with the exception of locations in the Black Elk Wilderness. However, risks to most of the occurrences from this use are low because many of the sites are on steep slopes with dense thickets of shrubs. Risks from other management activities (i.e. timber management) are currently low. No ongoing recreational impacts are being noted at the Black Elk Wilderness occurrences; however, they are located near an intensively used trail (USDA Forest Service 2004b, USDA Forest Service 2005a). Other potential future risk factors could include plant collection and noxious weed invasion (Hornbeck et al. 2003, USDA Forest Service 2005b).

The species persistence in the Black Hills is primarily limited by the small extent of cool, moist boreal habitat. The occurrences are scattered in mid- to late-successional paper birch/hazelnut

(*Betula papyrifera/Corylus cornuta*) forest, often with an overstory of white spruce (*Picea glauca*) (Hornbeck et al. 2003f). These habitats may be transitional to late-seral boreal forest communities such as white spruce/twinflower (*Picea glauca/Linnaea borealis*) forest. 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. Continued fire suppression is expected to continue to favor the expansion of spruce to the detriment of early-and mid-successional fire-dependent species such as paper birch and increase the probability of large-scale crown fires that could impact individual occurrences or clusters of *Platanthera orbiculata* sites. Therefore, large and small-scale disturbances, such as fire, are important in the development of a shifting mosaic of successional stages and vegetation structures. Although unfavorable within extant *P. orbiculata* sites, disturbances (especially fire) facilitate the successional development of seral birch habitats associated with *P. orbiculata,* limit spruce and pine expansion, and may increase soil moisture in potential *P. orbiculata* habitats. Management strategies that encourage the development of a continuous conifer overstory increase the risk of large-scale crown fires in these habitats. Management that includes prescribed burning and selective thinning of adjacent conifer stands could maintain a mosaic of seral stages, increase available moisture, and decrease the potential for widespread crown fires. Resulting patches of paper birch will provide firebreaks due to the low flammability of the birch type. Birch firebreaks can greatly alter the spread of fire across the landscape, causing crown fires to drop to the ground or even stop. In addition to slowing the spread of crown fires, landscape patchiness resulting from small-scale disturbances will provide a strategy whereby both fire-adapted and fire-sensitive species are more likely to be maintained (Hornbeck et al. 2003f). Prescribed fire or fuel reduction project activities are also subject to NEPA analysis (Hornbeck et al. 2003f).

The likelihood of *Platanthera orbiculata'*s long-term persistence in the Black Hills is dependent on limited boreal habitats. The following discussion explains how the alternatives are expected to conserve or restore associated habitat conditions.

Because of the risk associated with high intensity fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of *Platanthera orbiculata* occurrences that could be at risk to high intensity 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 known occurrences of Region 2 sensitive plant species, such as *P. orbiculata*. Alternative 3 is expected to provide the greatest likelihood of creating conditions that would be successful for dropping crown fires to the ground because it would create or maintain low crown fire hazard conditions near sensitive plant occurrences and botanical areas. A greater risk of crown fires affecting *P. orbiculata* occurrences is associated with Alternative 6 because it targets creation of a moderate to low crown fire hazard near those locations, instead of low hazard, therefore conditions for a higher intensity fire near emphasis plant species occurrences and associated effects to the plants could be expected to occur through implementation of Alternative 6, as compared to implementation of the objective for Alternative 3. Implementation of the objective under either alternative near *P. orbiculata* occurrences is expected to decrease fire effects (greater reduction under Alternative 3) and benefit the occurrences during fire events. This targeted objective is not part of Alternatives 1, 2 or 4 therefore the greatest risk of high intensity fires, such as crown fires, to emphasis plant species would be expected to be associated with these alternatives. Since approximately six percent of the known *Platanthera orbiculata* occurrences are located within the 1.5 mile WUI circumference area of ARC, it is likely that

Objective 200-5 could be achieved near this small percentage of the occurrences in conjunction with fuel reduction efforts near ARC (see Forestwide Objective 10-01 and 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 fuel reduction treatment under all alternatives because of the tie to the legislation (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARC and *P. orbiculata* because without a priority system or a map indicating which ARC are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of occurrences.

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. The birch/hazelnut community type is emphasized over spruce in these alternatives because it is less abundant, is often encroached upon by spruce, and is a habitat associate to several emphasis species, including *Platanthera orbiculata*. Restoration of some habitat conditions is expected to be a beneficial effect to long-term persistence of *P. orbiculata.*

Objective 200-01 was originally designed for Alternatives 3 and 6 to address a variety of risks associated with conifer encroachment for a number of the emphasis plant species. The objective was designed to favor hardwood restoration where spruce has encroached into hardwoods. Revision of objective wording that is now contained in Alternative 6 still indicates that a treatment of spruce is still to occur where it has encroached into hardwoods and for emphasis species managment, however, at least 20,000 acres of spruce is to be managed for under the alternative and based on that target it is uncertain that spruce encroachment removal desired at or adjacent to every emphasis plant species occurrence can be expected to be achieved. Therefore it is not known if Alternative 6 would be as successful as Alternative 3 at targeting this conservation measure for emphasis plant species. No version of this objective is included in the Phase II Amendment No Action Alternatives (Alternatives 1 and 2) or Action Alternative 4. Alternative 2 and 4 directs maintenance of existing patch size of white spruce structural stages (Standard 3215), which can significantly limit or prohibit the likelihood of hardwood restoration acitivities identified as potentially beneficial (depending on how they are designed) for the long term persistence of some emphasis plant species, such as *P. orbiculata*. This standard was revised for Alternatives 3 and 6 and identifies maintenance of canopy closures (40-50 percent) for marten corridors. Although not specified in the standard and actual site implementation is uncertain, it is assumed that this canopy closure would be composed primarily of conifer species rather than hardwoods. Therefore, in order to provide for for other species associated with hardwoods, it is assumed that at the project design at the implementation level for connectivity corridor design and placement would include consideration of hardwood restoration activities and could still provide beneficial effects for long term persistence of species such as *P. orbiculata*. Alternative 1 does not specifically address the removal of spruce encroachment from hardwoods or maintenance of canopy connectivity corridors for marten. Refer to the section on marten in this Biological Evaluation for more information on spruce maintenance and connectivity corridors.

Guideline 2206 in Alternative 1 is strengthened as a Standard in Alternatives 2, 3, 4, and 6 and directs that no new developed recreation sites be placed in aspen/birch stands. Implementation of

this direction would be expected to limit any direct adverse effects to *Platanthera orbiculata* individuals and retain potential associated habitat areas for this species from this use. This could be considered a beneficial effect if any new developed recreation sites where proposed in the vicinity of *P. orbiculata* occurrences.

Current monitoring is based on direction in FSM 2670 and Chapter 4 of the LRMP (1997), as amended by the Phase I amendment, and the Monitoring Implementation Guide (USDA Forest Service 2005b). Direction in Forest Service Manual 2670 and Chapter 4 of the 1997 LRMP do not specify the type and level of information that is needed in the monitoring of Region 2 Sensitive Species. General Forest monitoring direction for Region 2 Sensitive Species has been revised during this amendment process and is included in Chapter 4 of the LRMP, as amended by the Phase II amendment (refer to the Phase II amended Black Hills National Forest LRMP Chapter 4 for further discussion of monitoring direction). The current monitoring design specific to *Platanthera orbiculata* is located in the Monitoring Implementation Guide, Black Hills National Forest Plan (USDA Forest Service 2005b).

All currently known occurrences of *Platanthera orbiculata* in the Black Hills are within grazing allotments with the exception of locations in the Black Elk Wilderness. Livestock or wildlife use could negatively affect the species where grazing or trampling of its single pair of leaves results in the loss of energy producing tissues, impairs the function of underground structures, or decreases the viability or vigor of individuals. Livestock and wildlife use can also negatively affect the species' habitats by impacting soils and altering microclimate. However, most of the *P. orbiculata* sites in the Black Hills are on steep slopes with dense shrub vegetation, both of which deter livestock. Also, the prostrate leaves are probably very difficult for mammalian herbivores to browse, and trampling is probably a greater risk to the species (Hornbeck et al. 2003f). Although current levels of livestock use are not considered a risk to the persistence of *P. orbiculata* in the Black Hills, individual plants may be impacted. Guideline 2207 (Alternative 1) locates livestock/wildlife-watering sites (i.e., drinking structures) outside of hardwood communities when feasible. The equivalent guideline in Alternative 2 does not include "when feasible." The guideline was rewritten for Alternatives 3, 4, and 6 and strengthened to a standard that locates new livestock/wildlife watering sites outside of hardwood communities, except when no other option is available. Although P. orbiculata are not located within seep or spring areas, some occurrences are located in close proximity to them and the following direction that is expected to reduce effects, may also be expected to limit effects or risks to *P. orbiculata*. Guideline 3104 (Alternative 1) conserves habitat for sensitive plants and animals associated with moist soil conditions during development of springs or seeps as water facilities. This is strengthened to a standard in Alternatives 2 and is revised specifying the habitat should be protected and prohibits the development of springs or seeps at water facilities where sensitive species exist. In Alternatives 3 and 6 it is strengthened to a standard where springs or seeps as are not to be developed as water facilities where sensitive species or Species of Local Concern plants exist unless development mitigates an existing risk. Alternative 4 direction is also strengthened to a standard and directs to conserve or avoid habitat for sensitive plants and animals associated with moist soil conditions, and to not develop springs or seeps as water facilities where sensitive species exist.

Currently, known *Platanthera orbiculata* occurrences on lands administered by the Forest Service in the Black Hills are presently and generally at low risk from direct impacts associated

with timber harvest activities. Timber harvest is unlikely to directly impact *P. orbiculata* habitat primarily for two reasons. First, the birch/spruce ecological types in the Black Hills are rarely selected for timber harvest because of the low commercial value of both of these species although spruce stands have been treated recently to target alteration for wildlife habitat or to restore hardwoods. Second, most of the sites where *P. orbiculata* occurs would be difficult to harvest due to their steep slopes or narrow canyons. However, if timber was harvested from *P. orbiculata* sites or immediately adjacent to these sites, the construction of roads, skid trails, or log decks has potential to directly or indirectly impact *P. orbiculata* and its habitat. No impacts would occur in the Black Elk Wilderness Area, where timber management is restricted. In addition, the National Environmental Policy Act of 1969 requires analysis for proposed management activities at the project level, which includes assessments of known locations of designated Region 2 Sensitive species such as *P. orbiculata*. Timber harvest is not deemed a persistence risk to *P. orbiculata* because occurrences are currently being avoided and mitigated to reduce direct and indirect effects, or vegetative treatments may be designed to provide beneficial long term indirect effects for the species (i.e. reduce risk from high severity or intense disturbance events) (Hornbeck et al. 2003f, USDA Forest Service 2005a).

Even though *Platanthera orbiculata* is somewhat restricted by its isolated habitats in the Black Hills and many sites are hard to access, it is known that orchid species are sought by private collectors or for commercial trade (Hornbeck et al. 2003f, USDA Forest Service 2005a, USDA Forest Service 2005b). At this time, there is no record of orchid collection in the Black Hills and no evidence of plant collecting in *P. orbiculata* locations (Hornbeck et al. 2003f, USDA Forest Service 2005a). In addition, the likelihood of impacts from collection are further reduced through Forest Service Manual direction (FSM 2673.2) regarding restrictions of collecting designated Region 2 sensitive plants, and is applicable to all alternatives. Standard 3119 clarifies direction from the manual and is included in Alternatives 3 and 6 to restrict the collection of sensitive 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 a traditionally used species or how many individuals 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 the limited numbers of individuals for this type of collection would present much risk to the overall long term persistence of this species on the Black Hills National Forest.

Noxious weeds and other invasive plant species have been documented at a limited number of actual sites where *Platanthera orbiculata* individuals occur (USDA Forest Service 2005a) and current risk to the species from weeds is low. However, weeds have been documented along nearby drainages. Monitoring includes assessing the status of *P. orbiculata* occurrences, and documenting, if it can be determined, what may be affecting that status, such as noxious weed competitors (USDA Forest Service 2005b). Recognizing invasion of noxious weeds and other non-native aggressive plants and their treatment as a general risk to the Region 2 sensitive species' long-term persistence on the Black Hills, conservation strategies and measures are addressed in this section. All alternatives propose various levels of protection for Region 2

sensitive species 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 further increased to a minimum of 8,000 acres in Alternative 6. Guideline 4303 revises the priority order for treatment of weeds, and first priority of treatment in action alternatives is to occur at Region 2 Sensitive and Species of Local Concern (SOLC) plants and snails. Guideline 4304 (Alternatives 1 and 2) was revised and elevated to a standard in Alternatives 3, 4, and 6 to require treatment methods that pose the least risk to the species being protected. Alternatives1 and 2 are silent on the monitoring of weed control effectiveness at Region 2 sensitive species 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 this type of monitoring and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to Region 2 plant species such as *P. orbiculata*. 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. Preventing and reducing the effects of noxious weed invasion into native plant communities is targeted by direction for revegetating with native species is included under Guideline 1110 in Alternatives 1 and 2. The original guideline was revised and was strengthened to a Standard 1110 in Alternatives 3, 4, and 6. Standard 4301 provides for the assessment of 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 2003b) and other land ownership, as well as being identified as one of the primary risks for *P. orbiculata* (Hornbeck et al 2003f), Alternatives 3, 4, and 6 are expected to have the lowest risk of indirect and direct negative effects to *P. orbiculata* 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 3-6.3 of the FEIS.

Most changes in the Phase II Amendment Alternatives are within the Forest-wide Goals, Objectives, Standards and Guidelines. There are a limited number of changes within the specific management area (MA) direction. Changes in MA objectives, standards, and guidelines that are anticipated to benefit *Platanthera orbiculata* directly or reduce any adverse effects on known or potential habitat include the following:

MA 1.1A– Black Elk Wilderness
(Approximately 10 percent of *Platanthera orbiculata* occurrences fall within this MA)

- Despite being located near an intensively used Wilderness recreation trail, there are no ongoing recreation impacts to *Platanthera orbiculata* being noted at the Black Elk Wilderness occurrences (USDA Forest Service 2004a, USDA Forest Service 2005a). Although there are no current impacts have been noted with this recreational use within the Wilderness, a new MA Standard 1.1A-1202 included in Alternative 3 and 6 requires any new trail construction or relocation be routed away from Region 2 Sensitive plant occurrences. Furthermore, where Region 2 sensitive plants occur, climbing access will not be increased over what currently exists.

MA 3.1 – Botanical Areas
(Approximately 10 percent of *Platanthera orbiculata* occurrences fall within this MA):

- There are no proposed changes to the following existing standards and guidelines, which protect the values for which the BAs were designated: 3.1-1501, 3.1-2101, 3.1-2102, 3.1-2501, 3.1-2502, 3.1-4102, 3.1-5101, 3.1-5102, 3.1.-5103, and 3.1-9104. The standards and guidelines listed above already protect botanical values in this MA by withdrawing areas from mineral entry when necessary and by not including these areas towards the suitable timber base or allowable sale quantity. Regarding the listed standards and guidelines above, the following are permitted only when the values for which the BAs were designated are not threatened: livestock grazing and recreation. The following are allowed in BAs when they enhance or protect the values for which the BAs were designated: improvements, the use of prescribed natural fire, the use of closure orders when necessary, and construction of new roads and trails only when necessary for interpretive or educational purposes or to correct resource damage.

The following objectives, standards, and guidelines have been revised or added to the various Phase II Amendment Alternatives and full implementation is expected reduce the likelihood of adverse effects or provide further benefit to the conservation of the likelihood of long term persistence of *Platanthera orbiculata* within the Black Hills:

- Objective 3.1-201 requires maintenance or enhancement of botanical features at BAs in Alternatives 1, 2, and 4. In Alternatives 3 and 6, monitoring to see if this target is being achieved has been added to the objective.
- Standard 3.1-1001. For Alternatives 1, 2, and 4: Protect the unique biodiversity, geological, historical, and paleontological, along with the botanical values for which the BA was designated. No new mineral material permits will be issued for this area. Alternatives 3 and 6 include further protection for additional botanical values that may continue to be discovered within Botanical Areas.
- Standard 3.1-2503. Alternative 2 protects plants in designated BAs from adverse impacts of domestic livestock grazing. In Alternatives 3, 4, and 6 the language states to protect or restrict access to Region 2 sensitive plant occurrences, and it includes occurrences of plant Species of Local Concern (SOLC). Furthermore it adds that if monitoring documents that domestic livestock are not restricted from accessing Region 2 sensitive and SOLC occurrences by natural features within BAs, then method(s) will be implemented to remove the cattle access from the occurrences. Although current levels of livestock use are not considered a risk to the persistence of *Platanthera orbiculata* in the Black Hills (see earlier livestock effects discussion for this species), the refined standard in Alternatives 3, 4, and 6 would be expected to be beneficial to *P. orbiculata* occurrences within Botanical Areas if negative impacts were observed.
- Standard 3.1-4101 manages fire and fuel through control practices and prescribed fire to protect values of BAs in Alternatives 1 and 2. For Alternatives 3, 4, and 6, Minimum Impact Suppression Tactics (MIST) must be used over more aggressive actions that could still be used for Alternatives 1 and 2. MIST fire suppression efforts are expected to result in less intensive disturbances if a fire would occur within Botanical Areas and would be expected to result in fewer direct and indirect effects to *Platanthera orbiculata*.
- Guidelines 3.1-9101, 9102, and 9103 restrict vehicle use (including snowmobiles) to designated routes and prohibit off-road travel in all alternatives. For Alternatives 3, 4,

and 6, this was strengthened to a standard and only allows limited use for emergency and administrative uses.

MA 4.2A- Spearfish Canyon
(Approximately 6 percent of the *Platanthera orbiculata* occurrences fall within this MA)

Spearfish Canyon already has existing standards in place that when implemented provide protection of botanical features, such as R2 Sensitive Plant species. Spearfish Canyon is already withdrawn from mineral entry with no new mineral permits for commercial development allowed, is closed to authorized livestock grazing use, travel activities are restricted to designated routes, and the area is not part of the timber suitable land base.

- Standard 4.2A-4101 (Alternatives 1, 2, and 4) manages fire and fuel through control practices and prescribed fire to protect the biological and scenic values in the Spearfish Canyon MA. Alternatives 3 and 6 add various methods to incorporate all available fuel reduction tools, with Alternative 6 prioritizing these areas near ARC and within the WUI. There is a great deal of uncertainty on any effects statements regarding treatments around ARC and the WUI regarding *Platanthera orbiculata* because without a priority system or a map indicating which ARC are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of occurrences. All treatment methods adjacent to known occurrences could help reduce the risk of widespread crown fires that could have both negative direct and indirect effects on the few occurrences of *P. orbiculata* that located within this MA.

MA 5.1 – Resource Production Emphasis, MA 5.4 – Big Game Winter Range Emphasis, MA 5.6 – Forest Products, Recreation, and Big Game
(Approximately 74 percent of *Platanthera orbiculata* occurrences located on the Forest are located within the boundaries of these MA)

Very few changes are included in specific direction for these MA for the action Alternatives, other than those that affect ponderosa pine structural stages. 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 *Platanthera orbiculata* occurrences, and therefore these changes would generally not result in beneficial or negative effects to *P. orbiculata*. Standard 5.6-2101 maintains existing stands and acres of hardwoods in Alternatives 1, 2, and 4. Alternatives 3 and 6 include maintaining or expanding hardwoods, which could restore additional habitat conditions suitable for *P. orbiculata* colonization, if other micro-site conditions existed.

As a conservative measure, collection and storage of *Platanthera orbiculata* seed in a certified repository is to be could be considered if Alternatives 3. 4 or 6 are implemented, as well as the possibility for ex situ or in situ propagation. The availability of seeds or even plants would be valuable should the need to reintroduce the species arise (Hornbeck et al. 2003f). Objective 200-4 was designed into Alternatives 3, 4, and 6 for conservation of species expected to be at risk from high severity or intense disturbance 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. No direction for collection of such material is included in Alternatives 1 and 2, therefore it is likely that implementation of this objective under the action

alternatives provides additonal conservation options and less risk to the species long term persistence if occurrences may be lost.

None of the Forest *Platanthera orbiculata* occurrences are located within any of the candidate Research Natural Area boundaries and no beneficial or negative effects would be expected with any that may be proposed for designation the Phase II Decision.

4-1.7.2 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 then generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey, 1995). The spatial area used for the cumulative effects analysis for *Platanthera orbiculata* is larger than many of the sensitive plant species since the concentration of occurrences is located in three primary geographic locations within the Black Hills Ecoregion. The spatial area used for the cumulative effects analysis primarily includes the Bearlodge Mountains, the northwestern Black Hills, and the central granitic core area that lies north and west of Custer, SD. This area was chosen because it encompasses similar ecosystem components to where the known occurrences are located.

Historic downward trends in Black Hills *Platanthera orbiculata* associated habitat conditions (i.e. warmer and drier climatic changes, weeds, fire suppression, conifer encroachment, urban development, roads) have typically not been positive for the species, and a downward trend over historic conditions is considered likely (Hornbeck et al. 2003f). 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. 2003f). Increased densities of spruce alter habitat conditions associated with *P. orbiculata* by reducing birch habitat conditions, potentially resulting in decreased available soil moisture conditions, and by increasing the potential for large scale high intensity fires (see Section 3-7.1).

Unlike where the species occurs within the Black Elk Wilderness and the Bearlodge Mountains, there are many parcels of private land within the immediate vicinity of the concentration of *Platanthera orbiculata* occurrences in the northern Black Hills. Actions on those lands and their effect on potential occurrences of *P. orbiculata* are unknown. Occurrences on private land could be impacted by urban development (such as structures, culverts, land clearing, access roads, vegetation changes, etc.). There is a high rate of development occurring on private lands in the northern and northeastern Black Hills as evidenced by the amount of new construction on those lands.

Even though *Platanthera orbiculata* is somewhat restricted by portions of associated isolated habitat with limited access, it is widely known that orchid species are sought by private collectors or for commercial trade. At this time, there is no record of *P. orbiculata* collection in

the Black Hills and no evidence of plant collecting in *P. orbiculata* locations (Hornbeck et al. 2003f, USDA Forest Service 2005a).

Activities and effects on *Platanthera orbiculata* were discussed in the section based on the current locations of designated ARC (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 ARC (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface for more information), with fuel reduction actions to occur within an estimated 1.5 mile WUI circumference area around ARCs. 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.

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Platanthera orbiculata*. Therefore the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *P. orbiculata* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.7.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Platanthera orbiculata* for all Phase II alternatives**.** The rationale for this determination is that several standards and guidelines under each alternative address the various potential risks to this species, as described earlier. Other conservation strategies and measures that vary by alternative provide for conservation or enhancement of *P. orbiculata* habitat conditions, and *ex situ* collections of plant material are expected to be available for re-introduction if needed. Specifically, the above determination for *P. orbiculata* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations will be re-evaluated during any revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard and guideline direction listed above for the various alternatives will be applied or implemented as written.

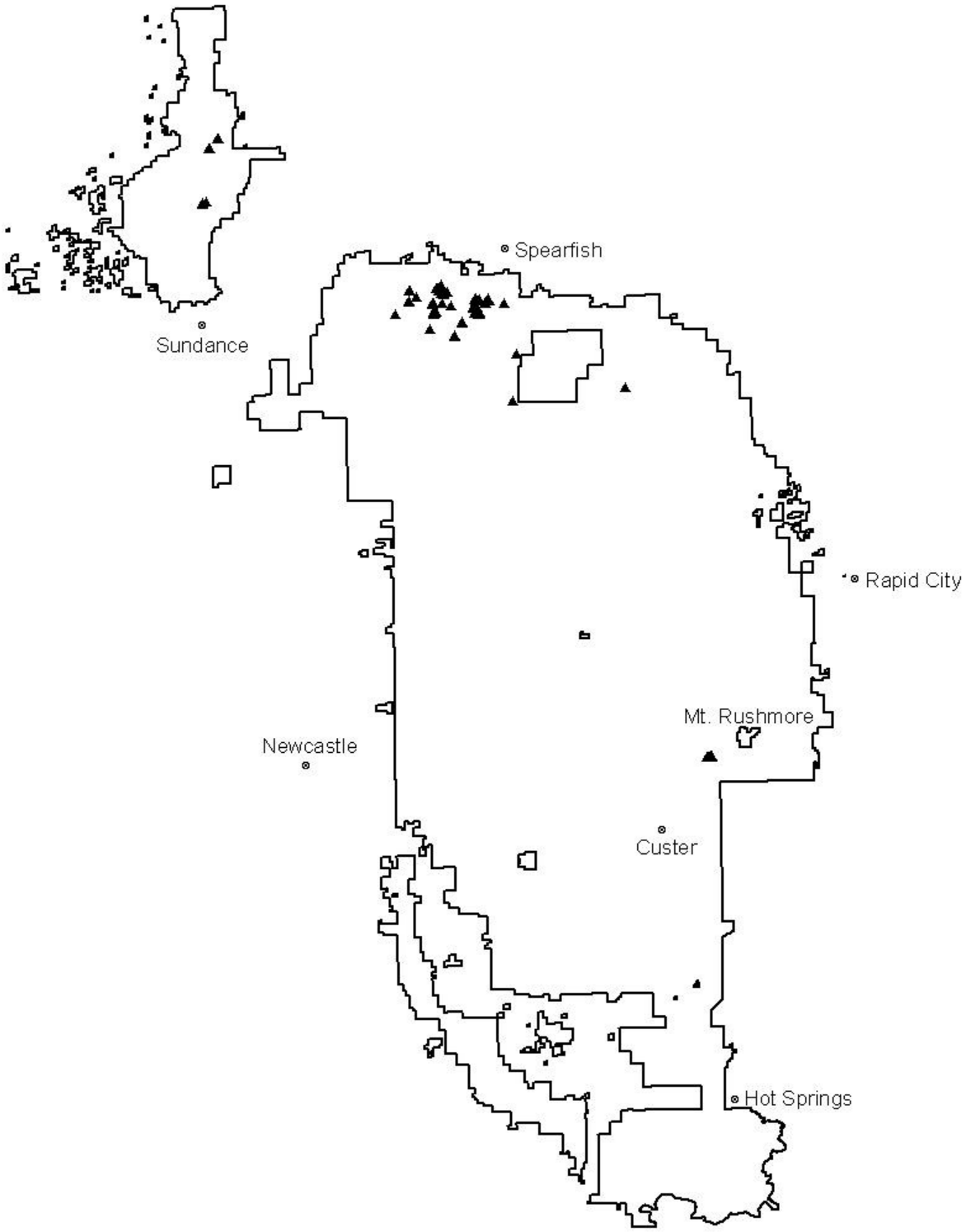
3. That regardless of which alternative is selected, the species will be monitored according to the current monitoring protocol (or as altered through reassessment with the Rocky Mountain Research Station), which is designed to detect and respond in a timely manner to changes in the extent and condition of *Platanthera orbiculata* occurrences (USDA Forest Service 2005b).

4. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as *Platanthera orbiculata* occurrences are the first priority for treating noxious weeds.

5. That plant material collected on the Forest can be used to successfully recolonize all (or portions of) core *Platanthera orbiculata* occurrences in the event such sites are lost.

6. That in spite of the conservation practices the Forest may use, this plant occurs in areas that have been periodically intensively impacted over many years by activities the Forest cannot control, such as highway construction or maintenance and the use of exotic invasive plants in roadside seeding, or may be impacted by a high intensity natural disturbance event. The monitoring strategy is designed to detect and respond in a timely manner to impacts to the species and its habitat that may occur on lands administered by the Forest, but not all impacts can be prevented.

General distribution of *Platanthera orbiculata* (Lesser Roundleaved Orchid) on lands administered by the Black Hills National Forest



4-1.8. *Botrychium multifidum* (Leathery Grapefern)

This species was included on the revised Region 2 Sensitive species list effective December 2003 (USDA Forest Service 2003) and remained on the updated Region 2 Sensitive Species list, effective May 17, 2005 (USDA Forest Service 2005c); therefore, information is not currently available in Black Hills National Forest programmatic level documents to which to tier to. Very limited information was available regarding species occurrences, distribution and associated habitat conditions within the Black Hills prior to 2003. Recent discoveries of occurrences in 2003 (USDA Forest Service 2005d), along with monitoring of those occurrences in 2004 (USDA Forest Service 2005a) is the basis for most of the following information that is specific to the species in the Black Hills.

Botrychium multifidum is nearly circumboreal in distribution, being found across North America, Europe and NW Asia (Flora of North America Editorial Committee1993). It is widespread across Canada from Newfoundland to British Columbia, and in the northern United States from New England west to Washington and Oregon, north into Alaska and south into California, Nevada, Utah, New Mexico and Arizona (Flora of North America Editorial Committee1993; NatureServe 2005a). Colorado and Wyoming occurrences are at least 300 miles from the Black Hills. *B. multifidum* is known from seven sites in South Dakota, all within a narrow geographic region, primarily on higher elevation locations of the Black Elk Wilderness and Norbeck Wildlife Preserve (Black Hills National Forest Plant Database 2003). Five of the seven extant occurrences were located during surveys in 2003. It is not known if this species has the potential or can be expected to occur in other areas on the Black Hills National Forest, but as a recently designated Region 2 sensitive species it is targeted for survey. *B. multifidum* is currently known from three watersheds on the Black Hills National Forest. Three occurrences are in the Spring Creek drainage, three occurrences are located within the Iron Creek drainage, and the other occurrence is located along Nelson Creek. An additional historic report is from the northern Hills near Galena, but no occurrence of the species was located during relocation attempts completed in 2003.

Botrychium multifidum is currently documented to have a limited range in the Black Hills, and occurs in two adjacent Forest Manament Areas (MA):

> MA 1.1A – Black Elk Wilderness – Approximately 86 percent of the occurrences are within this MA.
>
> MA 5.4A – Norbeck Wildlife Preserve – Approximately 14 percent of the occurrences are within this MA.

Botrychium multifidum has a current rank of G5, demonstrably secure (NatureServe 2004). It is currently assigned a rank of S1 (critically imperiled due to extreme rarity or other factors) in South Dakota and S2 (imperiled due to rarity or limited range) in Wyoming (NatureServe 2005a).

Botrychium multifidum is an evergreen species that can grow to nearly 16 inches in height at other documented occurrences within its range. The leaves are large (1 to 6 inches long), leathery, stalked, usually 3-4 times compound, and attached near ground level (Lellinger 1985). *B. multifidum* reproduces by wind dispersed spores.

Life cycles of members of the genus *Botrychium* (moonworts and grapeferns) are similar, and it can be assumed that features common to the genus apply to *Botrychium multifidum*. As in all ferns, the life cycle consists of two major stages: a diploid spore-producing stage represented in part by the structure described above, and a cryptic haploid stage. *Botrychiums* are dependent on mycorrhizal fungi for water and nutrient uptake. This relationship also allows moonworts to remain dormant for several years. Because the condition of mycorrhizal species are dependent on an adequate supply of soil moisture, it is thought that mycorrhizae are probably the most important limiting factor for *Botrychium* establishment (Beatty et al. 2003).

Range-wide, *Botrychium multifidum* grows in moist, open or shaded areas, including old pastures, meadows, woodland margins, riverbanks and bottom lands, from low elevations to 9,700 feet (Flora of North America Editorial Committee 1993; Lellinger 1985, USDA-Forest Service 2003c). In the Black Hills, *B. multifidum* has been found along streams, in old stream channels with no associated perennial running water but are still likely associated with flooding events, and in drainage bottom meadows or clearings in spruce/aspen riparian zones from 5100 to 6500 feet elevation within the granitic core region (USDA Forest Service 2005b, USDA Forest Service 2005d). *B. multifidum* is predominantly a riparian or wetland system associate in the Black Hills National Forest based on the currently known occurrences; however, it is important to note that it is primarily not located in areas of saturated soil conditions, but with mesic (moist) soil conditions (USDA Forest Service 2005d). *B. multifidum* in the Black Hills National Forest has been documented on disturbance-associated sites such as gravel bars and old stream channels, on substrates associated with the granitic core region. Lellinger (1985) states that *B. multifidum* occurs on subacid soils elsewhere in its range, so associated habitat conditions in the Black Hills may be restricted to the central granitic core region, most of which is restricted to the Black Elk Wilderness and the Norbeck Wildlife Preserve. Currently documented sites have white spruce (*Picea glauca*) as an associate. Other associated plant species that occur at three or more locations include *Athyrium filix-femina* (lady fern), *Cornus canadensis* (bunchberry), *Betula papyrifera* (paper birch) and Climacium moss. Some level of disturbance is likely to be a prerequisite for the establishment and persistence of *B. multifidum*, as well as other *Botrychium* species (Lellinger 1985) where they have been documented from elsewhere in their range. Lellinger (1985) uses grazing as an example of a disturbance that may provide suitable establishment conditions.

Numbers of individuals documented at the sites in 2003 an 2004 ranged from six to 65. In 2004, greater than 10 above ground individuals were documented at four of the seven locations USDA Forest Service 2005a, USDA Forest Service 2005b). As with many *Botrychiums*, this species is difficult to locate, and can be easily overlooked during casual observations (Lellinger 1985). Additional similar habitat conditions occur in adjacent areas within the Black Elk Wilderness and Norbeck Wildlife Preserve, and are likely present on the immediately adjacent areas administered by Custer State Park and Mount Rushmore National Memorial (USDA Forest Service 2005b). If microsite habitat associates are present in these other locations, it is possible that more occurrences of this small stature plant may be discovered.

4-1.8.1 Direct and Indirect Effects

The effects of disturbance on *Botrychium multifidum* are not well understood, but some disturbance is considered necessary for establishment and maintenance of occurrences (Lellinger

1985). Primary risks to the species in the Black Hills may include individuals trampled by recreationists or individuals monitoring occurrences, noxious weed or other non-native plant invasion and any associateed herbicide treatments, natural events such as flooding or climatic warming and drying trends, high intensity fire events (from the fire itself or from suppression acitivities), or road or trail construction that may cross a drainage where an unknown individual occurs (USDA Forest Service 2005b.

Individuals are located in areas that are currently not grazed and are located in the upper headwaters of bouldery steep gradient watersheds that are fairly resistent to alteration by various disturbance activities (USDA Forest Service 2005b), as compared to lower gradient meandering stream systems. Most changes among alternatives are at the Forestwide level Objectives, Standards and Guidelines. Very few changes are included in direction for these MAs for the action alternatives.

Mesic (moist) soil conditions are considered to be important for conservation of *B. multifidum* occurrences. Stream alteration and water development could reduce or increase potential habitat, but such modifications or developments are unlikely in the Black Elk Wilderness (MA 1.1A) and Norbeck Wildlife Preserve (MA 5.4A) where all currently known occurrences are located. Motorized vehicle use is prohibited in the Black Elk Wilderness. Timber harvest is generally not deemed a persistence risk to *B. multifidum* because the known occurrences are located in the Black Elk Wilderness where timber harvest is precluded, and the Norbeck Wildlife Preserve where timber harvest is to be limited to the enhancement of wildlife habitat and because timber harvest typically occurs in a different ecological type (ponderosa pine) than where *B. multifidum* occurs. Additionally,the steep slopes and bouldery drainages in the Black Elk Wildeness and the Norbeck Wildlife Preserve naturally limit activities that can occur there and do not lend themselves to much alteration.

Invasion of occurrences by noxious weeds or other non-native aggressive plant species may be one of the primary risks to the likelihood of the species long term persistence in the Black Hills. In 2004, *Cirsium arvense* (Canada thistle) was documented within 5 to 50 meters of three of the *Botrychium multifidum* occurrences (USDA Forest Service 2005a). No noxious weeds were observed at the other four occurrences. All alternatives propose various levels of Forest-wide direction for the prevention of noxious weeds and protection for Region 2 sensitive species 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 is increased to a minimum of 8,000 acres in Alternative 6. Guideline 4303 revised the priority order for treatment of weeds, and first priority of treatment is to occur at locations of Region 2 sensitive species and Species of Local Concern. Guideline 4304 (Alternatives 1 and 2) was revised and elevated to a standard in Alternatives 3, 4, and 6, to require treatment methods that pose the least risk to the species being protected. Alternatives 1 and 2 are silent on the monitoring of weed control effectiveness at Region 2 sensitive species 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 this type of monitoring and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to Region 2 plant species such as *B. multifidum*. 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 to require that the seed be tested at the time of delivery to confirm that the seed is weed-free in Alternatives 3, 4, and 6. Further prevention actions targeted at noxious weed invasion into native plant communities is through direction to revegetate with native species and is included under Guideline 1110 in Alternatives 1 and 2. The original guideline was revised and was strengthened to a standard in Alternatives 3, 4, and 6. Alternatives 3, 4, and 6 are expected to have the lowest risk of indirect and direct adverse effects to *B. multifidum* from noxious weeds and their treatment based on prioritize sensitive species sites for weed treatment and the use of treatment methods presenting the least risk to the species being protected at the site.

High intensity fire events and suppression activities associated with those events may be a risk to extant *Botrychium multifidum* occurrences. All currently known sites are located adjacent to stands of highly flammable conifers. Erosion resulting from fires has the potential effect of depositing large amounts of sediment in drainage areas, and fire itself can remove canopy cover and kill individual plants. Therefore, intense wildfire events could extirpate existing sites and temporaraly reduce the amount of habitat . Alternatively, fire in suitable habitats may expose the bare mineral substrates along drainages that may provide conditions that *Botrychium multifidum* may be require to become established. While the seven known occurrences are in three separate watersheds, they all occur within the same township and may be at risk to a high severity fire event or a series of events that occur within the general area. The rugged terrain would be expected to limit the risk that all occurrences would be affected by a single catastrophic event Because of the risk associated with high intensity fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of Region 2 Sensitive and Species of Local Concern plant occurrences that could be at risk to high intensity 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 known occurrences of Region 2 sensitive plant species, such as *B. multifidum*. Alternative 3 is expected to provide the greatest likelihood of creating conditions that would be successful for dropping crown fires to the ground because it would create or maintain low crown fire hazard conditions near sensitive plant occurrences. A greater risk of crown fires affecting *B. multifidum* occurrences is associated with Alternative 6 because it targets creation of a moderate to low crown fire hazard near those locations, instead of low hazard, therefore conditions for a higher intensity fire near emphasis plant species occurrences and associated effects to the plants could be expected to occur through implementation of Alternative 6, as compared to implementation of the objective for Alternative 3. High fire hazard condition reduction is not targeted as an objective for these emphasis plant species in any of the other alternatives, so risk associated with fire would be expected to be highest under those alternatives. It is important to note that no matter what alternative is selected, this type of fire hazard reduction would not occur within the Black Elk Wilderness Areas. This type of fuel treatment could occur within the Norbeck Wildlife Preserve as long as it is within the scope of treatments targeted to benefit the habitat for big game habitat improvement.

The persistence of *Botrychium multifidum* on Forest Service administered land is not currently at risk from livestock grazing, as none of the seven known locations are currently grazed, and most of the known sites are in allotments considered unsuitable for grazing. Grazing is permitted in the Black Elk Wilderness (Standards 1.1A-2501 and 1.1A-2503, Guideline 1.1A-2502), but only the Palmer Gulch allotment is designated as suitable (Standard 1.1A-2504). This allotment is not fenced, so occasional use by livestock may occur. Grazing is allowed in unsuitable areas on a limited basis as a tool to meet management objectives (Guideline 1.1A-2505). Grazing is

allowed in the Norbeck Wildlife Preserve, but no increase in livestock numbers are allowed over the 1997 levels (Standard 5.4A-2501) and grazing is allowed in unsuitable areas on a limited basis as a tool to meet management objectives (Guideline 5.4A-2505). Due to the bouldery and rocky conditions in the drainages and the amount of down woody debris that is present, cattle are unlikely to even access the known sites. Given these conditions of the known occurrences, livestock use is not expected to affect the likelihood of persistence of *B. multifidum* on Forest lands.

There are a various levels of conservation and protection measures in place for the riparian areas where *Botrychium multifidum* occurrences are located on the Forest. Objective 105 minimizes potential effects to *B. multifidum* in the Norbeck Wildlife Preserve by prohibiting motorized vehicle use in riparian areas except at designated places. This objective could restrict vehicle use to areas where *B. multifidum* does not occur (where motorized vehicles are permitted), or outside the Black Elk Wilderness and Norbeck Wildlife Preserves if new occurrences are located outside these MAs. Standards 1301 and 1302 limit actions in riparian areas and maintain natural vegetation and flow patterns in wetlands and will be applied only to correct human-induced changes in the natural ecosystem (Objective 1.1A-401). Standards and Guidelines 1505, 1506, 1507, 1508, and 1513 limit the impacts of mineral extraction on riparian areas. No new mineral leases are to be issued for the Black Elk Wilderness (Standard 1.1A-1501) and mineral extraction is limited in the Norbeck Wildlife Preserve by Standards 5.4A-1202 and 5.4A-1203). In the Norbeck Wildlife Preserve, Guidelines 3210, 3211, and 3212 provide for the maintenance or establishment of high quality riparian areas by encouraging habitat diversity through vegetation management and managing vegetation in a way that benefits the establishment of shrubs and trees, and encourages stable stream banks.

Objective 200-04 was designed into Alternatives 3, 4, and 6 for conservation of species expected to be at risk from high severity fire or other intense disturbance 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. No direction for collection of such material is included in Alternatives 1 and 2.

Another risk identified for *Botrychium multifidum*, based on the species proximity to trails, is that of trail maintenance and potential for recreational trampling. All alternatives include conservation measures and protection for sensitive plant species and their habitats during and after, trail, road and highway construction. Guideline 3107 in Alternatives 1, 2, and 4 was designed to eliminate or reduce the likelihood of any adverse effects to sensitive plant occurrences. This guideline was revised and strengthened to standard and is now labeled Standard 3106 in Alternatives 3 and 6, and limits the types of disturbances that can occur.

Objective 221 directs the Forest to conserve or enhance habitat for sensitive species, and is included in Alternatives 1,2, 3, 4, and 6. Standard 3115 requires that a sensitive species located after contract or permit issuance be appropriately managed through coordination with the contractor or permittee in all alternatives.

At this time, there is evidence of *B. multifidum* collection in the Black Hills, other than those that have been collected for placement in the Rocky Mountain herbarium for scientific and educational purposes (USDA Forest Service 2005d). In addition, the likelihood of impacts from

collection are further reduced through Forest Service Manual direction (FSM 2673.2) regarding restrictions of collecting designated Region 2 sensitive plants, and is applicable to all alternatives. Standard 3119 clarifies direction from the manual and is included in Alternatives 3 and 6 to restrict the collection of sensitive 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 a traditionally used species or how many individuals 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.

Monitoring of Region 2 Sensitive Species is directed based on in FSM 2670 and Chapter 4 of the LRMP (1997). However, the direction does not specify the type and level of information that is needed in the monitoring. Baseline data was collected at reported locations in 2004 (USDA Forest Service 2005a). The current monitoring strategy is primarily designed to detect changes to occurrences and to check adjacent habitat for additional plants (USDA Forest Service 2005b). Forest monitoring direction has been revised during this amendment process and is included in Chapter 4 of the LRMP, as amended by the Phase II amendment (refer to the Phase II amended Black Hills National Forest LRMP Chapter 4 for further discussion of monitoring direction). Information on the current monitoring strategy for *Botrychium multifidum* is provided in the Forest Plan Monitoring Implementation Guide (USDA Forest Service 2005b).

None of the currently known *Botrychium multifidum* occurrences are located within any of the candidate Research Natural Areas and no beneficial or negative effects would be expected with any that may be proposed in the Phase II Amendment Decision.

No known occurrences of *Botrychium multifidum* are located within the Wildland Urban Interface area (estimated 1.5 miles circumference area) surrounding a designated At Risk Community (ARC). No currently known occurrence would be expected to be impacted by activities associated with fire reduction treatments associated with any currently designated ARC.

4-1.8.2 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 then generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey, 1995). The spatial area used for the cumulative effects analysis for *Botrychium multifidum* primarily includes the central granitic core area including the Black Elk Wilderness, Mount Rushmore National Memorial and the northern unit of 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 and different geologic types which includes a different suite of species.

The known distribution of *Botrychium multifidum* occurrences on the Forest is currently limited to the granite core within the Black Elk Wilderness and the Norbeck Wildlife Preserve. Historically, more activities (such as roads or jeep trails used to access an active Lookout Tower, activities by the Civilian Conservation Corps, authorized livestock use, etc.) took place in these management areas before their current designation that prohibited or limited most of those activities that although unknown, may have historically affected some occurrences of *B. multifidum*.

There are similar associated habitat conditions within adjacent areas on the northern units of Custer State Park and land administered by Mount Rushmore National Memorial, however it is unknown if any occurrences of this species are located on those lands. Both of these areas receive significant levels of various recreation activities and development (such as construction of trails, parking lots and structures) because they are popular destination locations. Recreational use is expected to continue and increase at these areas. However, since it is unknown if occurrences are located there, it is unknown if the historical recreation activities, current activities or expected increases in recreational use of those lands would have any effects to this species

It is unknown if there are any extant *Botrychium multifidum* occurrences on private lands within the Black Hills. Actions on potential *B. multifidum* habitat on private land in the Black Hills and their associated effects on any potential occurrences on those lands are unknown.

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Botrychium multifidum*. Therefore the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *B. multifidum* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.8.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Botrychium multifidum* for all Phase II alternatives**.** Specifically, the above determination for *B. multifidum* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations will be re-evaluated during any revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard and guideline direction listed above for the various alternatives will be applied or implemented as written.

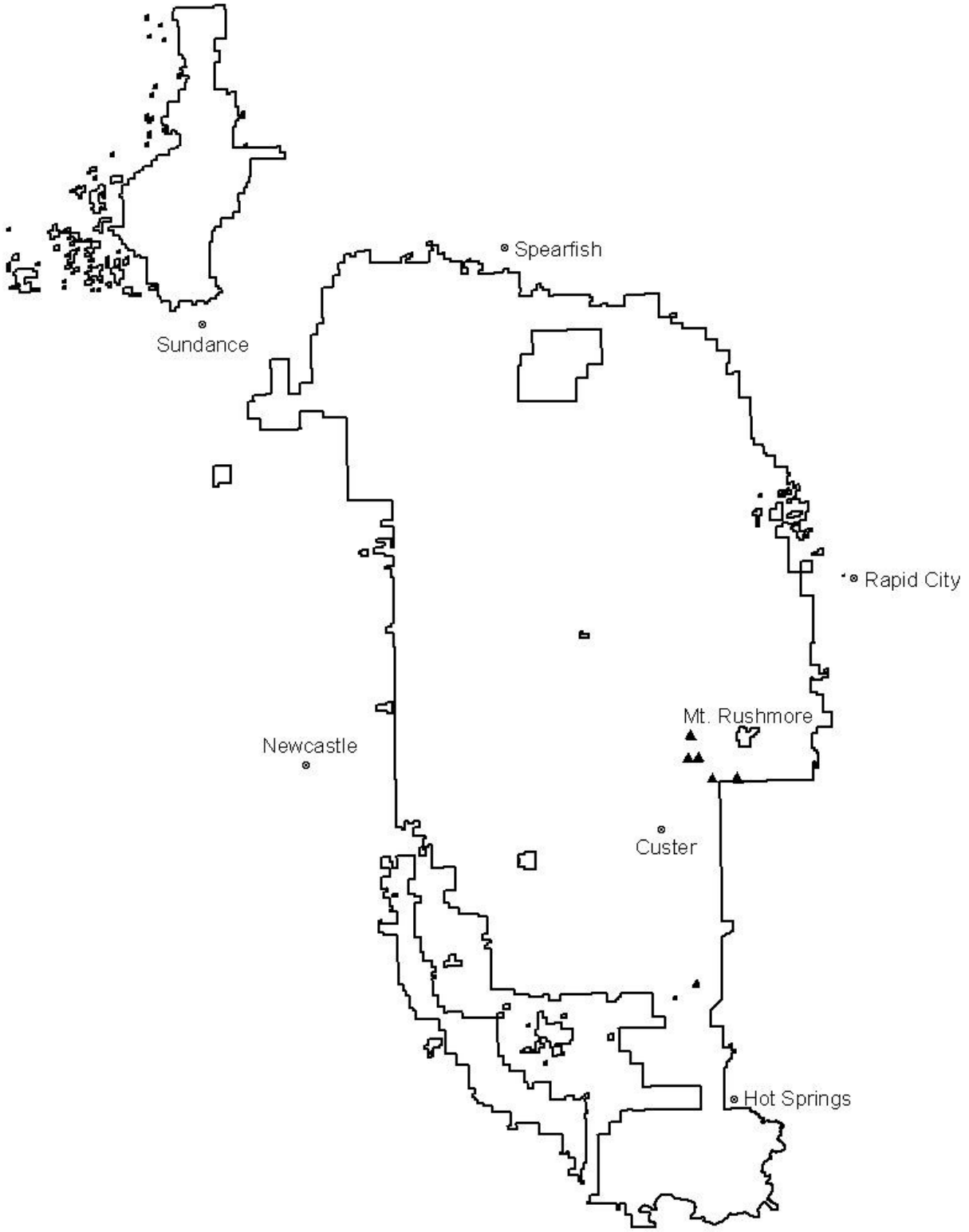
3. That under any of the selected alternatives the species will be monitored according to the current monitoring protocol (or as altered through reassessment with the Rocky Mountain Research Station) for *Botrychium multifidum* (USDA Forest Service 2005b).

4. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as *Botrychium multifidum* occurrences are the first priority for treating noxious weeds.

5. That plant material collected from Forest *Botrychium multifidum* occurrences can be used to successfully recolonize all or portions of Forest locations in the event occurrences may be lost to catastrophic events.

6. That a limited number of *Botrychium multifidum* individuals may be impacted from various disturbances, including but not limited to the following: long-term occurrence conservation efforts, conservation efforts targeted for other species, or from high intensity events such as flooding.

Distribution of *Botrychium multifidum* (Leathery Grapefern) on lands administered by the Black Hills National Forest



4-1.9. *Botrychium lineare* (Narrowleaf Grapefern)

This species was included on the revised Region 2 Sensitive species list effective December 2003 (USDA Forest Service 2003) and remained on the updated Region 2 Sensitive Species list, effective May 17, 2005 (USDA Forest Service 2005c); therefore, information is not currently available in Black Hills National Forest programmatic level documents to which to tier to. The species was recently (December 2003) determined to occur in Dugout Gulch, Wyoming on Forest lands. *B. lineare* was only known to occur in Colorado within USFS Region 2 until the documentation of this Black Hills occurrence (Beatty et al. 2003). The Black Hills occurrence of *Botrychium* species was located on June 19, 2003, and live plant specimens were collected and sent to Dr. Donald Farrar to validate identities with enzyme electrophoresis analyses (laboratory work is needed for definitive identification for many of the *Botrychium* species because of morphological similarities). Other *Botrychium* species are documented to occur on the Black Hills, but this is the first documented site of *B. lineare.* The Black Hills occurrence is also the first documented location for the state of Wyoming. In November 2003, an assessment for three *Botrychium* species (Beatty et al 2003) that included *B. lineare* within USFS Region 2 was completed and serves as a primary reference source for the following analysis.

Historical and current occurrences of *Botrychium lineare* have been documented in Idaho, Oregon, Montana, California, Washington, and Colorado, and in New Brunswick, Quebec and British Columbia, Canada (USDI Fish and Wildlife Service 2004). Based on new occurrence information (2003 and 2004) and continued herbarium searches of historic vouchers, the species is also now documented from Utah, Wyoming (Black Hills occurrence), Alaska, and the Yukon Territory and new additional occurrences have been found in Glacier National Park, MT (Farrar 2004). It is expected that the global rank and state heritage ranks will be changed to reflect increasing occurrence information for *B. lineare*. The closest known *B. lineare* occurrences to the Black Hills occurrence are in Colorado and Montana.

The number of aboveground stems of North American occurrences of *Botrychium lineare* is typically small, with two to 100 individual stems documented at various sites (Beatty et al. 2003). The number of plants belowground is generally much larger than the number that are visible aboveground, and it is estimated that what can be observed aboveground may represent only about 10 percent of the individuals at a given occurrence (Farrar 2004). Surveys, field identification of moonworts, and monitoring efforts are complicated by *Botrychium* biology. The combination of many characteristics (including, but not limited to, the relatively short period since *B. lineare* has been described to science; the fact that the species may be a habitat generalist; the fact that species is small in stature, difficult to find, and scarce at a number of occurrences; and the number of recent new occurrences being documented) indicates that there is likely an underestimate of the actual North American population size, and conclusions as to its range-wide distribution is problematic (Farrar 2004, Beatty et al. 2003). In reviewing recent information, Farrar stated that, given the abundance of *B. lineare* around Glacier National Park along with additional occurrences documented in the Yukon Territory and Alaska, *B. lineare* may be principally a northern species and may be distributed throughout the Canadian mountains to Alaska. If this is the case, he believes this may be why more southern disjunct occurrences, being warmer and/or drier, have fewer individuals in locations observed.

The Forest pursued an agreement with Iowa State University to search for *Botrychium* species during June of 2004 and May of 2005 to complete laboratory analyses during the winter of 2004-2005 and 2005-2006 on any individual plants collected to continue to add to *Botrychium* species status and distribution information in the Black Hills National Forest.

In addition to documenting new occurrences of *Botrychium lineare*, recent work being completed by Dr. Donald Farrar is revealing genetic similarity between *B. campestre* (prairie moonwort) and *B. lineare*. Dr. Farrar plans to continue analyses to resolve whether the taxa warrant taxonomic separation (Farrar 2003d).

On the Forest, *Botrychium lineare* is currently known from the single Dugout Gulch occurrence in Wyoming. The Forest pursued an agreement with Iowa State University to survey for *Botrychium* species during June 2004, to be followed by laboratory analyses that was completed during the winter of 2004-2005. This survey and laboratory analyses agreement was further extended into 2005-2006 to continue to increase status and distribution information for this species. None of the specimens from 2004 individual plant collections were determined to be *B. lineare.* In addition, through the agreement, Forest Service staff, along with Dr. Donald Farrar and staff, monitored the Dugout Gulch *B. line*are site on June 7, 2004. More above-ground individuals were documented in 2004 compared to when the occurrence was first documented in 2003 (USDA Forest Service 2005a).

Botrychium lineare is a candidate species for federal listing (US Fish and Wildlife Service 2004). It had been placed on the USFS Region 2 Sensitive species list based on Colorado occurrences and candidate status (USDA Forest Service 2003, 2003g). Its currently assigned global rank is critically imperiled (G1) (NatureServe 2005a). The species had not been listed by the Wyoming Natural Diversity Database (2003) prior to the Dugout Gulch discovery. The species is now currently assigned a rank of critically imperiled (S1) in Wyoming (NatureServe 2005) The species is not listed by the South Dakota Natural Heritage Program (2004).

Botrychium lineare, is a small perennial fern with a pale green leaf about two-to-seven inches long (Beatty et al. 2003). Spore producing fronds were documented on *Botrychium* individuals located on June 19, 2003 at the Dugout Gulch site on the Forest (USDA Forest Service 2005d). *Botrychiums* are dependent on mycorrhizal fungi throughout their life cycle (Beatty et al. 2003). These specialized fungi assist moonworts with water and nutrient uptake. The fungal association allows moonworts to remain dormant for several years at a time. Such prolonged dormancy can be advantageous during periods of drought or some other condition that is limiting to the species. Moonwort spores germinate underground and develop into belowground, non-photosynthetic gametophytes, which produce gametes (sperm and egg). The fertilized zygote then develops roots, stem, and the aboveground visual, fern-like, spore producing structure, the sporophyte. Leaf primordia (specialized leaf-producing cells) for several years are present just below the soil surface, and only one primordium matures each season (Beatty et al 2003).

Typically, moonworts are long-lived (i.e. 10-to-15 years), colonizing plants that may require disturbed sites to become established (Don Farrar personal communication 1996, 2003c, 2004). This is consistent with the *Botrychium lineare* occurrence conditions from the Black Hills since individuals are documented to occur on old native surface roadbed with low levels of ongoing disturbance.

Specific habitats and associated vegetation classifications for *Botrychium* species can be difficult to characterize since the vegetation and topography of observed sites vary greatly across their ranges. Understanding habitat characteristics is also compounded by the fact that few sites have been described in detail. In additon, although one species, such as *B. lineare* can be found in a range of habitats, *Botrychium* species likely have a suite of specific ecological requirements (Beatty et al. 2003).

Typical habitat descriptions for *Botrychium lineare* are problematic because known sites are so different across its currently known range (Beatty et al. 2003). This species may be a habitat generalist since habitat across the range for *B. lineare* is quite variable and its range stretches from sea level in Quebec to approximately 10,000 feet in Colorado. *B. lineare* has been observed growing in primarily open habitats and often in areas with documented disturbances, both human-caused (i.e. highway construction sites along Going-to-the-Sun Road in Glacier National Park) and natural (Farrar 2004). Only one observance to date has documented the species in a habitat with a closed canopy condition (Farrar 2004). *B. lineare* has been observed growing along the banks of a steep woodland trail in Montana, among deep grasses and forbs or in meadows in Colorado, in a grassy area under a single spruce tree in Oregon, and on limestone cliffs with narrow, grassy, horizontal terraces in Quebec (Beatty et al. 2003, Farrar 2004). At least three of the occurrences in Montana were located growing along roadsides in disturbed areas in seemingly early seral, open habitat dominated by low growing forbs rather than shrubs or trees (Beatty et al. 2003). Other documented sites occur in grass-and forb-dominated openings in meadows. Further information on these other occurrences across the species range can be found in Beatty et al 2003. In recent discussions with Dr. Farrar (2004), he mentioned that no recent sites documented to date are located out of mountain habitats (i.e. has not been found in areas like the Great Plains where *B. campestre* has been located). Dr. Farrar further described that occurrences have been located primarily in areas were soils have formed from limestone, with most being fairly rocky although a few sites have deep soil conditions.

There were no known occurrences of *Botrychium lineare* in Wyoming (Beatty et al. 2003) prior to the December 2003 confirmation of the species on the Black Hills National Forest. Habitat similar to that described for Colorado, Montana, and Idaho is also available elsewhere in Wyoming (Beatty et al. 2003). Across the range of *B. lineare*, not all habitat as described is known to be occupied, and occurrences are currently known to be generally discontinuous across the landscape.

As mentioned previously, the Black Hills occurrence is currently the single *Botrychium lineare* location known in Wyoming. If Dr. Farrar's hypothesis that *B. lineare* is a northern species is correct, it is likely that if additional occurrences of *B. lineare* were found on the Black Hills National Forest, they would be small and discontinuous, as documented elsewhere in the southern part of the species range.

Baseline inventory documentation of the *Botrychium lineare* occurrence on the Black Hills shows associated habitat condition similarities as well as differences to occurrences elsewhere. The Black Hills occurrence is located on an old native surface roadbed dominated by graminoids and forbs. The roadbed site where the species occurs is very open (little to no tree canopy cover) and sunny with a trace of snowberry (*Symphoricarpos* spp.) shrubs beginning to become established. Portions of the roadbed are covered with occasional pieces of down woody debris. There is no disturbance currently resulting from vehicles. Some current low intensity

disturbances are documented in the vicinity and where *B. lineare* individuals are located. An ephemeral drainage located about eight feet upslope of the occurrence drains onto the road and through the *B. lineare* occurrence area, creating periodic disturbances by water runoff. Cattle disturbance of the site has occurred in past seasons as evidenced by manure; however, no use by cattle had occurred during the 2003 grazing season at the time of the site observations. Elk disturbance of the roadbed area was evidenced by hoof tracks. The lower slopes immediately adjacent to the roadbed are dominated by paper birch (*Betula papyrifera*) and bur oak (*Quercus macrocarpa)* with a thick shrub layer of hazelnut (*Corylus cornuta)* (USDA Forest Service 2005d).

4-1.9.1 Direct and Indirect Effects

There is much uncertainty regarding risks to *Botrychium lineare*. Natural and human induced disturbances, including land management activities such as timber harvest, grazing, prescribed fire, and fire suppression may create and maintain suitable habitat for this species or may negatively impact existing populations, depending on the disturbance intensity and frequency (Beatty et al. 2003).

Many uncertainties exist with *Botrychium lineare* because research/literature is very limited for this species and little is known about its habitat in the Black Hills since there is just one documented occurrence. Consequently, additional personal contact was recently made to get the latest information from Dr. Don Farrar, who is recognized for his work with *Botrychium* species in North America and has experience with *Botrychium* species in the Black Hills.

The baseline data for this Black Hills occurrence documents that the species is able to colonize past disturbance areas (similar to other rangewide documented disturbances), and the species is currently persisting at the known occurrence with limited ongoing disturbances (USDA Forest Service 2005d). There is some permitted livestock use at the known occurrence site. Farrar (2004) stated that it is important to maintain the same level of disturbances as what has been occurring at the locations for the past several years. An occasional above-ground individual may receive a direct effect if trampled by cattle, but would likely not be grazed because of the plants small stature. In addition, since there would likely be enough belowground spores, gametes, juveniles, etc. such that not all of any one occurrence would be affected by livestock trampling. There was no documented grazing or trampling evidence of *Botrychium lineare i*ndividuals at the site in 2003 or 2004 (USDA Forest Service 2004e, USDA Forest Service 2005a).

Although it is uncertain, because of the species' persistence with disturbance and its colonization of disturbance areas (Farrar 2004), despite the fact that aboveground stems may be negatively affected, beneficial short- and long-term effects may be realized by the prescribed burning on the Forest. Dr. Farrar (2004) indicated that when an occurrence has aboveground growth, a fast moving fire may not negatively impact it. The fire may remove aboveground stem portions, but would not be expected to affect belowground individuals or parts. Dr. Farrar shared that an area reviewed after a fire had an increase in the number of *Botrychium* spp. stems. Dr. Farrar indicated that burning may release more nutrients to the soil that may immediately benefit the mycorrhizae and *Botrychium* species. He said this would be consistent with observations of other fungi that "flush" after fires. Prescribed fire may provide the disturbance needed for site colonization. Although unknown, an intense fire (from wildfires or a high intensity prescribed

burn) that may have high severity effects, such as deep soil heating could potentially negatively affect both the belowground and aboveground portions of *B. lineare* individuals. Because of the risk associated with catastrophic fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of occurrences that could be at risk to high intensity 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 Region 2 sensitive plant species, such as *B.lineare*. Alternative 3 is expected to provided the greatest likelihood of creating conditions that would be successful for dropping crown fires to the ground because it would create or maintain low crown fire hazard conditions near sensitive plant occurrences and botanical areas. A greater risk of crown fires affecting crown fires is associated with Alternative 6 because it targets creation of a moderate to low crown fire hazard near those locations, instead of low hazard, therefore conditions for a higher intensity fire near emphasis plant species occurrences and associated effects to the plants could be expected to occur through implementation of Alternative 6, as compared to implementation of the objective for Alternative 3. Implementation of the objective under either alternative near the *B. lineare* occurrence is expected to decrease fire effects (greater reduction under Alternative 3) and benefit the occurrence during fire events. This objective is not part of Alternatives 1, 2 or 4 therefore the greatest risk of high intensity fires, such as crown fires, to emphasis plant species would be expected to be associated with these alternatives.

The Dugout Gulch *Botrychium lineare* occurrence is not located within 1.5 miles of any of the currently designated ARC (Appendix G: Map G-6 At-risk Communities and Wildland-Urban Interface); therefore, no effects would be expected from the fuel reduction activities associated with those communities at the Dugout Gulch occurrence (refer to Appendix B of the FEIS for At-risk Communities and the Wildland-Urban Interface discussions).

An unknown site occurrence could expand, if present, or site conditions could be altered as a result of some level of disturbance (i.e. earlier successional conditions including shrub shade reduction, disturbed site conditions, and changes in plant competition patterns) that would be favorable for colonization by *Botrychium* spp. spores, as long as associated mycorrhizae and other microsite conditions are present (Farrar personal communication 2003c).

Skidding activity disturbances that do not occur when the ground is frozen could result in belowground disturbance that may impact some unknown individuals. Conversely, skidding may create conditions suitable for colonization sites for *Botrychium lineare* (Farrar 2003c).

Although specific data is lacking on the Black Hills National Forest for *Botrychium lineare*, the earlier successional conditions that occur with opening the overstory canopy could produce conditions that would be beneficial to site colonization by this wind-dispersed, spore-producing species, if the associated mycorrhizal species and other microsite conditions are present (Farrar 2004). Some portions of the ponderosa-pine stands of the Forest would be taken to a more open canopy condition under the various alternatives that could benefit *B. lineare* (i.e. ponderosa-pine seed and seed tree cuts – 10 to 40 basal area (BA) and 10 to 40 percent canopy cover resulting in structual stage 4A; patch clearcuts of ponderosa pine resulting in small openings grasses and forbs; hardwood restoration) if the *B. lineare* would occur in this ecological type. All alternatives are estimated to have very little difference in the amount of estimated structural stage 4A at 10 years following this amendment decision (31percent to 37 percent). However, Alternative 6 has

an estimated 13 percent of the ponderosa-pine area in structural stage 1 (grass/forb openings) with other alternatives ranging from eight percent for Alternatives 1 and 2 to only four percent in Alternative 3 and two percent in Alternative 4 at 10 years following the amendment decision. Benefits of opening the overstory canopy to Botrychium lineare through the use of vegetative treatments would be expected to have the most potential under Alternative 6.

Various acreages and intensities of disturbances are associated with Forest activities under the Phase II alternatives which may directly impact or eliminate *Botrychium lineare* individuals. Timber harvest, hardwood restoration, mechanical fuel reduction and prescribed burning, and precommercial thinning and areas for prioritization of activities do vary by alternative. The amount of livestock use does not vary by alternative but distribution of livestock will likely be expected to vary based on priority placement of activities.

Although uncertainty exists, weed competition as well as herbicide application are considered to be potential risks to *Botrychium lineare* (Beatty et al 2003, US Fish and Wildlife Service 2002, Farrar 2004). Herbicide sprayed during the period before *B. lineare* leaves emerge, or after the leaves have withered, is expected to have little to no direct effects on a *B. lineare* occurrence (Farrar 2004). Residual effects of herbicides to *B. lineare* or the associated mycorrhizae are unknown (US Fish and Wildlife Service 2002). If herbicide spraying would occur at an unknown occurrence site at the time aboveground portions of *B. lineare* could react to the herbicide (this would be in June based on the single occurrence information the Forest has), then a negative effect to those individuals would likely be realized. However, Dr. Farrar (2004) shared that there would likely be enough belowground spores, gametes, juveniles, etc. such that not all of any one occurrence would be affected by herbicide treatment. In addition, if a *B. lineare* occurrence may exist at a herbicide application site, the individuals would likely benefit from reducing weed competitors.

All Phase II alternatives target various levels of conservation and protection for Region 2 sensitive species from noxious-weed invasion and treatment. Objectives 231 is included in all alternatives to target the prevention to manage for 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, 4, and increased to a minimum of 8,000 acres in Alternative 6. Guideline 4303 revised the priority order of treatment of weeds, and first priority of treatment is to occur at Region 2 Sensitive and Species of Local Concern plants and snails. Under Guideline 4304 (Alternatives 1 and 2) was revised and elevated to a standard in Alternatives 3, 4, and 6, to using treatment methods that pose the least risk to the species being protected. Alternatives 1 and 2 do not require monitoring noxious weeds at Region 2 sensitive species sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious-weed competition. A standard (Standard 4300-1) was designed and included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to Region 2 sensitive plant species such as *Botrychium lineare*. 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 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. Further prevention of noxious weed invasion into native plant communities is targeted through the use of 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). Since noxious weed

occurrences and various other non-native invasive species are becoming more prevalent on the Forest (USDA Forest Service 2003b) and lands of other ownership, the assumption is that Alternatives 3, 4, and 6 would have present the least risk as compared to Alternatives 1 and 2 of indirect and direct effects to *B. lineare* from noxious weeds and their treatment.

Objective 200-4 was designed into Alternatives 3, 4, and 6 for the Phase II Amendment for conservation of species such as *Botrychium. lineare*, where the Black Hills occurrences are expected to be at higher risk from loss to high severity fire or other intensive disturbance events, whether it be natural or human induced. This objective provides for the collection of material from Black Hills for reintroduction efforts into occurrence sites that were lost to these events, and where it is likely that reintroduction efforts would be expected to be successful. No direction for collection of emphasis plant species material is included within Alternatives 1 and 2.

The Dugout Gulch *Botrychium lineare* occurrence is not located within any of the candidate RNAs and no beneficial or negative effects would be associated with any that may be proposed for designation in the Phase II Amendment Decision.

Basic monitoring direction for Region 2 Sensitive Species is provided in FSM 2670 and Chapter 4 of the LRMP (1997) and by the Phase I Amendment to the 1997 LRMP. However, the direction does not specify the type and level of information that is needed in the monitoring. Baseline data collection occurred at the occurrence location in 2003 before the species identity had been confirmed. A monitoring strategy has been designed and was used during the 2004 monitoring season for the Dugout Gulch *Botrychium lineare* occurrence. Monitoring is designed to continue to learn more about this species in the Black Hills and to detect and respond in a timely manner to changes in the extent and condition of the *B. lineare* occurrence (USDA Forest Service 2005b) if the changes are something that be responded to. Forest monitoring direction has been revised during this amendment process and is included in Chapter 4 of the LRMP, as amended by the Phase II amendment (refer to the Phase II amended Black Hills National Forest LRMP Chapter 4 for further discussion of monitoring direction). Information on the current monitoring design for *B. lineare* is provided in the Forest Plan Monitoring Implementation Guide (USDA Forest Service 2005b).

4-1.9.2 Cumulative Effects

The 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).

Since so little is known about this species, other than no confirmed reports have been documented below 5,000 feet within the general Rocky Mountain area occurrences, the spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995).

Complete distribution, abundance, microhabitat needs, and disturbance regime optimal for persistence of the narrowleaf grapefern are unknown. This lack of information makes it difficult

to predict what the cumulative effects on the species would be under any of the Phase II Amendment Alternatives. However, it is reasonable to assume based on what the Forest currently understands about the species that there may be at least a few scattered additional occurrences of this species in the Black Hills on private and public lands, and that they may be comprised of relatively small numbers of individuals. Past, present, and foreseeable future actions (as well as natural disturbances) likely have and could be expected to continue to have both beneficial or negative effects on some of these individuals or entire occurrences, while at the same time can contribute to site conditions suitable for colonization by *Botrychium lineare*, or helping to conserve or maintain existing habitat (e.g., reducing shrub encroachment at the occurrence location).

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Botrychium. lineare*. Therefore the least risk of adverse impacts to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *B. lineare* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.9.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Botrychium lineare* (narrowleaf grapefern) for all Phase II alternatives**.** Although risks to the species are uncertain, the rationale for this determination is that several standards and guidelines under each alternative address what are thought could be potential risks to this species, as described earlier. Another conservation strategy that varies by alternative provides for *ex situ* collections of plant material, and it is expected to be available for re-introduction if needed. Specifically, the above determination for *B. lineare* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations will be re-evaluated during any revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard-and-guideline direction listed above for the various alternatives will be applied or implemented as written.

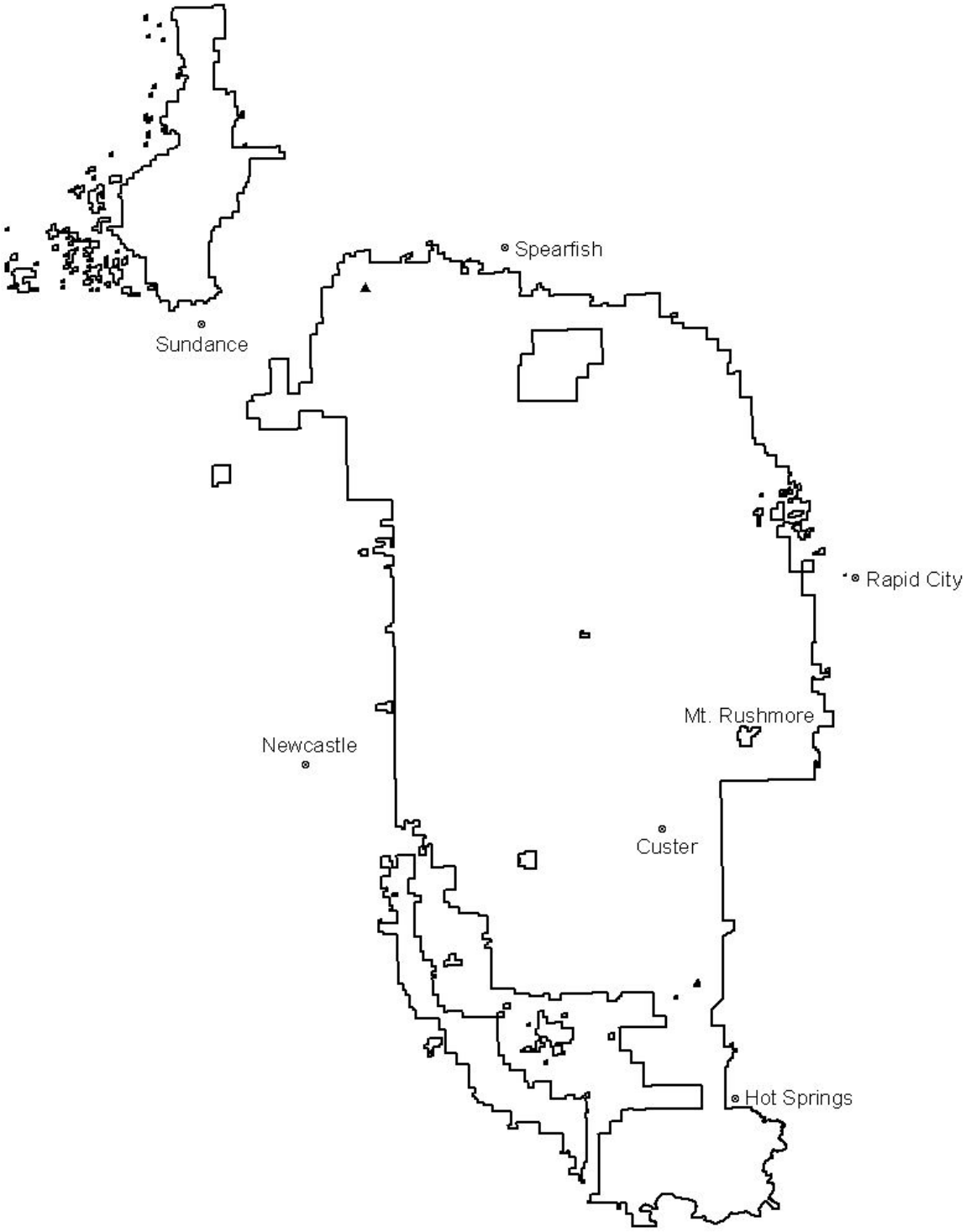
3. That regardless of which alternative is selected, the species will be monitored according to the current monitoring protocol (or as altered through reassessment with the Rocky Mountain Research Station), which is designed to detect and respond in a timely manner to changes in the extent and condition of the *Botrychium lineare* occurrence (USDA Forest Service 2005b).

4. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as the *Botrychium lineare* occurrence are the first priority for treating noxious weeds.

5. That plant material collected on the Forest can be used to successfully recolonize the (or portions of) *Botrychium lineare* occurrence in the event the site is lost.

6. That a limited number of *Botrychium lineare* individuals could be impacted from various disturbances, including but not limited to the following: long-term occurrence conservation efforts, conservation efforts targeted for other species, or from catastrophic events.

Distribution *Botrychium lineare* (Narrowleaf Grapefern) on lands administered by the Black Hills National Forest



4-1.10. *Botrychium campestre* (Iowa Moonwort)

The 1996 Final EIS Biological Assessment/Biological Evaluation to the 1997 LRMP (USDA-Forest Service 1996a Appendix H) and the Phase I Amendment Environmental Assessment Biological Assessment/Biological Evaluation (USDA Forest Service 2001a) provides an overview of prairie moonwort distribution and natural history and is incorporated by reference in the following discussion. A species assessment (Anderson and Cariveau 2003) was completed for the USDA Forest Service, Rocky Mountain Region and serves as a primary reference source for the following analysis.

Botrychium campestre (also known as prairie moonwort) is a North American endemic that ranges from the Canadian provinces of Alberta, Ontario, and Saskatchewan to Colorado, Iowa, Michigan, Minnesota, Montana, Nebraska, New York, North Dakota, South Dakota, Wisconsin, and Wyoming (Flora of North America 1993). It is considered an uncommon species with a very patchy widespread distribution (Anderson and Cariveau 2003). *B. campestre* is a grassland species originally described from the loess prairies of Iowa and dune habitats around the Great Lakes (Lellinger 1985). It reaches the southern edge of its range in Region 2 and occurs at only a few scattered sites within the region (USDA-Forest Service 2004j). In the Black Hills, there is a historic voucher record (1973) from a single occurrence in ponderosa-pine forest at 5,000 feet elevation in the Bearlodge Mountains in Crook County, Wyoming (USDA Forest Service 2004j). The closest other documented *B. campestre* occurrences to the Black Hills are from plains along the Missouri River area of eastern South Dakota and from the Bonny Prairie Natural Area on the plains of northeastern Colorado. Currently, the verified locations of *Botrychium campestre* are known from elevations of 5,000 feet or lower.

Despite a number of documented relocation survey efforts at the Bearlodge Mountains location on the Forest (1989, 1993, 1999, 2001, 2002, 2003 and 2004), the species has not been relocated (USDA Forest Service 2004h, Wyoming Natural Diversity Database 2000). However, other *Botrychium* species, verified by visual identification and enzyme electrophoretic analysis by Dr. Donald Farrar (Iowa State University), have been documented at the historic occurrence location for *Botrychium campestre*. In addition to the specific relocation survey efforts at Bearlodge Campground, the Forest pursued an agreement with Iowa State University to search for *Botrychium* species during June of 2004 and to complete laboratory analyses (winter of 2004-2005) on any plants collected to continue to add to *Botrychium* species status and distribution information in the Black Hills National Forest. None of the plants collected in 2004 were *B. campestre* based on the laboratory analyses completed at Iowa State University. The agreement with Iowa State University was extended for similar survey and collection during the likely emergence period in 2005 with laboratory analyses expected to be completed the winter of 2005-2006.

Members of the genus *Botrychium* (moonworts) can be difficult to identify to species level. Morphology is variable within species, and differences between species can be subtle. Recent research being completed by Dr. Donald Farrar (Iowa State University) is revealing genetic similarity between *B. campestre* (prairie moonwort) and *B. lineare*. Dr. Farrar plans to continue analyses to resolve whether the taxa warrant taxonomic separation (Farrar 2003d). Dr. Farrar examined the material that was collected from the Bearlodge Mountains in 1973 and stated that based on visual morphological characteristics the voucher looks much more like *Botrychium*

campestre than any of the other *Botrychium* individuals located in 2003 (Farrar 2003b*).* However, a *Botrychium* individual collected in Dugout Gulch in the Black Hills in 2003 also had morphological characteristics of *B. campestre* but was determined to be *B. lineare* through enzyme electrophoretic analysis (Farrar 2003a). The 1973 dry voucher material cannot be used for this type of analysis (requires material from fresh plant tissue), and any species determination can only be limited to morphological characteristics of the specimen. Hence, based on the recent issues of variances in morphological characteristics between *Botrychium* species, the question exists (USDA Forest Service 2004j) as to whether *B. campestre* ever occurred historically or will be confirmed to occur on Black Hills National Forest administered lands.

The currently assigned *Botrychium campestre* global rank is rare (G3); it is currently assigned a rank of "critically imperiled" in Wyoming (the Wyoming rank is based on the historical 1973 collection that is now being questioned) and is unrankable (SU) in South Dakota (NatureServe 2005, South Dakota Natural Heritage Program 2004, Wyoming Natural Diversity Database 2003, Anderson and Cariveau 2003).

Botrychium campestre is a small perennial fern about two to seven inches tall that is divided into a vegetative frond-like structure and a spore-bearing segment. It is most similar to *Botrychium lineare* (narrowleaf grapefern), differing in vegetative leaf morphology (Anderson and Cariveau 2003).

Life cycles of members of the genus *Botrychium* (moonworts) are similar, and it can be assumed that features common to the genus apply to prairie moonwort. As in all ferns, the life cycle consists of two major stages: the diploid spore-producing stage represented, in part, by the structure described above and a cryptic haploid stage (Anderson and Cariveau 2003).

Botrychiums are dependent on mycorrhizal fungi in the soil for water and nutrient uptake. This relationship also allows moonworts to remain dormant (no emergence of visual above-ground plant structures) for several years. Because mycorrhizal function is dependent on adequate soil moisture, mycorrhizae are probably the most important limiting factor for *Botrychium* establishment (Anderson and Cariveau 2003).

Rangewide, *Botrychium campestre* is inconspicuous (often less than three inches in height; only visible for a few weeks in the early April to early June and often grows among much taller vegetation) and is considered a grassland species, associated with sandy grassland habitats in prairies, dunes, railroad sidings, and fields over limestone (Flora of North America 1993). The 1973 single reported occurrence in the Black Hills is in ponderosa-pine forest. This habitat is unlike habitat elsewhere in the species range, except for the sandy soil conditions, from where the species identity has been confirmed by enzyme electrophoresis analyis This confounds understanding of its habitat and distribution on the Forest (USDA-Forest Service 2001c) and continues to further support the questions raised on the identity of the 1973 collection at the site.

4-1.10.1 Direct and Indirect Effects

In general, the effects of proposed alternatives and management activities on *Botrychium campestre* cannot be adequately addressed because so little is known about the species distribution and any associated habitat conditions in the Black Hills (USDA-Forest Service

2000b, 2001a) and because the Bearlodge Mountain historical *Botrychium* collection identity from the Bearlodge is now being questioned regarding identity (USDA Forest Service 2004j). Personal contact regarding Mountain-various *Botrychium* species has occurred with Dr. Don Farrar, who is recognized for his work with *Botrychium* species in North America, with one of his major focus species being that of *Botrychium campestre*. In addition, Dr. Farrar has specific experience with *Botrychium* species in the Black Hills.

Although it is uncertain what elevation range *Botrychium campestre* can inhabit, it has not been documented to occur above 5,000 feet from verified locations elsewhere in the Rocky Mountain Region. Approximately 67 percent of Black Hills National Forest lands are above 5,000 feet, and that area of land may be too high to support associated conditions for the species. As with other Region 2 sensitive species, if the species is located on the Forest, conservation measures and protection as identified in the various alternatives would apply, and would be expected to result in avoidance of effects or reduction in effects to *B. campestre*.

Farrar (2004) has shared that it is important to maintain the same level of disturbances as what has been occurring at *Botrychium* (such as *B. campestre*) locations for the past several years. Farrar's statement is supported through the recent (2003 and 2004) number of documented Botrychium individuals that have colonized a variety of past disturbance locations in the Black Hills (i.e. skid trails, old native surface roads, game trails). Anderson and Cariveau (2003) also document the species colonizing disturbed locations. A species evaluation recently prepared for the Region, questions that rather being vulnerable to habitat alterations, if the species is actually tolerant of or dependent on grazing, fire, and other localized soil disturbance (USDA Forest Service 2004j).

The amount of livestock use does not vary by alternative for the Phase II alternatives. In discussing effects from cattle use in active allotments, an occasional aboveground *Botrychium campestre* individual may receive a direct effect if trampled by cattle but individuals would likely not be grazed because of the plants' small stature. In addition, the above-ground phase of the plant is from early April to early June (Anderson and Cariveau 2003); therefore, with most Forest pastures not receiving use until mid-June or later, it is generally unlikely that most above ground structures of *B. campestre* would be subject to grazing or trampling effects. In addition, there would likely be enough belowground spores, gametes, juveniles, etc. such that not all of any one occurrence would be affected by livestock trampling. Cattle are restricted from accessing a number of areas on the Forest by fences, topography, and limitations on water availability. Authorized cattle are further restricted on six currentlyvacant allotments in the north to northeastern portion of the Forest and a closed allotment in the central granitic core of the Forest, along with other areas where cattle are prohibited on the Forest. The majority, if not all, of these allotments and restricted areas are expected to remain vacant or closed into the future. Therefore, no effects from cattle, whether adverse direct effects or beneficial indirect effects, such as through providing colonization sites, would be expected within these Forest locations.

Although it is uncertain, another similarity to *Botrychium lineare* is that *Botrychium campestre* have persisted with disturbances in other areas of its range and has been documented a number of times to colonize of disturbed areas (Farrar 2004). Despite the fact that aboveground stems may be negatively affected, beneficial short- and long-term effects may be realized by the prescribed burning on the Forest. Dr. Farrar (2004) indicated that when a *Botrychium* occurrence has

aboveground growth, a fast moving fire may not negatively impact it. The fire may remove aboveground stem portions but would not be expected to affect belowground individuals or parts. Dr. Farrar shared that an area reviewed after a fire had an increase in the number of *Botrychium* spp. stems. Dr. Farrar indicated that burning may release more nutrients to the soil that may immediately benefit the mycorrhizae and *Botrychium* species. He said this would be consistent with observations of other fungi that "flush" after fires. Prescribed fire may provide the disturbance needed for site colonization. It can be assumed that an intense fire (from wildfires or a high intensity prescribed burn) that may have high severity effects, such as deep soil heating, could negatively affect both the belowground and aboveground portions of *B. campestre* individuals. An experimental burn has been offered as a way to manage habitat for *B. campestre* on the Bonnie Prairie Natural Area in Colorado (Anderson and Cariveau 2003). Objective 200-5 was included in Alternatives 3 and 6 to target the creation or maintenance of low crown-fire hazard conditions adjacent to emphasis plant species. This conservation strategy was developed to increase the likelihood of dropping crownfires to the ground before reaching sensitive plant occurrences, to reduce the risk of loss of occurrences. If *B. campestre* were located on the Forest, it is anticipated that this objective would be targeted for implementation next any documented occurrence. Actions successful in achieving this objective under Alternatives 3 and 6 adjacent to any located *B. campestre* occurrence would be expected to reduce the likelihood of loss associated with a high intensity fire.

At this time, no occurrences of *B. campestre* are known to be located within 1.5 miles of any of the currently designated ARC (Appendix G: Map G-6 At-risk Communities and Wildland-Urban Interface); therefore, no effects would be expected from the fuel-reduction activities associated with those communities (refer to Appendix B of the FEIS for At-risk-Communities and the Wildland-Urban Interface discussions). In addition to treatments for fuel-reduction activities around ARC, various levels of timber harvest and associated activities would take place under all alternatives. If there was an unknown site occurrence it is possible that it could expand, if present, or site conditions could be altered as a result of some level of disturbance by either fuel treatments or timber harvest activities (i.e. earlier successional conditions including shrub shade reduction, disturbed site conditions, and changes in plant competition patterns) that would be favorable for colonization by *Botrychium* spp. spores, as long as associated mycorrhizae and other microsite conditions are present (Farrar 2003c). Skidding activity disturbances that do not occur when the ground is frozen could result in below-ground disturbance that may impact some unknown individuals. Conversely, skidding may create conditions suitable for colonization sites for *Botrychium campestre* (Farrar 2003c).

Although specific data is lacking on the Black Hills National Forest for *Botrychium campestre*, the earlier successional conditions that occur with opening the overstory canopy could produce conditions that would be beneficial to site colonization by this wind-dispersed, spore-producing species if the associated mycorrhizal species and other microsite conditions are present (Farrar 2004). Some portions of the ponderosa-pine stands of the Forest would be taken to a more open canopy condition under the various alternatives that could benefit *Botrychium campestre* (i.e. ponderosa-pine seed and seed tree cuts – 10 to 40 basal area and 10 to 40 percent canopy cover resulting in structual stage 4A; patch clearcuts of ponderosa pine resulting in small openings grasses and forbs; hardwood restoration) if *B. campestre* would occur in this ecological type. All alternatives are estimated to have very little difference in the amount of estimated structural stage 4A at 10 years following this amendment decision (31 percent to 37 percent). However,

Alternative 6 has an estimated 13 percent of the ponderosa-pine area in structural stage 1 (grass/forb openings) with other alternatives ranging from eight percent for Alternatives 1 and 2 to only four percent in Alternative 3 and two percent in Alternative 4 at 10 years following the amendment decision.. Benefits of opening the overstory canopy to *B. campestre* through the use of vegetative treatments would be expected to have the most potential under Alternative 6. Various acreages and intensities of disturbances are associated with Forest activities under the Phase II alternatives which may directly impact or eliminate *Botrychium campestre* individuals. Timber harvest, hardwood restoration, mechanical fuel reduction and prescribed burning, and precommercial thinning do vary by alternative with the greatest total number of acres affected associated with Alternative 6 (more than double the number of acres of any other alternative) followed by Alternative 3, with Alternatives 1, 2 and 4, targeting fewer hardwood restoration acres. (see Appendix B) of the FEIS for estimated treatment acres by alternative). Therefore, the greatest likelihood of directly impacting an individual would be alternatives with the most activities (e.g., Alternative 6). Thus, there are both risks and potential benefits from these activities.

There is no data suggesting a direct impact of weeds on *Botrychium* species, but their mutural affinity for disturbance may cause *Botrychium* species and their habitats to be vulnearable to negative impacts from weeds. Although uncertainty exists, herbicide applications could be considered to be potential risks to *Botrychium campestre* (Farrar 2004). Herbicide sprayed during the period before *B. campestre* leaves emerge, or after the leaves have withered, is expected to have little to no direct effects on *B. campestre* occurrences (Farrar 2004). If herbicide spraying would occur at an unknown occurrence site at the time above-ground portions of *B. campestre* could react to the herbicide, then a negative effect to those individuals would likely be realized. However, Dr. Farrar (2004) shared that there would likely be enough belowground spores, gametes, juveniles, etc. such that not all of any one *Botrychium* occurrence would be affected by herbicide treatment. In addition, if a *B. campestre* occurrence may exist at a herbicide application site, it is expected that *B. campestre* individuals would likely benefit from the reduction of competitive weeds.

All Phase II alternatives target various levels of conservation and protection for Region 2 sensitive species from noxious-weed invasion and treatment. Objectives 231 is included in all alternatives to target the prevention and to manage for 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 of 8,000 acres in Alternative 6. Guideline 4303 revised the priority order of treatment of weeds, and first priority of treatment is to occur at Region 2 sensitive and Species Of Local Concern plants and snails. Guideline 4304 (Alternatives 1 and 2) was revised and strengthened to a standard in Alternatives 3, 4, and 6, to using treatment methods that pose the least risk to the species being protected. Alternatives 1 and 2 do not require monitoring noxious weeds at Region 2 sensitive species sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed competition. A standard (Standard 4300-1) was designed and included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to Region 2 sensitive plant species such as possible to *Botrychium campestre*. 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 to require that the seed be tested at time of purchase to confirm that the seed is weed-free. To further target the prevention of noxious weed

invasion into native plant communities is through the practice of 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). Since noxious weed occurrences and various species are becoming more prevalent on the Forest (USDA Forest Service 2003b) and lands of other ownership, the assumption is that Alternatives 3, 4, and 6 would have a greater reduction in risk of indirect and direct impacts to any potential occurrences of *B. campestre* that may be located from noxious weeds and their treatment.

The following objective is not yet applicable since there are no known occurrences of *B. campestre*. If the species was ever located then Objective 200-4 ,which was designed into Alternatives 3, 4, and 6 for the Phase II Amendment for conservation of species that may be at risk from loss to high severity fire events or intense disturbance events, whether it be natural or human induced, may benefit the species. This objective provides for the collection of material from Black Hills for reintroduction efforts into occurrence sites that were lost to these types of events, and where it is likely that re-introduction efforts would be expected to be successful. *B. campestre* is not currently known to be successfully cultivated (Anderson and Cariveau 2003). No direction for collection of emphasis plant species material is part of either of the No Action alternatives (Alternatives 1 and 2).

Since there are currently no genetically confirmed *Botrychium campestre* occurrences located on the Forest, a Phase II Amendment Decision to propose any of candidate Research Natural Areas (RNAs) is not considered to have beneficial or negative effects to this species. Anderson and Cariveau (2003) state that vegetative succession may lead to unsuitable conditions and Farrar (2000) has stated that it is important to conserve the more open vegetative successional conditions (i.e. removing shrub and tree canopies that begin to encroach) within any *B. campestre* occurrences that may be located. Since management of RNAs would not likely be expected to include this type of vegetative canopy removal (see Appendix D Management Area 2.2 Goals, Objectives, Standards and Guidelines), designation of any area as a RNA where a *B. campestre* occurrence may be located could actually be expected to result in long term indirect negative effects from potentially developing closed canopy later successional vegetative conditions. If natural disturbance processes, such as fire that consumed overstory canopies occurred in any designated RNA where *B. campestre* may eventually be discovered, it is expected that suitable conditions for colonization could potentially become available for the species, provided other microsite conditions were present (such as the presence of mycorrhizae). Positive effects could be that off road vehicle use and other activities that could potentially directly impact individuals would be restricted from any designated RNAs. Nine candidate RNAs are included in Alternative 4, four candidate RNAs are included in Alternative 6 (identified as the preferred alternative), and four candidate areas are included Alternative 3. No candidates are included within the Phase II Amendment No Action Alternatives (Alternatives 1 and 2.)

If aboveground individual *Botrychium* plants are located in the future that display identification characteristics of *Botrychium campestre*, plans are to collect samples for lab analysis for identity verification. If aboveground portions of the individuals are collected using the methodology that Dr. Farrar shared with the Forest, leaving below ground portions of the plant intact, collection for identification is expected to result in little effects to *Botrychium campestre*.

No monitoring protocols for *Botrychium campestre* are included in the current Forest Plan Monitoring Implementation Guide (USDA Forest Service 2005b) since there are no currently verified or known occurrences to monitor. If the species continues to remain on the USDA Forest Service Region 2 sensitive species list and an occurrence would be verified on the Black Hills, monitoring would be expected to be developed based on direction for monitoring Region 2 Sensitive species provided in Chapter 4 of the LRMP (1997), revised by the Phase I amendment, and as revised through this Phase II amendment.

4-1.10.2 Cumulative Effects

The 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).

Since so little is known about this species, other than no confirmed reports have been documented above 5,000 feet, the spatial scale for cumulative effects analysis of Phase II Amendment alternatives for this plant species generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995).

Distribution, abundance, microhabitat needs, and disturbance regime optimal for persistence of the *Botrychium campestre* in the Black Hills are unknown. This lack of information, along with no currently verified known occurrences or a viable population existing on the Hills, makes it difficult to predict what cumulative effects could be expected to *B. campestre* on the Forest.

Historic conditions in the Black Hills (prior to European settlement in the Black Hills) were associated with more openings and less dense canopy conditions. Because of unsuitable conditions associated with later successional conditions for this species (Anderson and Cariveau 2003), historically suitable habitat may no longer exist due to fire suppression and other activities that have led to a denser Forest condition (refer to the Disturbances and Fire sections of Chapter 3 of the FEIS). Recent large fires during the dry years since 2000 that have resulted in more than 10percent of land administered by the Black Hills National Forest (as well as thousands of acres in lands of other ownerships within the Black Hills were burned) may have burned individuals if they existed; however, these fires have likely created suitable open canopy conditions and soil disturbances that could be colonized by the species providing the appropriate microsite conditions and mycorrhizae are present. Future fires would be expected to have similar effects.

It is unknown if occurrences or habitat is available on private land or other land ownerships. However, private and state lands on the low-elevation open prairies would likely have more habitat conditions similar to where the species occurs elsewhere compared to the majority of habitat conditions (i.e. with tree canopies) located on the majority of the Forest. Actions on the large proportion of private land in and adjacent to the Black Hills and their effect on potential *Botrychium campestre o*ccurrences at those sites are unknown. However, there is a high rate of development occurring on private lands in the northern Black Hills, as evidenced by new construction on those lands, and development (i.e. houses, commercial buildings, sheds, paved or

rocked access roads) could result in direct impacts to the species if it would occur in those specific development locations.

Activities and effects on *Botrychium campestre* were discussed in the section based on the current locations of designated ARC (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 ARC (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface 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 and types of fuel reduction treatments used.

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such as *Botrychium campestre*. Therefore, if the species is ever verified to occur on land administered by the Black Hills National Forest the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence if *B. campestre* would be verified to occur here is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.10.3 Determination and Rationale

Making a determination for a species such as *Botrychium campestre*, where no current occurrences are known on the Black Hills and where a viable Black Hills landscape population is not known to exist, is difficult and can only be built on many more uncertainties and assumptions as compared to species with documented occurrences for the Black Hills. However, since a number of other *Botrychium* species occur in the Black Hills, along with the genetically similar species, *Botrychium lineare*, an analysis of potential or expected effects along with a determination was made using one of the four written determination options provided by the Region (USDA Forest Service 2005c) and that was thought to be appropriate in this programmatic level document. Unless an occurrence of *B. campestre* is located on the Black Hills, no additional documentation of potential effects or a determination will be included in project level documents that would tier to the Phase II Amendment Biological Assessment/Biological Evaluation, or the 1997 Black Hills National Forest Land and Resource Management Plan as amended by the Phase II Amendment Decision.

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 (USDA Forest Service 2005c) is made for *Botrychium campestre* for all Phase II alternatives. The rationale for this determination is that if *B. campestre* does in fact occur on the Black Hills National Forest, it benefits from many of the same standards, guidelines, and activities that benefit other moonwort species (e.g., efforts to reduce high intensity wildfires that might otherwise sterilize the soil) and that these benefits would offset the associated risks. Since moonwort species often co-occur in mixed occurrences, *B. campestre* may not yet have been detected within known occurrences of these other species, which are expected to receive management attention designed to conserve occurrences. Furthermore, ongoing inventory and monitoring efforts will likely continue to

locate additional occurrences of designated Region 2 Sensitive *Botrychium* species, which will be subject to the protective standards and guidelines discussed above. In addition, if *B. campestre* is confirmed to occur on the Black Hills National Forest, materials will be targeted for collection for *ex situ* storage and potential reintroduction (though the technology for such reintroduction is as yet unproven). Specifically, the above determination for *B. campestre* is based upon the following assumptions:

1. The life cycle of *Botrychium campestre* is similar to that of other moonworts.
2. Although there are no currently known occurrences, the species could be present at lower elevations.
3. The limiting factors are likely the presence of appropriate habitats and mycorrhizal fungi.
4. The species is associated with or tolerant of localized soil disturbance and opening the forest canopy may encourage establishment.

No general distribution figure is included since the species is not currently known to occur on the Black Hills National Forest.

4-1.11. *Viola selkerkii* (Selkirk's Violet)

The Revised Forest Land and Resource Management Plan (LRMP) Biological Evaluation (BE) (USDA Forest Service 1996a Appendix H) and the LRMP Phase I Amendment BE (USDA-Forest Service 2001c) give an overview of *Viola selkirkii* (Selkirk's violet/Great-spurred violet) distribution and natural history, and this information is incorporated by reference. However, based on the location of a number of new occurrences, baseline data collection and monitoring efforts that have occurred since 2000, more is known about the species occurrences and distribution in the Black Hills. A recent assessment of *Viola selkirkii* on the Forest has also recently been completed (Hornbeck et al. 2003d). This assessment provides detailed information on this species; most of the information in this section is taken from that assessment.

Viola selkirki (also known as great-spurred violet in addition to the common name listed above) is a circumboreal herbaceous species. In North America, it occupies boreal regions south to Pennsylvania, Minnesota, and British Columbia, with disjunct occurrences in the Black Hills of South Dakota and the Rocky Mountains of Colorado and New Mexico (Hornbeck et al. 2003d). Throughout the species' range, it is locally abundant in specialized microsites in coniferous and deciduous forests. The closest occurrences to the disjunct Black Hills occurrences are in the Colorado Rocky Mountains. In the Black Hills, *V. selkirkii* is restricted to cold, shaded ravines in spruce-dominated forests from 5,400 to 7,000 feet elevation (Hornbeck et al. 2003d). Prior to the spring of 2003, there were 10 known occurrences of *V. selkirkii* in the Forest, all in South Dakota, comprised of eight sites in the Black Elk Wilderness and two in the Norbeck Wildlife Preserve (Hornbeck et al. 2003d). In 2003 another new occurrence was documented in the Norbeck Wildlife Preserve, and two additional occurrences were located in 2004 in the Upper Pine Creek Research Natural Area on the Black Hills National Forest. In addition to those on lands administered by the Black Hills National Forest, seven occurrences have been reported from Custer State Park (Hornbeck et al. 2003d). In 2004, an occurrence was observed on lands administered by Mount Rushmore National Memorial (Mayer, personnel communication 2004).

There are no known occurrences on private lands within the Black Hills (Hornbeck et al. 2003d). In total, there are 21 occurrences of *V. selkirkii* reported for the Black Hills area, 13 of which are on lands administered by the Black Hills National Forest (USDA Forest Service 2005b).

The global rank for this primarily northern species is demonstrably secure (G5), although it may be rare at the edges of its range where microhabitat requirements may occur less often. The southern occurrences of northern species are often more disjunct and may be smaller in size, often limited by the availability of cooler and moister conditions, as may likely be the case with *Viola selkirkii* occurrences in the Black Hills. As is common with a number of these northern species with a limited number of disjunct occurrences at the southern end of their range, the last updated assigned South Dakota rank for *Viola selkirkii* was "critically imperiled" due to extreme rarity (S1) (NatureServe 2005, Hornbeck et al. 2003d). However, the last update on that ranking was assigned in April 2002 (South Dakota Natural Heritage Program 2004) prior to many of the 21 occurrences being located. Based on South Dakota Natural Heritage ranking definitions (South Dakota Natural Heritage Program 2004) it can be expected that when rankings are adjusted, *V. selkirkii* will likely be assigned a new State rank of S2 or S3.

The occurrences of *Viola selkirkii* on the Black Hills National Forest are located in Forest Management Area (MA) 1.1A – Black Elk Wilderness (10 occurrences or approximately 77 percent of the occurrences) and MA 5.4A – Norbeck Wildlife Preserve (3 occurrences or approximately 23 percent of the occurrences) (USDA Forest Service 2005d).

Viola selkirkii is a small, spring-flowering, perennial herb that spreads vegetatively by long slender rhizomes. The small, scalloped, overlapping lobes on its heart-shaped leaves and a floral spur that is relatively long, thick and bluntly rounded are two of the key characteristics of the species. A flower is required to correctly identify *Viola selkirkii*. Pollinators are uncertain, but it may be pollinated by subalpine butterflies (Hornbeck et al. 2003d). Seeds are dispersed by explosion of the fruiting capsule and by ants, which feed on the lipid-rich cresent (Hornbeck et al. 2003d).

In the Black Hills, *Viola selkirkii* occurs in treeless microhabitats that are sheltered by large rock formations within a matrix of mature spruce forest on soils derived from granitic parent material (Hornbeck et al. 2003d). It is commonly found in association with rotting logs and stumps, or on moss mats on rock outcrops (USDA Forest Service 2001c). In the Forest, all known occurrences of *V. selkirkii* are locally dense. During baseline data collection of eight occurrences in the Black Elk Wilderness in 2002 the number of individuals at sites ranged from 11 to more than 1,000 ramets; three occurrences in the Norbeck Wildlife Preserve are estimated at 250, 500 and 600 ramets (USDA Forest Service 2005d, Hornbeck et al. 2003d). In 2004, one of the two occurrences (near the 2003 Elkhorn Fire) in the Upper Pine Creek Research Natural Area was estimated to have between 501-1,000 ramets. The other Upper Pine Creek RNA occurrence had an estimated range of of 1,001-10,000 individuals (USDA Forest Service 2004e).

4-1.11.1 Direct and Indirect Effects

3-1.1 On the Forest, *Viola selkirkii* is relatively secure from most potential risks, with the potential exception of an extreme climatic change. The 10 previously known occurrences on Black Hills National Forest lands are not currently at risk from management activities (i.e. timber

management and grazing are not currently occurring at known occurrences) but may be vulnerable to impacts from hikers and rock climbers in the future. In addition, invasion by noxious weeds or other exotic plant species and efforts to control them, trampling or browsing by elk (*Cervus elaphus*) or mountain goats (*Oreamnos americanus*), and future fire suppression efforts are potential risks at some sites. Naturally occurring periodic flooding may reduce the size and extent of some patches, but may create habitat for others. The new occurrence found in 2003 is made up of two primary sub-populations. One of the sub-populations is located along a small creek approximately 30 meters from a permitted summer cabin in the Norbeck Wildlife Preserve. The other sub- population is located upstream near the Custer State Park boundary and near the Sunday Gulch Trail. There were no observed trampling effects to the occurrence documented at the time baseline data were collected; however, it is recognized as a potential risk because of the proximity to the cabin and the trail. In addition, a portion of the population is under an electric utility line, and maintenance activities have occurred (tree trimming below). Some of the *V. selkirkii* plants occur in the slash created by trimming trees along the utility line. The two occurrences found in 2004 are in the Upper Pine Creek RNA, in high altitude areas that do not receive much recreational use. One is located within the Elkhorn Mountain Fire area (fire occurred in 2003), but does not appear to have been adversely affected by the fire (USDA-Forest Service 2004e).

The persistence of *Viola selkirkii* on Forest Service-administered land is not currently at risk from livestock grazing (Hornbeck et al. 2003d). The new sites that have been located since the species assessment was written (Hornbeck et al. 2003d) are in areas of the Forest where livestock grazing is not permitted. High concentrations of wildlife species, particularly elk and mountain goats, have the potential to damage *V. selkirkii* individuals directly by trampling and indirectly through effects on its habitat. Evidence of past wildlife or livestock use has been noted at two of the occurrences in the Black Hills National Forest. Although there is the potential for wildlife trampling or browsing at all sites, the odds of an occurrence being eliminated is judged to be low (Hornbeck et al 2003d).

Timber harvest is generally not deemed a risk to the persistence of *Viola selkirkii* because occurrences are currently being avoided, project harvest activities include mitigation to reduce direct and indirect effects, or vegetative treatments may be designed to provide beneficial long-term indirect effects for the species (i.e. reduce risk from high intensity fire events).

Off-road vehicle use is prevalent in the Black Hills and continues to increase. The one *Viola selkirkii* occurrence that has site characteristics that could be expected to potentially experience illegal off-road vehicle use is the site identified as “Violet Valley.” This area is located in the Norbeck Wildlife Preserve where off-road vehicle use is prohibited (see Management Area 5.4A). However, recent vegetation treatment activities that have reduced tree basal areas have increased access potential in the Norbeck Wildlife Preserve (some treatment areas are adjacent to the “Violet Valley” *V. selkerkii* occurrence) that could be expected to allow for easier access by tresspass off-road vehicle use, which could result in direct adverse effects to portions of that occurrence that is located on mesic benches above the stream.

Various disturbances that may result in negative direct effects to individuals include: trampling by recreationists, off-road vehicle use, Forest Service monitoring activities, or wildlife, fire line creation, fuel reduction activities within the WUI (see Phase II FEIS glossary), vegetation treatment to remove encroaching conifers to conserve and target regeneration of hardwood

habitat associates, herbicide treatments, clearing under power lines (specifically the Sunday Gulch occurrence), trail maintenance/reconstruction and *Viola selkirkii* individuals collected for herbarium vouchers or harvested by unauthorized collectors. 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, large scale climate changes, high severity fire events, flooding events, or by fire suppression efforts.

Recognizing noxious weeds and other invasive plants, and their treatment, could be expected to be a primary risk to the long-term persistence of *Viola selkirkii* on the Black Hills, conservation strategies and measures to address and reduce direct and indirect effects are given priority discussion in this section. All alternatives propose various levels of protection for Region 2 sensitive species from noxious-weed invasion and treatment. Objectives 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 further increased to a minimum of 8,000 acres in Alternative 6. Guideline 4303 revised the priority order for treatment of weeds, and first priority of treatment is to occur at Region 2 sensitive and Species Of Local Concern plant and snail occurrences. Guideline 4304 (Alternatives 1 and 2) was revised and elevated to a standard in Alternatives 3, 4, and 6, to require treatment methods that pose the least risk to the species being protected. Alternatives 1 and 2 do not include monitoring of weed control effectiveness at Region 2 Sensitive species sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed competition. Standard 4300-1 specifies this type of monitoring and was included in Alternatives 3, 4, and 6 to further address the risk that noxious-weeds present to sensitive plant species such as *V. selkirkii*. 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 to require that the seed be tested at time of delivery to confirm that the seed is weed-free. A The prevention of noxious-weed invasion is further targeted in native plant communities by revegetating with native species as Guideline 1110 in Alternatives 1 and 2. The original guideline was revised and was strengthened to Standard 1110 in Alternatives 3, 4, and 6. Alternatives 3, 4, and 6 are expected to have the lowest risk of indirect and direct negative effects to *Viola selkirkii* 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 3-6.3 of the FEIS.

The effects of wildfire, wildfire suppresion, or fire and fuel reduction on *Viola selkirkii* are not known; the species appears to benefit from the build up of woody debris. The increased density of trees that results from fire suppression could affect the species by reducing groundwater flow into its habitats, which could result in fewer flood events and/or reduce the quantity and quality of its habitats. The risk of fire or flooding at known occurrences is variable, depending upon the characteristics of the site and the surrounding landscape. Fire is a greater risk to those sites with dense conifer stands nearby, but most occurrences are in treeless habitats that are sheltered by large rock formations that may exclude fire (Hornbeck et al 2003d). Because of the risk associated with catastrophic fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of occurrences that could be at risk to high intensity 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 Region 2 sensitive plant species, such as *V. selkerkii*. Alternative 3 is expected to provide the greatest

likelihood of creating conditions that would be successful for dropping crown fires to the ground because it would create or maintain low crown fire hazard conditions near sensitive plant occurrences and botanical areas. A greater risk of crown fires affecting crown fires is associated with Alternative 6 because it targets creation of a moderate to low crown fire hazard near those locations, instead of low hazard, therefore conditions for a higher intensity fire near emphasis plant species occurrences and associated effects to the plants could be expected to occur through implementation of Alternative 6, as compared to implementation of the objective for Alternative 3. Implementation of the objective under either alternative near the *V. selkerkii* occurrences located in Norbeck Wildlife Preserve is expected to decrease fire effects (greater reduction under Alternative 3) and benefit those occurrences during fire events. No high intensity fire reduction treatments would be expected to occur in areas near the occurrences located in the Wilderness. This objective is not part of Alternatives 1, 2 or 4 therefore the greatest risk of high intensity fires, such as crown fires, to emphasis plant species would be expected to be associated with these alternatives. Alternatives 3 and 6 provide more fire-related protection to the Region 2 sensitive species with Guidline 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 degradation by wildfire suppression efforts. In Alternatives 3 and 6 the protection is extended to Region 2 Sensitive species such as *V. selkirkii*. In addition, Standard 3200-03 states that wildfire suppression camps will not be placed at known mapped Region 2 Sensitive species locations. Alternatives 1 and 2 do not contain this standard. Most of the occurrences are located within bouldery, rocky areas that are not expected to be selected for fire camps. However, the two lowest elevation occurrences have some individuals that extend into some flat areas, or onto some gentler slopes nearby. Although the standard would have limited applicability at the majority of the occurrence locations, it may be beneficial to the two lower elevation occurrences if a fire is located nearby.

When there is recreation in an area, there is the potential for plant collecting to become a risk to the species, especially for a showy species such as *Viola selkirkii.* Standard 3119 is included in Alternatives 3 and 6 to restrict the collection of sensitive 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.

Additional standards that address the potential risks to *V. selkirkii* from recreation include Standard 1.1A-1202, Standard 5205 and Standard 5200-01. Standard 1.1A-1202 (Alternatives 3 and 6) states that if trails are to be constructed or relocated, route them away from Region 2 sensitive and Species Of Local Concern (SOLC) plant occurrences and do not increase climbing access over what currently exists where Region 2 Sensitive or SOLC plants occur. Some *V. selkirkii* occurrences may be vulnerable to impacts from hikers and rock climbers in the future, this standard will help to protect them. Alternatives 1, 2, and 4 do not include this standard. In Alternatives 1 and 2, Standard 5205 require that facilities and access be designed to provide site

protection, efficient maintenance and user convenience. In Alternatives 3, 4, and 6 Standard 5205 has been strengthen by adding that facilities and access also be designed to restrict access or route recreational use away from Region 2 Sensitive species that are located within or immediately adjacent to developed recreation sites. Standard 5200-01 (Alternatives 3 and 6) prevents new developed recreation sites from being located in or immediately adjacent to known locations of Region 2 Sensitive plants, such as *V. selkirkii*.

Although there is no expectation that all occurrence sites would be lost at any one time (Hornbeck et al. 2003d), should an occurrence be lost to a high severity fire or some other intense disturbance event, Objective 200-04 targets an activity that may help conserve the species. Objective 200-04 was designed into Alternatives 3, 4, and 6 for conservation of species expected to be at risk from high severity fire or other high intensity disturbance events, whether natural or human-induced. This objective targets the collection of emphasis plant species material from the Black Hills for re-introduction efforts if needed. No direction for collection of such material is included in Alternatives 1 and 2.

In Alternatives 3 and 6 Guideline 3206 is changed to include consideration of plants for reintroduction and to consider the risk to Region 2 Sensitive plant species that may occur from transplanting animals. The risks associated with the effects of the reintroduction of mountain goats and elk around the granite core of the Black Hills may present a risk to the long term persistence of *Viola selkirkii*. This same guideline in Alternatives 1, 2, and 4 does not include plants nor give consideration to the risks to Region 2 Sensitive species that may occur due to the transplanting of wildlife species.

Standard 3106 was expanded in Alternatives 3 and 6 to state that riparian areas or wetlands, where populations of sensitive species are located, are to be avoided during ground disturbing activities. In Alternatives 1, 2, and 4 it is a guideline and specifies trail, road and highway construction rather than ground disturbing activities.

Monitoring of Region 2 Sensitive Species is directed based on in FSM 2670 and Chapter 4 of the LRMP (1997). However, the direction does not specify the type and level of information that is needed in the monitoring. Monitoring continues to document the presence and extent of *Viola selkirkii* at designated monitoring sites on the Black Hills National Forest (USDA Forest Service 2005a, USDA Forest Service 2005b). Forest monitoring direction has been revised during this amendment process and is included in Chapter 4 of the LRMP, as amended by the Phase II amendment (refer to the Phase II amended Black Hills National Forest LRMP Chapter 4 for further discussion of monitoring direction). Information on the current monitoring strategy for *V. selkirkii* is provided in the Forest Plan Monitoring Implementation Guide (USDA Forest Service 2005b).

Under Alternatives 3, 4, and 6, Management Area (MA 2.2) direction has been included specific to Research Natural Areas (RNA). Alternatives 1 and 2 do not contain direction specific to the RNAs (direction for management direction for the existing RNA is included in direction for the management of the Black Elk Wilderness). The following MA objectives, standards, and guidelines could be expected to benefit the *Viola selkirkii* occurrences in the current Upper Pine Creek RNA (under Alternatives 3, 4, and 6):

- Standard 2.2-1501 withdraws RNAs from mineral entry in conformance with Section 204 of Federal Land Policy and Management Act of 1976, reducing potential risks to *Viola selkirkii* individuals and habitat from mining.

- Standard 2.2-3201 allows for habitat manipulation for the protection of Region 2 sensitive species, such as *Viola selkirkii.*

- Standard 2.2-4101 requires the use of Minimum Impact Suppression Tactics (MIST) when suppressing wildfire, which could be expected to decrease the risk of direct impacts to *Viola selkirkii* individuals and occurrences.

- Standard 2.2-4103 states that natural control features and hand tools are the preferred means to confine, contain, and/or control wildfires, which may also be expected to reduce the risk of direct impacts to *Viola selkirkii* individuals.

- Standard 2.2-4201 requires that populations of invasive, non-native pant and wildlife species be controlled using measures that minimize threats to native species, such as *Viola selkirkii*.

4-1.11.2 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 then generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995). The general spatial area used for the cumulative effects analysis for *Viola selkerkii* primarily includes the higher elevation portions of the central granitic core area of the Black Hills including the Black Elk Wilderness, Norbeck Wildlife Preserve, Mount Rushmore National Memorial 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 other geologic types or lower elevation and warmer and drier ecosystem components which includes a different suite of species.

Very little private land occurs in the general vicinity of the distribution range of *Viola selkirkii* in the Black Hills. Actions on private lands in the area, and the effects of such actions on potential occurrences of *V. selkirkii* located on them, are unknown. According to Hornbeck et al. (2003d), the *V. selkirkii* occurrences in the northern unit of Custer State Park face potential risks from dispersed recreation, invasive weeds, fire and flooding, and are equally vulnerable to drought and climatic warming. Timber is harvested in Custer State Park, but it is not known if cutting or associated activities will occur in close proximity to *V. selkirkii* habitat, and if so, whether these activities will affect the species. Trampling from recreational use appears to be a greater risk in Custer State Park than on Forest lands, especially since rock climbing access routes or staging

areas are in or adjacent to three of seven occurrences with a least a portion of each of these occurrences potentially at risk to intensive use.

Activities and effects on *Viola selkirkii* occurrences were discussed in the section based on the current locations of designated ARC (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 ARC (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface 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.

When considering the past, present and foreseeable actions on both the lands administered by the Black Hills National Forest, and those owned/administered by other entities, all of the Phase II alternatives evaluated are expected to provide various levels of conservation for the long-term persistence of *Viola selkirkii* on the Black Hills National Forest. As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Platanthera orbiculata*. Therefore the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *P. orbiculata* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.11.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Viola selkirkii* for all Phase II alternatives**.** The rationale for this determination is that several standards and guidelines under each alternative address the various potential risks to this species, as described earlier. Other conservation strategies and measures that vary by alternative provide for conservation or enhancement of *Viola selkirkii* habitat conditions, and *ex situ* collections of plant material are expected to be available for re-introduction if needed. Specifically, the above determination for *Viola selkirkii* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations will be re-evaluated during any revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard and guideline direction listed above for the various alternatives will be applied or implemented as written.

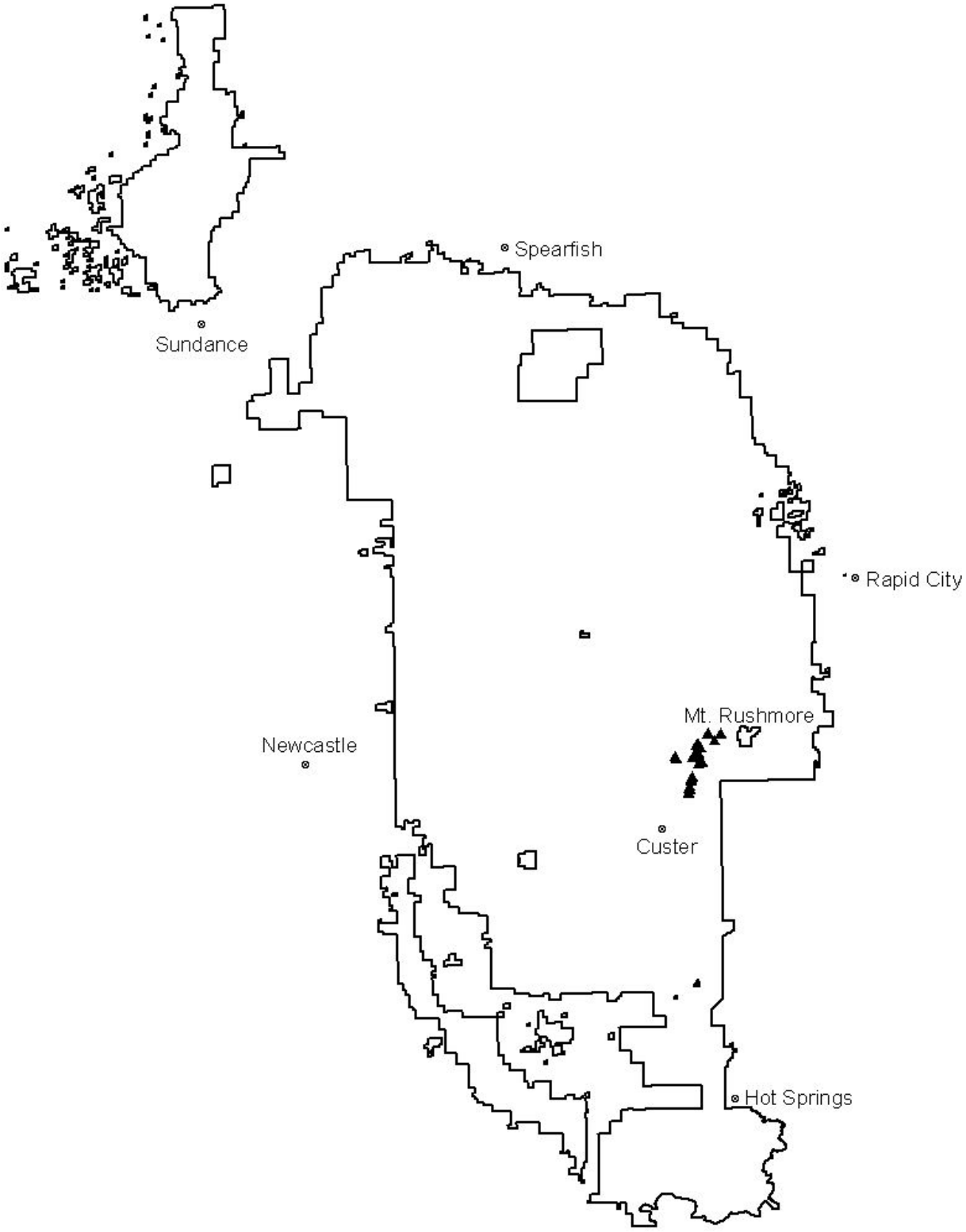
3. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as *Viola selkerkii* are the first priority for treating noxious weeds.

4. That regardless of which alternative is selected, the species will be monitored according to the current monitoring protocol (or as altered through reassessment with the Rocky Mountain Research Station), which is designed to detect and respond in a timely manner to changes in the extent and condition of *Viola selkirkii* (USDA Forest Service 2005b).

5. That plant material collected on the Forest can be used to successfully recolonize *Viola selkirkii* occurrences in the event such sites are lost and would not be able to recolonize naturally.

6. That a limited number of *Viola selkirkii* individuals are likely to be impacted from various disturbances, including but not limited to the following: long-term occurrence conservation efforts, conservation efforts targeted for other species, or from catastrophic events.

Distribution of *Viola selkirkii* (Selkirk's Violet) on lands administered by the Black Hills National Forest



4-1.12. *Cypripedium parviflorum* (Lesser Yellow Lady's Slipper)

This species was included on the updated Region 2 sensitive species list, effective May 17, 2003, and continued to remain on the list during a recent update (USDA Forest Service 2005c); therefore, information is not currently available in Black Hills National Forest programmatic level documents to tier to. An assessment of *Cypripedium parviflorum* in the Black Hills (Mergen 2003) was prepared and serves as a primary reference for the following analysis.

Cypripedium parviflorum is known by a variety of common names (small yellow lady's slipper, yellow lady's slipper, large yellow lady's slipper, etc.), however, when the PLANTS database was recently accessed it listed the common name of this species as lesser yellow lady's slipper (USDA, NRCS 2004). *C. parviflorum* is widespread in distribution, but is primarily circumboreal in distribution, with occurrences in north and central Europe, Siberia, northern China, Korea, and North America. The occurrences in Europe are *Cypripedium calceolus* and the occurrences in the United States and Canada, with somewhat smaller flowers, are now designated *C. parviflorum*, although many references use the older nomenclature (*C. calceolus* var. *parviflorum*). In North America, *C. parviflorum* occurs from Alaska to Newfoundland, south to Washington, Arizona, New Mexico, Kansas, Missippi, and Georgia. There are only five states that are not shown to include occurrences of the widespread *C. parviflorum* in the United States include Hawaii, Nevada, Texas, Louisiana, and Florida (NatureServe 2005a).

Occurrences of *Cypripedium parviflorum* in the Black Hills are disjunct from those in the Bighorn Mountains in Wyoming, western Montana and eastern North and South Dakota. Occurrences are located on three of the Black Hills National Forest Ranger Districts (Bearlodge, Northern Hills and Mystic) and are widely dispersed across 21 sixth level watersheds. According to a recent monitoring report (USDA Forest Service 2004c), a minimum of 50 sites had been reported on the Black Hills (with the number of historical reports ranging from 50 to 100 based on how sites were documented in the field). Ten new occurrences were discovered in 2004 (USDA Forest Service 2005b) on lands administered by the Forest, therefore the number of sites are over 60. Overall, occurrence sizes ranged from 2 plants to 324. Four occurrences are known to exceed 100 plants, and 55 percent of the records (at the time the assessment was prepared) that listed the number of plants recorded fewer than ten individuals (Mergen 2003). The species is likely under reported because it has not been targeted for survey until recently (USDA Forest Service 2004c). The discovery of 10 new sites in 2004 (USDA Forest Service 2005b) further supports that the species is likely under-reported in the Black Hills. Based on the number of discovered locations during recent surveys it is being questioned whether this species should remain on the Region 2 Sensitive species list.

Cypripedium parviflorum is scattered across the northern and eastern portions of the Black Hills National Forest, occurring within the following Forest Management Areas:

> MA 3.1 – Botanical Areas – Approximately seven percent of the reports are from within this MA (Englewood Springs Botanical Area, Bear/Beaver Gulches Botanical Area).

MA 3.32 – Backcountry Non-motorized Recreation Emphasis – Approximately two percent of the reports are from within this MA.

MA 3.7 – Late-successional Forest Landscape – Approximately 12 percent of the reports are from within this MA.

MA 4.2A - Spearfish Canyon – Approximately 28 percent of the reports are from within this MA.

MA 5.1 – Resource Production Emphasis – Approximately nine percent of the reports are from within this MA.

MA 5.2A – Approximately one percent of the reports are from within this MA.

MA 5.4 – Big Game Winter Range Emphasis – Approximately 33 percent of the reports are from within this MA.

MA 5.6 - Forest Products, Recreation and Big Game – Approximately 1 percent of the reports are from within this MA.

Private land – Approximately six percent of the reports in the Forest database are not located on Forest land but are from private land.

Mergen (2003) indicated that the species was ranked as vulnerable (S3) in South Dakota, critically imperiled to imperiled (S1S2) in Wyoming, and globally secure (G5) (Mergen 2003). Recent review of the currently assigned rank indicate that the rank for South Dakota is (S3?) (NatureServe 2005).

Cypripedium parviflorum is a herbaceous perennial with stems averaging from 10 to12 inches in height in the Black Hills. Plants may occur in groups of several to over 300 stems, but are also found as single plants. The showy yellow flowers, one or rarely two per stem, are produced in the Black Hills from late May through July and into early August. Like many orchids, this species is assumed to be dependent on fungi in the soil for survival, at least for germination and early growth. Insects are presumed to be the pollinators for *C. parviflorum* on the Black Hlls since no evidence exists otherwise (Mergen 2003).

Across its geographic range, *Cypripedium parviflorum* is generally found in shady deciduous and mixed woodlands near streams, shrublands, swamps, bogs, and wet forests (Mergen 2003). Currently known locations in the Black Hills indicate that the species is associated with mesic conditions on limestone rock outcrop areas, often on north-facing slopes, and on mesic to saturated conditions in and adjacent to riparian areas. It is often associated with hardwoods(USDA Forest Service 2004c, USDA Forest Service 2005d). Mergen (2003) found *C. parviflorum* to occur in conifer-deciduous communities, deciduous communities and conifer, mostly *Picea glauca* (white spruce) communities.

4-1.12.1 Direct and Indirect Effects

Cypripedium parviflorum is currently considered to relatively secure in the Black Hills, based on the large number of occurrences that are widely geographically dispersed across the Black Hills. The abundance of *C. parviflorum* on the Black Hills is still uncertain since new occurrences are being reported during surveys (10 sites discovered in 2004) (USDA Forest Service 2005b); however, it is suspected that the current abundance has decreased in the past century based on overall decline in other parts of its range. The recent assessment for the species identified the primary risks for *C. parviflorum* on the Black Hills as plant collecting and habitat alteration or degradation. This may be associated or as a result of management related disturbance activies or from natural causes. Various levels and types of timber harvest, road construction, weed establishment and grazing may create some of the greater risks of alteration or degradation to associated habitat conditions (Mergen 2003).

Recognizing noxious weeds and other invasive plants, and their treatment, as a risk *Cypripedium parviflorum* occurrences on the Black Hills, conservation strategies and measures to address and reduce direct and indirect effects are given priority discussion in this section. All alternatives propose various levels of protection for Region 2 sensitive species 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 in Alternative 6. Guideline 4303 revised the priority order for treatment of weeds, and first priority of treatment is to occur at Region 2 Sensitive and Species Of Local Concern plants and snails sites. Guideline 4304 (Alternatives 1 and 2) was revised and elevated 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 are do not include direction to monitor weed control effectiveness at Region 2 Sensitive species sites to determine if weeds at those sites need to be retreated throughout the season to reduce noxious weed competition. Standard 4300-1 specifies this type of monitoring and was included in Alternatives 3, 4, and 6 to further address the risk that noxious weeds present to Region 2 Sensitive plant species such as *Cypripedium parviflorum*. 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 to require that the seed be tested at time of delivery to confirm that the seed is weed-free. A prevention method for noxious-weed invasion is targeted for native plant communities by revegetating with native species and is included under Guideline 1110 in Alternatives 1 and 2. The original guideline was revised and strengthened to Standard 1110 in Alternatives 3, 4, and 6. Therefore, Alternatives 3, 4, and 6 are expected to have the lowest risk of indirect and direct negative effects to *C. parviflorum* from noxious weeds and their treatment.

Plant collection has been identified as a risk to this species across its range. No evidence of collection was documented at seven Forest occurrences where baseline monitoring data were collected in 2004 (USDA Forest Service 2005d). Mergen (2003) stated that collecting can decrease or extirpate local occurrences or at the least decreases the condition of an occurrence when the above ground plant parts are collected. Standard 3119 is included in Alternatives 3 and 6 to restrict the collection of Region 2 Sensitive 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 or amount of collection would present much risk to the overall long term persistence of this species on the Black Hills National Forest.

Cutting and removing timber can directly or indirectly adversely affect individual plants or an entire occurrences. However, removing a portion of the overstory canopy may alter current microsite conditions, possibly altering the associated habitat conditions that could favor *Cypripedium parviflorum* seed to germinate and plants to become established (Mergen 2003). Currently, timber harvest is generally not deemed a persistence risk to *C. parviflorum* because the species is targeted for survey and currently known occurrences are generally being avoided or mitigated to reduce direct and indirect effects through the NEPA process, a number of the known occurrences are located in some areas that are not targeted for commercial timber harvest (such as MA 3.1) and a number of the known occurrences are located in an ecological type (primarily hardwoods) that is generally not targeted for commercial harvest activities.

Domestic or wild grazing animals in the Black Hills select certain plants at different times of the year. At times, herbaceous forbs are selected by these grazing animals. Therefore, it may be expected that *Cypripedium parviflorum* individuals may be affected by livestock or wildlife grazing. However, there is no indication that *C. parviflorum* is a preferred plant by domestic or wild animals in the Black Hills. Mergen (2003) documented that 4-12 percent of the *C. parviflorum* plants at two of the larger occurrences located in 2002 had been grazed by early August. *Cervus elaphus* (elk) were thought to be the grazer at those locations. Data are lacking to indicate any increase or decrease in *C. parviflorum* occurrences as the result of grazing (Mergen 2003). A general statement of risk from effects associated with livestock use is difficult to make, because the amount of livestock use and the conditions at the sites are variable. However, approximately 15 percent of reported *C. parviflorum* occurrences (16 occurrences) on the Black Hills National Forest are located within vacant grazing allotments (no livestock grazing permitted at this time), 28 percent are excluded from livestock grazing in Spearfish Canyon (MA 4.2A) and another 7 percent are located in designated Botanical Areass where R2 Sensitive plants are to be protected from livestock (Alternatives 1 and 2) or livestock are to be restricted from accessing Region 2 Sensitive or Species of Local Concern plants (Alternatives 3, 4 and 6) (Standard 3.1-2501) (USDA Forest Service 2005d). In addition, livestock grazing is subject to the project level NEPA analysis process, which includes conservation and protection such as avoidance and mitigation for Region 2 Sensitive plant species such as *C. parviflorum*. As well as the NEPA process, administration of livestock grazing permits utilize Annual Operating Instructions which would be expected to include monitoring instructions for identified “key areas” or “key species” (which would be expected to include sensitive plant occurrences that occur within allotments), and implementation of this monitoring and moving livestock based on that monitoring would be expected to further limit adverse impacts to sensitive species, such as *C. parviflorum*. Guideline 2207 (Alternative 1) locates livestock/wildlife watering sites (i.e., drinking structures) outside of hardwood communities when feasible. The equivalent guideline in Alternative 2 does not include “when feasible” and is treated as a standard. The guideline was rewritten and was strengthened to a Standard (Standard 2207) in Alternatives 3, 4, and 6 which

requires that new livestock/wildlife watering sites are located outside of hardwood communities, except when no other option is available. This guideline would be expected reduce effects to any *C. parviflorum* individuals that may occur in near seeps or springs that had been proposed for water development. Guideline 2507 (Alternatives 1, 2, and 4) is strengthened to a standard for Alternatives 3 and 6. It addresses use of forage by livestock and wildlife in fenced riparian pastures. Alternatives 3 and 6 allows use as long as it meets the objectives of maintaining, enhancing, or conserving the riparian ecosystem and emphasis species persistence.

Mergen (2003) states that the only benefit to fire suppression is plants may not be burned directly, but overall fire suppression could be expected to be a risk the long term peristence of this species Forestwide population. *Cypripedium parviflorum* occurrences located adjacent to continuous, dense stands of highly flammable conifers are expected to be particulary vulnerable to high intensity fires. Further, high intensity stand-replacing crown fires have the potential effects of depositing large amounts of sediment in drainage side slope areas where occurrences are documented to occur, removing hardwood canopy cover, and consuming or killing individual plants or resulting in the loss of entire occurrences. However, occurrences on Forest land are widely dispersed in the northern, central and eastern portions of the Forest and are located within 21 separate sixth level watersheds (USDA Forest Service 2005d) therefore it is not considered likely that all occurrences would be impacted by a single high severity fire event (it would have to be a high intensity fire that would likely have to occur over at least 400,000 acres, or approximately an estimated 40 percent of the Forest). Overtime, *C. parviflorum* occurrences located adjacent to within a fire boundary may be expected to potentially benefit from altered habitat conditions even if fire were to remove or affect the current year's growth (Mergen 2003). Because of the risk associated with high intensity fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of occurrences that could be at risk to high intensity 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 Region 2 sensitive plant species, such as *C. parviflorum*. Alternative 3 is expected to provided the greatest likelihood of creating conditions that would be successful for dropping crown fires to the ground because it would create or maintain low crown fire hazard conditions near sensitive plant occurrences and botanical areas. A greater risk of crown fires affecting crown fires is associated with Alternative 6 because it targets creation of a moderate to low crown fire hazard near those locations, instead of low hazard, therefore conditions for a higher intensity fire near emphasis plant species occurrences and associated effects to the plants could be expected to occur through implementation of Alternative 6, as compared to implementation of the objective for Alternative 3. Implementation of the objective under either alternative near *C. parviflorum* occurrences would be expected to decrease fire effects (greater reduction under Alternative 3) and benefit the occurrences during fire events. This objective is not part of Alternatives 1, 2 or 4 therefore the greatest risk of high intensity fires, such as crown fires, to emphasis plant species would be expected to be associated with these alternatives. Alternatives 3 and 6 provide additional fire suppression related protection to the Region 2 Sensitive plant species with Guideline 4102, and Standard 3200-03. Guideline 4102, in Alternatives 1 and 2, provides for protection of heritage resources, streams, stream banks, shorelines, lakes and associated vegetation from degradation by wildfire suppression efforts. In Alternatives 3 and 6 the protection is extended to Region 2 Sensitive species such as *C. parviflorum*. In addition, Standard 3200-03 states that wildfire suppression camps will not be placed at known mapped Region 2 Sensitive plant species locations. Alternatives 1 and 2 do not contain this standard

therefore more risks to the species are associated with those alternatives as compared to Alternatives 3, 4 and 6.

Because some of the *Cypripedium parviflorum* occurrences are located within the estimated 1.5 mile WUI circumference area of ARC, it is likely that Objective 200-05 could be achieved near many of the sites in conjunction with fuel reduction efforts near ARC (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 FEIS for discussion of At-risk Communities and the Wildland-Urban Interface for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARC and *C. parviflorum* because without a priority system or a map indicating which ARC are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of occurrences.

Plant trampling by people is a risk since occurrences are located near some picnic areas and tourist destinations on the Black Hills. In addition, an increasing recreational use in the Forest that could access some of the occurrences on some of the gentler slopes near riparian areas is that of Off-road vehicle use. Therefore, recreation can impact individuals or occurrences and can be expected to contribute to altered or degraded associated habitat conditions for this species in the Black Hills. Developed recreation locations or advertised recreation opportunities can be expected to attract and place people near plants and could be expected to increase the liklihood of plant collecting of this showy flowered orchid and contribute to the introduction of noxious weeds and other non-native invasive plant species (Mergen 2003). Forestwide standards and guidelines that address the potential risks to *C. parviflorum* associated with recreation related activities include Standard 5205, Standard 5200-01 and Guideline 2206. In Alternatives 1 and 2, Standard 5205 requires facilities and access be designed to provide site protection, efficient maintenance and user convenience. In Alternatives 3, 4, and 6 was redesigned to reduce effects to *C. parviflorum* by adding that facilities and access also be designed to restrict access or route recreational use away from Region 2 Sensitive species that are located within or immediately adjacent to developed recreation sites. Standard 5200-01 (Alternatives 3 and 6) prevents new developed recreation sites from being located in or immediately adjacent to known locations of Region 2 Sensitive plants, such as *C. parviflorum*. Guideline 2206 (strengthened to a standard for Alternatives 3, 4, and 6) directs that no new developed recreation sites be placed in *Populus tremuloides/Betula papyrifera* (aspen/birch) stands. This could be considered a beneficial effect if any new developed recreation sites were to be proposed in the vicinity of *C. parviflorum* occurrences.

Recognizing that *Cypripedium parviflorum* is widespread across the northern, central and eastern Black Hills (USDA Forest Service 2005b, USDA Forest Service 2005d), there is no expectation that all occurrences would be lost from a single high intensity event. However, should an occurrence or occurrences be lost, such as from a high severity fire, implementation of Objective 200-04 could provide material for restoring sites. Objective 200-04 was designed into Alternatives 3, 4, and 6 further supporting the conservation of species expected to be at risk from high severity fire or other intense disturbance events, whether natural or human-induced. This objective targets the collection of plant material from the Black Hills for reintroduction efforts if needed, primarily for species with low numbers of occurrences. No direction for collection of such material is included in Alternatives 1 and 2. Based on the number of occurrences located in

the Black Hills, it is likely that materials could becollected from nearby *C. parviflorum* occurrences to re-colonize or restore lost occurrences if it was determined that sites were likely not to re-colonize naturally.

Mergen (2003) states that deciduous habitat conditions are associated with this species. Objectives 201, 200-01, and 2205 address hardwood conservation and restoration. Objective 201 (Alternatives 1, 2, and 4) provides direction for conserving existing hardwood communities and targets restoration of historic hardwood communities by 10 percent over 1995 conditions. Alternatives 3 and 6 targets doubling the current existing *Populus tremuloides* (quaking aspen) acreage and restoring *Quercus macrocarpa* (bur-oak) by 50 percent. This objective is expected to benefit the species where it occurs with the hardwoods or in adjacent drainages that may have suitable microhabitats that have been encroached upon by conifers. In addition, these restoration activities could also prove beneficial for the long-term persistence of *Cypripedium parviflorum* if they reduce the intensity of fires before they reach the *C. parviflorum* sites (e.g., reducing crown fires to less intense surface fires). Objective 200-01 was originally designed for Alternatives 3 and 6 to address a variety of risks associated with conifer encroachment for a number of the emphasis plant species. The objective was designed to favor hardwood restoration where spruce has encroached into hardwoods and where beaver reoccupation is desired to target conservation of the species. Revision of objective wording that is now contained in Alternative 6 still indicates that a treatment of spruce is still to occur, however, at least 20,000 acres of spruce is to be managed for under the alternative and it is uncertain that spruce encroachment removal desired at or adjacent to emphasis plant species locations, such as *C. parviflorum* can be achieved. Therefore it is not known if Alternative 6 would be as successful at targeting this conservation measure for emphasis plant species as Alternative 3. No version of this objective is included in Alternatives 1, 2, and 4. Alternative 2 and 4 directs maintenance of existing patch size of white spruce structural stages (Standard 3215), which can significantly limit or prohibit the likelihood of hardwood restoration acitivities identified as beneficial for the long term persistence of some emphasis plant species, such as *C. parviflorum*. This standard was revised for Alternatives 3 and 6 and identifies maintenance of canopy closures (40-50 percent) for marten corridors. Although not specified in the standard and actual site implementation is uncertain, it is assumed that this canopy closure would be composed primarily of conifer species rather than hardwoods. Therefore, in order to provide for for other species associated with hardwoods, it is assumed that at the project design and implementation level that the connectivity corridor design and placement would include consideration of hardwood restoration and could still provide beneficial effects for long term persistence of species such as *C. parviflorum*. Alternative 1 does not specifically address the removal of spruce encroachment into hardwoods or maintenance of canopy connectivity corridors. Refer to the section on marten in this Biological Evaluation for more information on spruce maintenance and connectivity corridors. Alternative 1, 2 and 4 do not specifically address the removal of *P. glauca* encroachment into hardwoods. Guideline 2205 (Alternatives 1, 2, and 4) is revised and strengthened to a standard in Alternatives 3 and 6. In Alternatives 1, 2, and 4 it reduces overstory conifers per acre and treats the understory to shift the dominance from conifer to hardwood. Implementation of this standard in Alternatives 3 and 6 would be expected to remove all overstory conifers. These measures increase the amount of light reaching herbs (such as C. parviflorum) on the forest floor while still retaining the hardwood canopies, which can be expected to provide some long term benefits to the *C. parviflorum* occurences that are currently located in mixed conifer-deciduous plant communities,

provided that other direction is implemented to keep disturbances to a minimum in implementing this standard.

Cypripedium parviflorum is also documented in habitats that have greater soil moisture, like riparian areas, wet meadows, springs, seeps and other wetlands (Mergen 2003, USDA Forest Service 2005d). All alternatives contain direction to maintain or restore historic wet areas, wet meadows, and beaver (Objective 215). Any successful restoration of hardwoods, and reintroduction of beaver (Objective 215) that would improve the riparian conditions that some occurences are located in, would be expected to conserve or improve saturated soil conditions at these sites. Conserving or improving the saturated soil conditions could contribute to the likely long-term persistence of *C. parviflorum* on Forest lands. In addition, Objective 214 targets 500 acres of riparian shrub community restoration under Alternatives 1, 2, 4 and 6 and 1, 000 acres under Alternatives 3. Implementation of this objective under Alternative 3 could occur anywhere on the Forest and could be prioritized for species needs, such as for *C. parvflorum*. Alternative 6 prioritizes riparian restoration efforts in areas surrounding Federal Register designated Communities At Risk (Vol. 66 Federal Register, Beginning Page 753, January 4, 2001; Vol. 66, Federal Register, Beginning Page 43384, August 17, 2004) which could benefit the occurrences that occur within a 1.5 miles of the designated ARC (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARC and *C. parviflorum* because without a priority system or a map indicating which ARC are targeted first or to what level, it is not known if any treatments would even occur within the immediate vicinity of occurrences (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface for more information).

Objective 215 targets the rehabilitation of riparian habitat conditions along three stream reaches under Alternatives 1, 2, 4, and 6 and five stream reaches under Alternative 3. If these activities, under any of the alternatives, were prioritized near any of the existing *Cypripedium parviflorum* occurences, then the activities could be expected to provide long term associated habitat benefits for continued persistence of the species on Forest land.

Implementation of Standards 1210, 1301, 1302, and 1304, and Guidelines 9107 and 9108 (all alternatives) are to contribute towards the maintainenance and improvement of stream and wetland condition which could be expected to benefit *Cypripedium parviflorum* if successful. Standard 1210 (all alternatives) is to maintain enough water in perennial streams to sustain existing stream health, returning some water to dewatered perennial streams when needed and feasible. Alternatives 2, 3, 4, and 6 return some water to dewatered perennial streams when needed. Standard 1301 (all alternatives) allows only those land treatments that maintain or improve long-term stream health in the water influence zone next to perennial and intermittent streams, lakes, and wetlands. Alternatives 2, 3, 4, and 6 add consideration of riparian ecosystem condition as well. Standard 1302 (all alternatives) conserves ground cover, soil structure, water budgets, and flow patterns in wetlands. Alternatives 2, 3, 4, and 6 incorporate sustaining the ecological function of wetlands, according to Clean Water Act Section 404 regulations. Standard 1304 (all alternatives) relocates or implements measures to reduce impacts from roads, trails, watering tanks and similar facilities currently located within the Water Influence Zone as opportunities arise and as need dictates. Alternatives 2, 3, 4, and 6 include ponds and water catchments in the facilities to be considered. Guidelines 9107 and 9108 (Alternatives 1, 2, and 4)

are elevated to standards under Alternatives 3 and 6. This could be expected to reduce vehicle impacts on streams and riparian areas, thereby reducing impacts to associated habitat conditions and thereby contributing to conservation of conditions for the likelihood of persistence of those *C. paviflorum* occurrences that are located in association with saturated riparian conditions.

Forest-wide Guideline 8101 (all alternatives) prioritizes lands with riparian areas and streams and Region 2 Sensitive species for land acquisition. Acquisition of the any of the land upstream of any of the occurrences of *Cypripedium parviflorum* would be expected to reduce the potential of development within riparian areas. Even though these areas would rise in priority for acquisition because of the streams, acquisition is dependent upon funding, land availability, and landowner willingness to participate. If land above occurrences could be acquired, this action would be expected to reduce the potential for long-term risk and benefit conservation of saturated conditions for any downstream occurrences that may be associated with riparian conditions.

Baseline data collection monitoring for this recently designated (December 2003) Region 2 Sensitive species has been included in the 2004 monitoring strategy for *Cypripedium parviflorum* based on direction in FSM 2670 and Chapter 4 of the LRMP (1997). However, this direction does not specify the type and level of information that is needed in the monitoring. The 2005 monitoring strategy is currently designed to attempt to relocate a number of the previously reported locations and gather baseline-monitoring data. This information is expected to be used to design, then annually update and refine the monitoring strategy, as needed. Forest monitoring direction has been revised during this process and is included in Chapter 4 of the LRMP, as amended by the Phase I amendment and through this Phase II amendment (refer to the Phase II amended Black Hills National Forest LRMP Chapter 4 for further discussion of monitoring direction for Region 2 Sensitive Species). Information on the current monitoring design for *C. parviflorum* is available in the Forest Plan Monitoring Implementation Guide (USDA Forest Service 2005b).

Specific MA objectives, standards, and guidelines could be expected to reduce risks or benefit *Cypripedium parviflorum* occurrences located within BAs (MA 3.1):

- Objective 3.1-201 targets the maintenance or enhancement of botanical features at BAs in Alternatives 1, 2, and 4. In Alternatives 3 and 6, monitoring to see if this target is being achieved, has been added to the objective.
- Standard 3.1-4101 manages fire and fuel through control practices to protect values of BAs in Alternatives 1 and 2. For Alternatives 3, 4, and 6, Minimum Impact Suppression Tactics (MIST) are to be used over more aggressive actions that could still be used for Alternatives 1 and 2. MIST fire suppression efforts are expected to result in less intensive disturbances if a fire would occur within the BAs, and would be expected to result in fewer direct and indirect effects to *C. parviflorum* in BAs where the species is located.
- Guidelines 3.1-9101, 9102, and 9103 restrict vehicle use (including snowmobiles) to designated routes and prohibit off-road travel in all alternatives. For Alternatives 3, 4, and 6, emergency and administrative needs were recognized and included and the guidelines were strengthened to standards. The potential risk of impacts from snowmobiles leaving designated routes was recognized, and the guideline was strengthened to a standard to reduce the risks of potential effects to emphasis plant species.

- Standard 3.1-2501 allows livestock grazing only if it does not conflict with values for which the area was designated.
- Guideline 3.1-2502 is included in all alternatives. It allows new improvements only when necessary to maintain, restore, or enhance the values for which the area was designated; therefore, minimal, if any effects to *C. parviflorum* occurrences located within BAs from new improvements would be expected.
- Standard 3.1-2503 was reworded for clarification of what is meant by protection of Region 2 Sensitive plant species in Alternative 1 and 2. Implementation of Alternatives 3, 4 and 6 is that protection is to restrict livestock from accessing Region 2 Sensitive plant species within Botanical Areas. Monitoring of this is to be included in the Forest Plan Monitoring and Implementation guide (see Appendix D Standard 3.1-2503 Rationale and the Forest Plan Monitoring and Implementation Guide, Monitoring Item ***).
- Standards 3.1-5101 and 5102 and Guideline 3.1-5103 allow limited recreational uses of BAs when they do not threaten the values of botanical features. Standard 3.1-9104 limits new road and trail construction to those needed for interpretive or education purposes or when needed to correct resource damage that may be occurring from existing roads, trails or other uses. These standards provide for action to reduce potential effects that may be observed to species such as *Cypripedium parviflorum.*

The following specific MA objectives and standards are expected to benefit *Cypripedium parviflorum* occurrences located in Spearfish Canyon (MA 4.2A): Implementation of Standard 4.2A-4101 is for protection of the biological and scenic values of the area. In Alternatives 1, 2, and 4 the tools available are limited to fire control practices and prescribed fire. Under Alternatives 3 and 6 the words “various methods” replaces “fire control practices and prescribed fire” to provide flexibility for the use of other availabl tools. Under Alternative 6 the priority is fire hazard reduction in Wildland Urban Interface. Alternative 6 would be expected to provide the greatest protection from high severity wildfire to the *C. parviflorum* occurrences within the Wildland Urban Interface areas in Spearfish Canyon. However, short term effects could occur with fuel reduction activies (see earlier paragraph on discussion of ARC and WUI effects for *C. parviflorum*)

Occurrences are also located within MAs 3.7, 5.1, 5.4 and 5.6. Very few changes specific to these MAs were changed for the Phase II Amendment Action Alternatives (Alternatives 3, 4 and 6), other than those that affect *Pinus ponderosa* (ponderosa pine) structural stages. The assumption is that changes to ponderosa pine structural stages 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 *Cypripedium parviflorum* occurrences, and therefore would be expected to have minimal changes in any beneficial or negative effects to the species. Such actions are also subject to the project level NEPA analysis process, which would be expected to include conservation and protection such as avoidance and mitigation for Region 2 Sensitive plant species.

4-1.12.2 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 then generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995). The spatial area used for the cumulative effects analysis for *Cypripedium parviflorum* is larger than many of the sensitive plant species since it is well-dispersed across 21 watersheds. The spatial area used for the cumulative effects analysis primarily includes the central to northeastern to northwestern Black Hills. This area was chosen because it encompasses similar ecosystem components to where the known occurrences are located.

As compared to historical conditions for hardwoods and riparian systems (see Sections Riparian Areas and Wetlands and Forest Ecosystems in Chapter 3 of the FEIS for the 1997 LRMP Record of Decision and Sections 3-2.3 Riparian and Wetlands Ecosystems and 3-2.1.3 of the Phase II Amendment FEIS), a downward trend or altered associated habitat conditions is considered likely for *Cypripedium parviflorum* in the Black Hills. Alterations in Black Hills habitat conditions include but are not limited to competition from noxious weeds and other invasive plants, reduction of beaver and associated condidions, conifer encroachment, urban development, and roads. These types of altered habitat conditions have typically not been positive or beneficial for the species. In addition, *C. parviflorum* information indicates that intensive historical collection occurred for the species (Mergen 2003).

There are many parcels of private land distributed throughout the primary concentration areas of where *Cypripedium parviflorum* occurs in the northern, eastern and central Black Hills. Individual plants have been observed on private lands, six of which are included in the Forest database (USDA Forest Service 2005d). Although unknown, it is assumed that other private lands contain occurrences as well as potentially suitable associated habitat conditions. Actions on the large proportion of private land in the Black Hills and their effect on potential occurrences of *C. parviflorum* is unknown. However, there is a high rate of development occurring on private lands in the northern and northeastern Black Hills, as evidenced by new construction on those lands, some of which are close to Forest *C. parviflorum* occurrences. Various development activities and structures could could be expected to alter habitat or result in a loss of *C. parviflorum* habitat conditions, or lead to direct loss of individuals or occurrences.

Activities and effects on *Cypripedium parviflorum* were discussed in the section based on the current locations of designated ARC (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 ARC (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface 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.

As mentioned above, some areas of the Forest are receiving greater levels of Off Road Vehicle use and increasing areas of soil and site disturbances have recently been noted associated with

the increasing amounts of Off Road Vehicle activity in the Black Hills. Therefore, it may be expected that any future increases in this activity in the Black Hills could also lead to increases in direct adverse effects of *Cypripedium parviflorum* individuals wherever off road vehicle use may occur within a portion of any of the occurrences that occur on gentler slopes or in areas that are easily accessed by those vehicles. The Forest is currently working on a travel management plan to specifically address issues and effects associated with Off Road Vehicle use.

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Cypripedium parviflorum*. Therefore the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *C. parviflorum* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.12.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Cypripedium parviflorum* for all Phase II alternatives**.** The rationale for this determination is that this species is widely dispersed with over 60 occurrences dispersed across 21 watersheds in the northern, eastern and central Black Hills (and is likely under-reported based on discoveries of 10 occurrences in 2004) and that several standards and guidelines under each alternative address the various potential risks to this species, as described earlier. Other conservation strategies and measures that vary by alternative provide for conservation or enhancement of *C. parviflorum* associated habitat conditions, and *ex situ* collections of plant material are expected to be available for re-introduction if needed. Specifically, the above determination for *C. parviflorum* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations will be re-evaluated during any revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard and guideline direction listed above for the various alternatives will be applied or implemented as written.

3. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as *Cypripedium parviflorum* occurrences are the first priority for treating noxious weeds.

4. That regardless of which alternative is selected, the species will be monitored according to the current monitoring strategy (or as altered through reassessment with the Rocky Mountain Research Station), which is currently designed to attempt to relocate a number of the previously reported locations and gather baseline monitoring data (USDA Forest Service 2005b).

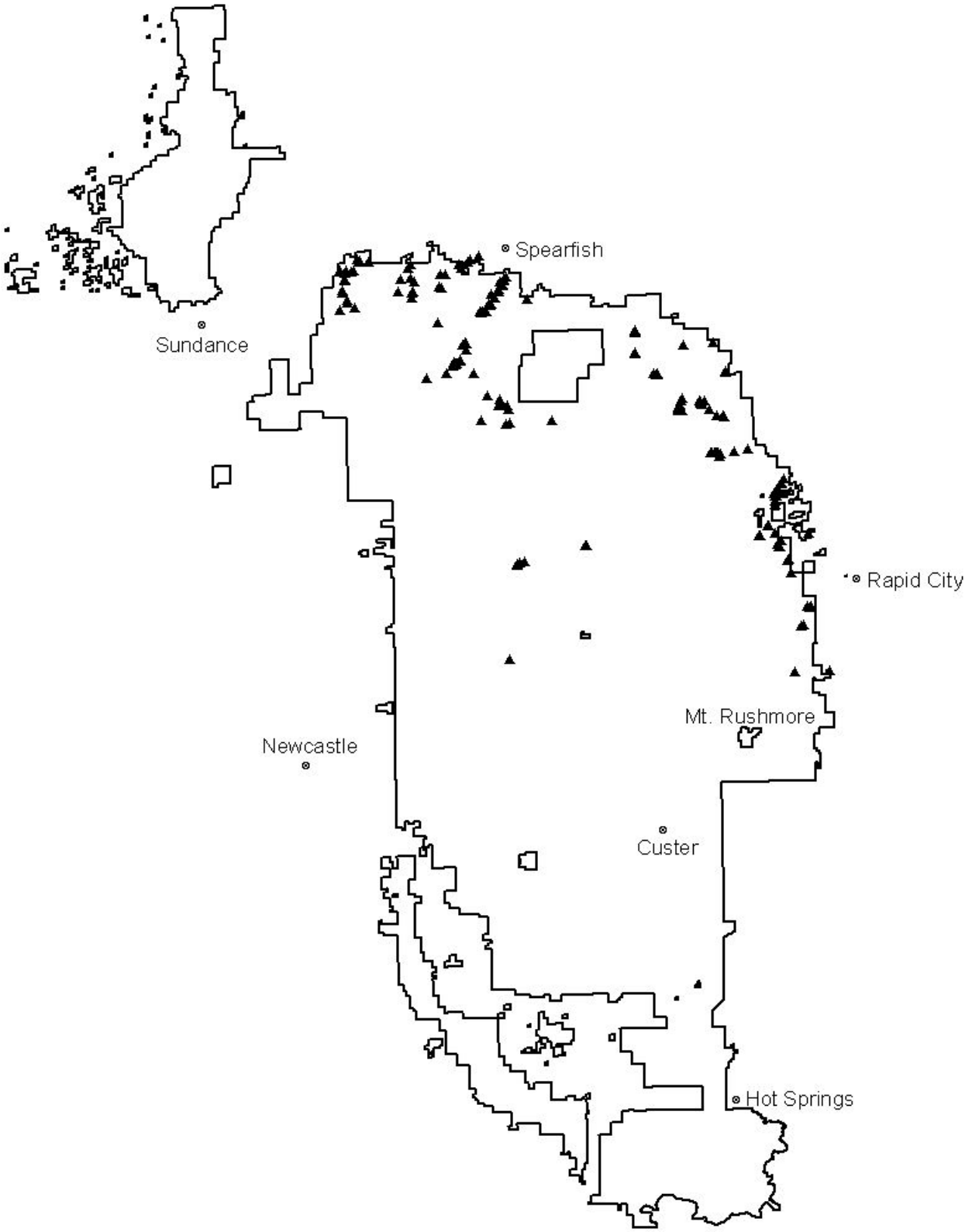
5. That regardless of which alternative is selected; any allotment supporting *Cypripedium parviflorum* occurrences that are currently vacant will remain vacant.

6. That plant material collected on the Forest can be used to successfully re-colonize *Cypripedium parviflorum* occurrences in the event such sites are lost and it was determined that they would not be able to re-colonize naturally.

7. That a limited number of *Cypripedium parviflorum* individuals are likely to be impacted from road maintenance, conservation efforts targeted for other species, and other disturbances such as large-scale, high intensity wildfires; but given the distribution of occurrences among several geographically disjunct sites, it is very unlikely that all individuals at all occurrences will be impacted by a single disturbance.

8. That in spite of the conservation practices the Forest may use, this plant occurs in areas that have been periodically intensively impacted over many years by activities the Forest cannot control, such as highway construction or maintenance and the use of exotic invasive plants in roadside seeding. The monitoring strategy is designed to detect and respond in a timely manner to impacts to the species and its habitat, but not all impacts can be prevented.

General distribution of *Cypripedium parviflorum* (Lesser Yellow Lady's Slipper)on lands administered by the Black Hills National Forest



4-1.13. *Epipactis gigantea* (Stream Orchid)

The Revised Forest Land and Resource Management Plan (LRMP) Biological Evaluation (BE) (USDA-Forest Service 1996a Appendix H) and the LRMP Phase I Amendment BE (USDA-Forest Service 2001c) give an overview of *Epipactis gigantea* (Stream orchid/Giant helleborine) distribution and natural history, and this information is incorporated by reference. However, based on baseline data collection and continued monitoring efforts that have occurred since 2000, more is known about the species occurrence in the Black Hills. In addition, an assessment of *Epipactis gigantea* in the Black Hills (Hornbeck et al. 2003c) was prepared and serves as a primary reference for the following analysis.

Epipactis gigantea (also commonly known as giant helleborine in addition to the common name listed above) occurs in western North America from British Columbia south to California, and east to Texas. In the colder northern portions of its range, the *E. gigantea* may be confined to warm springs habitats (Hornbeck et al. 2003c). In the Black Hills, the only known occurrence of *E. gigantea* is located along Cascade Creek in the southern Black Hills. The species is located on land administered by the Black Hills National Forest at Cascade Springs (J.H. Keith Cascade Springs Picnic Ground). This occurrence is a small portion of a much larger population, of which the majority occurs downstream on The Nature Conservancy's Whitney Preserve. The closest occurrence of E. gigantea to the Black Hills occurrence is located approximately 200 miles west in Bighorn County, Wyoming. The species is unlikely to disperse or occupy additional habitats within the Black Hills. At present, *E. gigantea* occupies nearly all suitable habitat at J.H. Keith Cascade Springs Picnic Ground (Hornbeck et al. 2003c).

Recent data (2000-2002) document increased extent of the species in comparison to earlier reports. However, the current size of the population could be in response to several recent years of higher than average moisture in the Black Hills (Hornbeck et al. 2003c), as well as recent conservation activities taking place in the Cascade Creek valley. The population appears to be stable or increasing, but there is insufficient data to demonstrate a trend at the present time. (USDA Forest Service 2004c).

Epipactis gigantea is currently ranked as vulnerable/apparently secure (G3G4) globally and critically imperiled due to extreme rarity (S1) in South Dakota and Wyoming (NatureServe 2005).

On the Black Hills National Forest, *Epipactis gigantea* occurs within Forest MA 8.2 - Developed Recreation Complexes.

As its botanical name suggests, *Epipactis gigantea* is a large (1 to 3.5 foot tall) perennial herb with one to many leafy stems and smooth to rough sheathing leaves up to 8-inches long and 2-inches wide. In the Black Hills, it flowers in June and is distinguished by its large stature, large leaves, and by an impressive inflorescence of red-brown flowers. Generalist pollinators at Cascade Springs/Creek presumably pollinate the species (Hornbeck et al. 2003c). Rangewide, *E. gigantea* occurs in moist areas along streams and rivers, lake margins, wet meadows, at the base of cliffs, and commonly near seeps and springs, especially near calcareous or minerotrophic

thermal waters. The continuous flow of warm spring water at a constant, year-round temperature moderates the climate in and around Cascade Springs and may be vital to the survival of *E. gigantea* in the Black Hills. At Cascade Springs, the species seems is associated with the open, early successional flood bench habitats along the creek and other moist, open areas associated with the springs, creek side slopes, and sedge meadow (Hornbeck et al. 2003c).

4-1.13.1 Direct and Indirect Effects

The only known occurrence of *Epipactis gigantea* on lands administered by theBlack Hills National Forest is at J.H. Keith Cascade Springs Picnic Ground. In 1962, Edna Keith Florence deeded the 10 acre Cascade Springs site to the USFS. The land deed granted to the USFS specifically requires that the grantee must preserve, develop, care for and maintain Cascade Springs as a park for the use of the public and for no other purpose (Hornbeck et all. 2003c). 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 orchid and its habitat on the Black Hills National Forest administered lands (USDA Forest Service 2005b, Hornbeck et al. 2003c).

Recreational use of the area is to continue as specified in the land deed. 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 Cascade Creek/Springs area. This standard is omitted in Alternative 1. Goal 8.2-201 (Alternatives 3 and 6) was reworded and states that the vegetation at Cascade Springs (high use recreation areas) will be managed in a way to protect the Region 2 Sensitive species as well as maintain or improve the desired recreation setting and conserve the botanical features. Goal 8.2-201 language for Region 2 Sensitive species is not included in Alternatives 1, 2, and 4. Standard 8.2-2104 is strengthened in Alternatives 3, 4, and 6 by directing that if monitoring of Region 2 sensitive species 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 simply calls for the 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 a risk to the species, especially for showy species such as *Epipactis gigantea*. There was no evidence of unauthorized collections of *E. gigantea* at the time monitoring was completed in 2004 (USDA Forest Service 2005a). Standard 3119 is included in Alternatives 3 and 6 to restrict the collection of Region 2 Sensitive 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 or amount of collection would present much risk to the overall long term persistence of this species on the Black Hills National Forest.

All alternatives target various levels of conservation and protection for Region 2 sensitive species 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 *E. gigantea* 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. 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 to a minimum of 8,000 acres in Alternative 6. Guideline 4303 is revised in Alternatives 3, 4, and 6 to make occurences of Region 2 Sensitive species the priority for treatment of weeds. Guideline 4304 (Alternatives 1 and 2) was revised and strenthened to a standard in Alternatives 3, 4, and 6. The standard is expected to further reduce risks to *Epipactis gigantea* by requiring use of treatment methods that pose the least risk to the species. Standard 4300-01 specifies monitoring of weed control effectiveness at Region 2 Sensitive species 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 Region 2 plant species. Alternatives 1 and 2 do not include monitoring of weed control effectiveness at Region 2 Sensitive species sites. 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. The prevention of noxious weed invasion into native plant communities is further targeted 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) includes targeting the monitoring of and treatment of *Tamarix* spp. (salt cedar) (invasive non-native species of concern) and *Lythrum salicaria* (purple loosestrife), along Cascade Creek. These two species are aggressive competitors with native vegetation and could out-compete *E. gigantea* should they become established in the area (Hornbeck et al. 2003c, USDA Forest Service 2005b). Alternatives 1, 2, and 4 do not address these two invasive species (see Section 3-6.3 Noxious Weeds.

The confinement of this species to a single watershed makes it vulnerable to random events such as extreme drought, disease outbreaks, invasions by noxious weeds or other exotic plant species (addressed above), disease, insect infestations, high intensity fires, etc (Hornbeck et al. 2003c, USDA Forest Service 2005b). Because of the risk associated with high intensity fire events, Objective 200-05 was included in Alternatives 3 and 6 to target conservation of occurrences that could be at risk to high intensity 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 Region 2 Sensitive plant species, such as *E. gigantea*. However, the species occurrence is located on a small parcel of Forest land with few conifers, and is surrounded by private land and land administered by TNC's Whitney Preserve. Objective 200-04 (Alternatives 3, 4, and 6) addresses the collection of seeds, spores, or other plant material from Region 2 Sensitive plant species to allow for the reintroduction of the species should the existing portion of the occurrence on Forest lands be lost. Alternatives 1 and 2 do not include direction for collection of material. Guideline 4102 (Alternatives 1, 2 and 4) protects heritage resources, streams, stream banks, shorelines, lakes and associated vegetation from degradation by wildfire suppression efforts. In Alternatives 3, 4 and 6 the protection is extended to Region 2 Sensitive species such as *E. gigantea*. In addition, Standard 3200-03 states that wildfire suppression camps will not be placed at known mapped Region 2 Sensitive species locations. The *E. gigantea* occurrence at Cascade Springs is a known and mapped location therefore

activities associated with fire suppression would not be expected to result in direct effects to the species under Alternatives 3 and 6. Alternatives 1 and 2 do not contain this standard.

Additional potential risks to the species could include alterations to the habitat by hydrologic or geologic modifications, or from erosion (USDA Forest Service 2005b). Objective 8.2-207 (Alternatives 3 and 6) targets the implementation of additional measures to prevent and control erosion, including erosion brought on by recreational use at locations along Cascade Creek where known *Epipactis gigantea* individuals exist, if monitoring reveals that the existing measures are not adequate. Alternatives 1, 2, and 4 do not include Objective 8.2-207.

Livestock grazing is not permitted at Cascade Springs. There are no timber harvest or other vegetation management activites planned on the land administered by the Forestin the immediate area, other than suppression of noxious weeds or other exotic plants (Hornbeck et al. 2003c) or for conserving Region 2 Sensitive or Species of Local Concern plants or conserving other botanical features (Alternatives 3 and 6 Goal 8.2-201)

Monitoring is currently occurring for *E. gigantea* based on direction in Forest Service Manual 2670 and Chapter 4 of the LRMP (1997). However, this direction does not specify the type and level of information that is needed in the monitoring. Monitoring continues to document the presence and extent of *Epipactis gigantea* at J. H. Keith Memorial Picnic Ground (USDA Forest Service 2005a). Information on the current monitoring design for *E. gigantea* is available in the Forest Plan Monitoring Implementation Guide (USDA Forest Service 2005b).

The *Epipactis gigantea* occurrence is not located within any of the candidate RNAs and no beneficial or negative effects would be associated with any that may proposed for designation through the Phase II Amendment Decision.

Because *Epipactis gigantea* occurrence on the Black Hills National Forest is located within the estimated 1.5 mile WUI circumference area of an At Risk Community (refer to Appendix G, Map G-6: At-risk Communities and Wildland-Urban Interface) and if fuels would increase over time fuel reduction activities could be expected (especially throught the selection of 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 At-risk Communities and the Wildland-Urban Interface for more information). There is a great deal of uncertainty on any effects statements regarding treatments around ARC and *E. gigantea* because without a priority system or a map indicating which ARC 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 additions much of the small parcel is comprised of riparian species and open areas with few conifers so little in the way of fuel reduction activities would be expected.

When all five alternatives are considered, the most conservation opportunities and protection for *Epipactis gigantea* is afforded under Alternatives 3 and 6, as described above.

4-1.13.2 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 then generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995). The spatial area used for the cumulative effects analysis for *Epipactis gigantea* primarily includes the Cascade Creek watershed. This area was chosen because it encompasses the ecosystem components of where the known occurrence is located. A larger area would include higher elevation and cooler ecosystem components which includes a different suite of species than what occurs along Cascade Creek.

The first documented account of the *Epipactis gigantea* at Cascade Springs was in 1929 (Hornbeck et al. 2003c). With the exception of four acres in the middle of the occurrence, the rest of the site is either administered by the Forest (headwaters and upstream portion of the occurrence) or else owned or under a conservation agreement with The Nature Conservancy (Whitney Preserve) (Hornbeck et al. 2003c). The effect of management actions on adjacent private lands is unknown; however, the Cascade Creek occurrence has persisted since it was first documented in 1929. The recent acquisition of the Whitney Preserve by The Nature Conservancy is expected to benefit the likelihood of persistence the single occurrence of *Epipactis gigantea* in the Black Hills as the Preserve targets management to conserve the portions of the occurrence downstream from 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 *Epipactis gigantea* is tolerant of, or perhaps able to exploit disturbances. Although the species has persisted during periods of intensive levels of 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. 2003c).

The constant flow of warm water from Cascade Springs is essential to the persistence of *Epipactis gigantea* in the Black Hills. Due to the springs' deep source in Hell Canyon, the quality and quantity of its water are not 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. 2003c). 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 well location being placed in the Minnekahta area and a 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 adverse effects to the species persistence of *E. gigantea* could be expected

According to Hornbeck et al, (2003c), 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 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 *Epipactis gigantea* at risk. Livestock grazing is not permitted at Cascade Springs, but may occur on bordering private lands, and on The Nature Conservancy's Whitney Preserve. There was no evidence of browsing, disease or predation on plants at Cascade Springs at this time. There is no evidence of livestock grazing in the past, when it was a public park, and there are no plans to permit livestock grazing at Cascade Springs in the future (Hornbeck et al 2003c).

Activities and effects on *Epipactis gigantea* were discussed in the section based on the current locations of designated ARC (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 ARC (refer to Appendix B of the FEIS for discussion of At-risk Communities and the Wildland-Urban Interface 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 indiviudals due to the recreational developments in the past, but recent conservation actions are occurring on private land, as well as focused species management by the Forest. In addition it is expected that there will be increased attention in the foreseeable future to continue to target conservation and protection for this species. It is important to recognize that natural catastrophic events, such as droughts, or hydrological alterations associated with activities outside the control of the Forest, could offset or negate the effects of the current management actions or actions as they would occur under the Phase II Amendment alternatives.

As described in the Direct and Indirect Effects section above, Alternatives 3, 4, and 6 target additional conservation measures (e.g., Objective 200-04) designed specifically for conservation of species such *Epipactis gigantea*. Therefore the least risk to the species long term persistence in the Black Hills would be expected with full implementation of Alternatives 3, 4 and 6. Although there is uncertainty, the overall order of the five alternatives considered in Phase II from highest to lowest in terms of the likelihood of persistence for *E. gigantea* is: Alternatives 3 and 6, followed by 4, then by 2 and 1.

4-1.13.3 Determination and Rationale

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 (USDA Forest Service 2005c) is made for *Epipactis gigantea* for all Phase II alternatives**.** The rationale for this determination is

that several standards and guidelines under each alternative address the various potential risks to this species, as described earlier. Other conservation strategies and measures that vary by alternative provide for conservation or enhancement of *E. gigantea* habitat conditions, and *ex situ* collections of plant material are expected to be available for reintroduction if needed. Specifically, the above determination for *E. gigantea* is based upon the following assumptions:

1. The determination is made for the remaining life of the 1997 Plan with associated amendments and determinations will be reevaluated during any future amendments or revisions to the Forest Plan (currently expected targeted revision Decision date is 2012).

2. The conservation objectives and protective standard and guideline direction listed above for the various alternatives will be applied or implemented as written.

3. Regardless of which alternative is a selected, any sites supporting Region 2 Sensitive species such as *E. gigantea* occurrences are the first priority for treating noxious weeds.

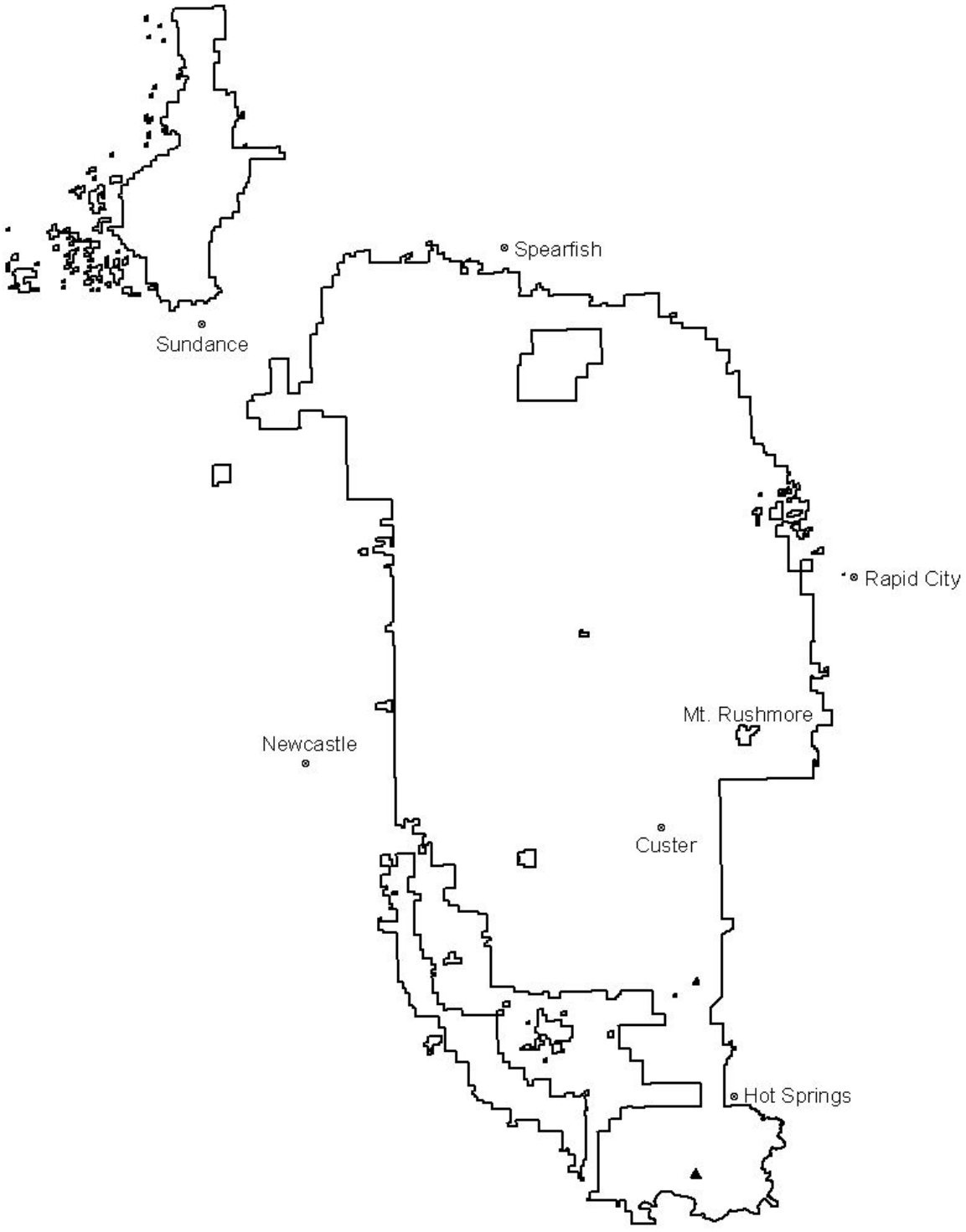
4. Regardless of which alternative is selected that J. H. Keith Picnic Ground will not be authorized for livestock use in the future.

5. That regardless of which alternative is selected, the species will be monitored according to the current monitoring protocol (or as altered through reassessment with the Rocky Mountain Research Station), which is designed to detect and respond in a timely manner to changes in the extent and condition of the *E. gigantea* occurrence (USDA Forest Service 2004c).

6. That plant material collected on the Forest can be used to successfully re-colonize the *E. gigantea* occurrence in the event the site is lost.

7. That in spite of the conservation practices the Forest may use, this plant occurs in an area that has been periodically intensively impacted over many years by activities while the land was under private ownership and from activites the Forest cannot control, such as from high intensity natural disturbance events (such as drought or floods), adjacent highway construction or maintenance, the use of exotic invasive plants in roadside seeding or the drilling of wells that could result in changes to the systems hydrology. The monitoring strategy is designed to detect and respond in a timely manner to impacts to the species and its habitat, but not all impacts can be prevented.

Distribution of *Epipactis gigantea* (Stream Orchid)on lands administered by the Black Hills National Forest



4-2. SPECIES DESCRIPTIONS AND EFFECTS ANALYSIS – INVERTEBRATES

This section contains the distribution and status, natural history, direct and indirect effects, cumulative effects, resource conservation measures, and determination and rationale for Region 2 sensitive invertebrates.

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 generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995). This area was chosen because it encompasses similar ecosystem components and species that occur on the Black Hills National Forest. A larger area would include the surrounding plains, which includes a vastly different suite of species and ecosystem components.

4-2.1. Cooper's Mountainsnail

The 1996 Final EIS BA/BE (USDA-Forest Service 1996 Appendix H) gives a thorough overview of Cooper's mountainsnail *(Oreohelix strigosa cooperi*) distribution and natural history, and is incorporated by reference.

In 2002, the Forest received the final report for a contract to inventory and/or monitor 357 sites for land snails (Frest and Johannes 2002). Many of the sites had been surveyed in the early to mid 1990s, and some were re-visited in 1999 to help assess population changes. More than 100 new sites were inventoried for the first time. A total of 38 species were identified, including 12 not documented previously in South Dakota. The surveys also provided information on Cooper's mountainsnail. Cooper's snail was found at 109 sites, including approximately 70 sites that contain a form of *Oreohelix* that Frest and Johannes (2002) propose be split from the Cooper's snail into its own species, though these taxonomic revisions have not been formally accepted (Anderson 2005). Locations are concentrated in the northern and western Black Hills (Anderson 2005).

When comparing original survey data with that replicated in 1999, five sites appear to have lost the Cooper's snail and one site gained Cooper's snail. In addition, sites surveyed for the first time in 1999 show Cooper's snail at 42 sites.

In 2001 or 2002, Mystic Ranger District personnel monitored ten of the sites that Frest and Johannes surveyed in 1991, 1992, or 1999. Five of the sites were within the Jasper Fire area, but none of these five sites originally contained Cooper's snail. No live specimens of the snail species originally present were observed at any of the Jasper Fire area sites, but additional monitoring is recommended to detect snails emerging from refugia. The remaining (unburned)

five sites contained snail species assemblages similar to those originally reported by Frest and Johannes.

The following discussion is based on information from the Black Hills (Frest and Johannes 2002). Cooper's snail was found on calcareous soils; most localities were lowland wooded areas and talus slopes, generally but not always with northern or eastern exposures. Many of the colonies, including most of the largest, are found in ponderosa pine with a partially closed canopy, a secondary deciduous tree component, and diverse understories. At some sites, white spruce was common. Riparian woodland communities, often in areas with adjacent steep rocky slope bases, were also found to contain some substantial colonies. This species generally dominates the mollusk fauna in the area of occurrence, but it has been found to occur with two other species of land snail: the callused vertigo and striate disc.

Litter is an important component for snails as food and cover. In general snails prefer a well-developed litter layer, but not thick or matted (Anderson 2005). In contrast to other land snails, Cooper's snail can thrive with little cover and thin litter (Anderson 2005). Oreohelix have been observed in a variety of litter types in the Black Hills, including coniferous needles litter, deciduous litter and areas of thin litter (Anderson 2005).

Cooper's snail colonies appear to have been negatively impacted by road construction, grazing, logging, herbicide and pesticide application, and forest fires. No colonies were found in areas that were heavily grazed or completely logged (Frest and Johannes 2002). Timber harvest and grazing may affect snails if it affects the amount of litter, soil moisture or temperature on snail colonies (Anderson 2005). Although fire is a natural disturbance, it can potentially eliminate snail habitat (Anderson 2005). Snails may be able to survive low intensity fires, but high intensity fire would likely be detrimental (Anderson 2005). Forest management, including fire suppression, in the last century has led to fuel buildup, which may promote high intensity fires. Road construction and maintenance can also affect snails by eliminating habitat or killing snails. Roadside brushing or weed spraying can also damage snails and/or their habitat (Anderson 2005). Several known locations of Cooper's mountainsnail are near roads.

4-2.1.1 Direct and Indirect Effects

Hardwood restoration could benefit the species since colonies have been found in these communities. Alternatives 1, 2, and 4 propose to increase the acreage of existing hardwood communities by 10, 10, and 20 percent respectively (Objective 201). Alternatives 3 and 6 more aggressively approach losses to encroachment by proposing to restore 46,000 acres of aspen (approximately doubling the current acreage) and 4,000 acres of bur oak (about a 33 percent increase from current levels) (Objective 201). Alternative 3 and 6 also convert Guideline 2205 to a standard; here, all conifers must be removed when restoring hardwoods. This is intended to slow the encroachment of conifers into hardwood stands. This could negatively affect the Cooper's snail if the conifers are already overtopping the hardwoods, and snails occupy the site. If the conifers are just beginning to encroach and there are snails present (riparian hardwood site), removal of the conifers could be positive. Both of these scenarios assume that the current condition is providing the most suitable habitat, and any changes might reduce suitability.

The effects on the hardwood ecosystem are discussed in Section 3-2.1.3 Hardwood Ecosystems earlier in this chapter and are summarized here. All alternatives are expected to increase hardwoods if Objectives are met and standards and guidelines are followed (See above). Guidelines 2201, 2202, 2203, 2205, 2206, and 2207 conserve and promote hardwood habitats. Alternatives 3, 4 and 6 strengthen Guidelines 2205, 2206 and 2207 to standards, providing the most comprehensive direction for hardwood restoration across the Forest. Alternatives 3 and 6 modify Guideline 2203 to provide a clearer definition of a regenerated aspen stand and change it to a standard. Alternatives 3 and 6 also modify Guideline 2205 to remove all conifers when treating for hardwood restoration. Additional habitat, namely aspen/birch and other hardwood communities, is projected to increase under all alternatives. See Section 3-2.1.3 Hardwood Ecosystems for more discussion of this community. To add additional emphasis for snail conservation, each alternative contains snail-specific direction (Standard 3103). Snail specific direction for each alternative is discussed below.

Alternative 1 conserves habitat at Cooper's snail colonies identified by Johannes and Frest in 1993. This will likely provide adequate protection, assuming that conservation is interpreted as maintaining moist site conditions and protecting the sites if needed. Alternatives 2 and 4 add colonies found by Frest and Johannes (2002) and requires that these colonies be protected from adverse effects of livestock use and other management activities, though the definition of protect is open for interpretation. Alternatives 2 and 4 provide the strictest protection, assuming that 'protect' means no management activities on the colony. However, Alternatives 2 and 4 do not include newly found colonies, as is the case with Alternatives 3 and 6. Alternative 3 allows only management activities at known colonies that maintain mesic site conditions and surface organic material, or enhances snail habitat.

Alternative 6 offers the most direction on managing snail colonies (Standard 3103). The direction in Alternative 6 is based on Anderson (2005) and Burke et al. (1999). Alternative 6 manages sensitive snail colonies to:

a. Retain overstory sufficient to maintain moisture regimes, ground level temperatures and humidity;

b. Retain ground litter, especially deciduous litter;

c. Avoid burning, heavy grazing, OHVs, heavy equipment and other activities that may compact soils or alter vegetation composition and ground cover;

d. If prescribed burning is unavoidable, burn when snails are hibernating, usually below 50 degrees F, and use fast moving fires to minimize effects to snails;

e. Control invasive weeds, but use herbicides when snails are not on the surface and treat individual plants rather than broadcast application.

Alternative 6 also takes an aggressive approach to fuels management. If the above standard is followed on snail colonies, effects to known snail colonies are expected to be minimal. The additional fuel treatments may lead to a more open forest condition in some areas. This could lead to an increase in understory shrubs, which may benefit the snail.

Fire is likely to negatively affect snails, as was found in the Jasper Fire area (USDA-Forest Service 2004b). Management such as Alternatives 3 and 6, which seek to reduce stand density, may provide lower intensity fires to which this species is better adapted. The direction (Standard 3103) in Alternative 6 is the most explicit of all the alternatives and will have best likelihood of reducing effects of prescribed fire on snail colonies.

Herbicide and pesticide applications can contaminate areas with toxic chemicals. Under Alternatives 1 and 2, Guideline 4304 suggests treating individual plants or groups of plants to control noxious weeds, which would minimize the amount of exposure snails might have to chemicals than if broadcast applications occurred. In Alternatives 3, 4, and 6, Guideline 4304 is strengthened to become a standard, and would prohibit broadcast application where sensitive plants occur. Snails are not specifically mentioned here, so it is possible that noxious-weed treatments could affect snails more in Alternatives 3 and 4, than in Alternatives 1 and 2. Alternative 6 specifically addresses herbicide use (Standard 3103) at snail colonies and is expected to have the least impact to snails from herbicides.

Road maintenance will likely affect snail colonies in all alternatives. Road right-of ways are often brushed, including along State highways (e.g. Spearfish Canyon where *Oreohelix* occurs). This activity will likely continue for public safety reasons. The effects from these activities are not expected to change from current levels for all alternatives.

Vegetation management activities, including timber harvest, grazing and fuel treatments, can increase insolation, disturb ground cover, reduce microsite humidity, and increase soil compaction from mechanical operations. Alternatives 1, 2, 3, and 4 will likely provide for the continued persistence of this species, assuming that “conserve” and “protect” is interpreted as including many of the items mentions in Alternative 6 (Standard 3103). The interpretations of “conserve” and “protect” are not always clear. Therefore, these alternatives carry some uncertainty with the likelihood of persistence. Alternative 6 (Standard 3103) specifically outlines the conservation measures for snail colonies and offers the best likelihood that snail colonies will persist over time.

Colonies in the Black Hills are usually separated by less than a few miles. The degree of isolation between colonies depends on their dispersal patterns, which are largely unknown (Anderson 2005). All alternatives will likely conserve existing colonies and are not expected to cause further isolation of colonies through fragmentation.

4-2.1.2 Cumulative Effects

Cumulative effects result from the incremental impact (direct and indirect effects) associated with the alternatives when added to past, present and reasonably foreseeable actions. Past activities on National Forest System lands in the Black Hills are accounted for in the existing condition displayed under direct and indirect effects. Other Federal and non-Federal activities are discussed here.

Management of national and state parks adjacent to the Forest would have an unknown effect on land snail populations. It is assumed that federal and state lands offer suitable habitat for land snail colonies; however, their occurrence is uncertain. Surveys in Wind Cave National Park have

not found this species. National parks and monuments likely contribute to the conservation of this species and compliment the conservation on the Forest.

Road construction and maintenance and right-of-way brushing can be expected to continue on non-National Forest System land. This may affect snail colonies if they occur along these roads.

Privately owned forest lands within the Black Hills Ecoregion may also provide suitable habitat, but resource management by companies and private citizens depends on a number of factors (e.g., desired goals, market prices, development potential) making it difficult to predict future trends in private forest structure and diversity. Potential suitable snail habitat is expected to occur on private lands across the Black Hills. Continued urban development in the Black Hills will likely continue to affect habitat, including riparian areas, thereby increasing the importance of habitat on NFS lands. However, given the conservation measures designed into the Alternatives for hardwoods and riparian areas on NFS lands, and the efforts at national parks and monuments, this species is likely to persist in the Black Hills.

Cumulative effects are likely to be lowest in Alternative 6, followed by Alternative 3, Alternative 4, Alternative 2, and Alternative 1. In Alternative 6, Standard 3103 specifically outlines the conservation measures for snail colonies and offers the best likelihood that snail colonies will persist over time. Alternative 3 does not include the detail in Standard 3101 as does Alternative 6. Alternatives 2 and 4 "protect" snail colconies, but colonies are limited to those identified by Frest and Johannes (2002). Additive impacts might occur at newly discovered snail colonies. Alternative 1 is likely to have the most additive impacts due to the use of the "conserve" in Standard 3103, which could lead to a variety of interpretations.

4-2.1.3 Determination and Rationale

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. The ecosystem approach to forest and riparian area management likely provides suitable habitat for the species in all Alternatives. Riparian areas would be maintained or restored if objectives, standards and guidelines are followed. When this is combined with the snail-specific direction (Standard 3103) for known snail colonies, snails would likely persist on the Black Hills over the next 50 years under all alternatives. Alternative 6 offers the least risk to the species due to the specific direction in Standard 3103. The above determination is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction listed above for the various alternatives will be applied or implemented as written.

2. In Standard 3103, "protect" means no management activities on the colony, and "conserve" means that moist site conditions and litter will be maintained on the colony.

4-2.2. Regal Fritillary

The 1996 Final EIS BA/BE (USDA-Forest Service 1996 Appendix H) provides an overview of regal fritillary distribution and natural history, and is incorporated here by reference.

The Black Hills are at the western margin of the regal fritillary's range, possibly due to increased aridity further west (USDA-Forest Service 2000b). There are only two records for this species from the Black Hills area. One was observed within Custer State Park during 1946, and the second was in the Fort Meade Recreation Area during 1985 (USDA-Forest Service 1996 Appendix H). Neither of these locations is on or within the Black Hills National Forest, but instead is adjacent to the Forest where prairies are more dominant.

The regal fritillary requires open prairies (Royer and Marrone 1992). In South Dakota, the fritillary is most likely to be found in native tall-grass prairies composed of big bluestem *(Andropogon gerardii),* western wheatgrass *(Pascopyrum smithii),* and green needlegrass *(Stipa viridula)* (Royer and Marrone 1992). Continuous prairie greater than 1,000 acres may be required for stable populations (Royer and Marrone 1992). In smaller habitat patches, individuals will move in and out depending on habitat condition and size (Royer and Marrone 1992, USDA-Forest Service 2000b). The Black Hills is primarily forested, and as such contains only relatively small patches. The best habitats within the Black Hills occur in lower elevation prairies along the outer Forest boundary and in interior prairies, although tall-grass species are not predominant in the interior prairies (USDA-Forest Service 1996). Forest-wide, there are less than 24,000 acres of prairie or grasslands that are at least 250 acres in size (USDA-Forest Service 1996 p. H-162).

Adult females of the species lay eggs near violets. After hatching, the first stage larvae crawl to ground cover, where they over-winter. During the following spring, the larvae feed exclusively on violet leaves. By late June or early July, juveniles transform to adults (Royer and Marrone 1992). Adults require a continuous source of nectar-producing flowers such as coneflowers, fleabanes, and thistles (Royer and Marrone 1992).

The primary factor affecting long-term population decline and concerns of species persistence is thought to be conversion of native tall-grass prairie habitats to cropland and pasture, which primarily occurs on private lands. It is estimated that one-half to two-thirds of the regal fritillary's original range has been converted to cultivated cropland, making it a species that is considered rare range-wide (USDA Forest Service 2000b). Fire, prescribed or natural, can be deleterious when it impacts larval hosts (violets), nectar producing flowers, or larvae (Royer and Marrone 1992). Although a prairie native, the regal fritillary apparently has not adapted to fire. Other risks to this butterfly include tree or exotic weed encroachment within prairie meadows, the use of pesticides and herbicides, and grazing by livestock (USDA-Forest Service 1996, 2001a).

4-2.2.1 Direct and Indirect Effects

The regal fritillary and its habitat are limited in the Black Hills region. Because of this, most Forest activities would have no effects. However, because the species may be present periodically, effects could occur and must be disclosed.

No alternative results in the conversion of native prairie to cropland, and there are no croplands administered by the Forest. Conversely, all of the alternatives promote the maintenance or restoration of grassland and meadow habitats. Under Alternatives 3 and 6, Objective 205 encourages restoration of approximately 12,000 acres (13percent increase) of prairie grasslands, and 2,400 acres of meadows (300percent increase) by removing encroaching pines. In addition,

Objective 200-02 in Alternative 3 promotes high grass and forb cover across 20 percent of prairie grasslands, with the intent to provide increased structural diversity. Alternatives 1, 2, and 4, however, take a more conservative management approach by restoring grassland acreage up to 10 percent over 1995 conditions.

Prescribed burning could positively affect regal fritillaries by maintaining native grassland communities and preventing the conversion to shrubs, trees, or undesirable non-native plants. Prescribed fire may be used to accomplish Objectives 205 and 200-02 discussed above. Negative effects from prescribed burning could occur by burning nectar plants, larval host plants, or larvae. All alternatives provide consistent guidance in the application of prescribed burning activities in regal fritillary habitat through Guideline 3105. The guideline prompts butterfly surveys prior to fire use (suitable habitat implied), and in the event regal fritillaries are found, it encourages the Forest to conserve important habitat components. Alternatives 3 and 6 strengthen these measures through Standard 3100-10, which mandates that no more than 60 percent of any contiguous grassland be burned at any one time. This would increase the chance fire would not occur in all places where larvae might be present.

Noxious weed treatments could positively impact the regal fritillary by aiding in native plant restoration. Treatments could potentially harm the species if nectar or larval host plants were treated. Noxious weed treatments would be similar under all alternatives. Guidelines 4302, 4304, and 4305 promote a common sense approach to treating noxious weeds that encourage minimal treatments with the least toxic method; these would benefit the fritillary by decreasing the occurrence of weeds and minimizing unintended negative effects to non-target plants. These guidelines would help ensure that food sources are still available for adults, and minimize the extent to which larvae, larval hosts and larval forage might be affected.

Livestock grazing could affect the regal fritillary by altering plant species composition and by trampling. Utilization could be beneficial by opening grass cover and allowing the establishment and growth of violets and nectar-producing forbs. Heavy utilization could be detrimental by causing the establishment and spread of noxious weeds or through consumption or trampling of important forbs. Grazing guidance would be similar under all alternatives. Objective 302 and Guideline 2501 encourage the Forest to achieve or maintain rangelands in satisfactory condition. If no trend toward satisfactory condition is evident, Guideline 2504 allows changes in grazing systems, allowable use or residual guidelines to improve trend. In Alternatives 3, 4 and 6, the same Guideline (2504) also allows cattle removal or relocation to improve trend. Allowable use levels are prescribed in Guideline 2505 and are the same for all alternatives; however, they would be considered a standard (required) under Alternatives 3 and 6.

In summary, all alternatives conserve or enhance habitat through Objective 205. Alternatives 3 and 6 would also encourage more habitat restoration efforts than Alternatives 1, 2 or 4. All alternatives provide consistent guidance in the application of prescribed burning activities in regal fritillary habitat through Guidelines 3105 and 3100-10. Alternatives 3 and 6 would provide slightly more habitat protection than Alternative 1, 2, and 4 by applying allowable grazing use levels as a standard instead of as a guideline.

4-2.2.2 Cumulative Effects

Cumulative effects result from the incremental impact (direct and indirect effects) associated with the alternatives when added to past, present and reasonably foreseeable actions. Past activities on National Forest System lands in the Black Hills are accounted for in the existing condition displayed under direct and indirect effects. Other Federal and non-Federal activities are discussed here.

Wind Cave National Park and Custer State Park contain considerable amounts of prairie; in fact, they likely administer more prairie than any other government entity in the Black Hills. Management tools employed in these parks are similar to what are used on the Forest, and would generally be considered additive in effects; however, the butterfly's limited occurrence anywhere in the Black Hills must be considered to provide proper context. Both parks support relatively high numbers of native grazing animals such as bison, elk, pronghorn and prairie dogs. Many grassland areas receive relatively constant grazing pressure by one or more of these species, resulting in localized areas with high utilization levels. This could reduce the amount of suitable fritillary habitat available at any given time. Both parks have active prescribed fire programs that, in part, are designed to prevent or reverse pine encroachment on grasslands. Whether butterflies are surveyed or mitigated for prior to these efforts is unknown. Custer State Park also has an active noxious-weed program, but the extent or emphasis of this unknown. Presumably, some treatment occurs in grassland habitat that could be used by regal fritillaries.

Privately owned lands within the Black Hills Ecoregion may also provide suitable habitats for the regal fritillary. The two largest interior prairies within the Black Hills (Reynolds and Gillette Prairies) are primarily privately owned. These areas are in agricultural uses, with grazing and/or hay production occurring. Grazing and hay production also occur in the large, contiguous grasslands outside of the Forest boundary. Smaller meadow or grassland complexes within the Forest boundary are subject to these same uses, as well as increasing development to housing areas. Haying and housing likely render habitat unsuitable, whereas grazing may maintain suitability depending on intensity.

Overall, effects from all sources in the Black Hills have likely resulted in a loss of suitable habitat for the regal fritillary. However, because some activities (e.g., grazing, prescribed fire) do not necessarily result in habitat loss, there is likely to be sufficient suitable habitat across the landscape that would remain suitable and accommodate use by the butterfly in the event it was present in the western portion of its range.

In summary, all alternatives conserve or enhance habitat on the Forest through Objective 205, which could offset impacts on other lands. Alternatives 3 and 6 would also encourage more habitat restoration efforts than Alternatives 1, 2 or 4. All alternatives provide consistent guidance in the application of prescribed burning activities in regal fritillary habitat through Guidelines 3105 and 3100-10. Alternatives 3 and 6 would provide slightly more habitat protection than Alternative 1, 2, and 4 by applying allowable grazing use levels as a standard instead of as a guideline.

4-2.2.3 Determination and Rationale

May adversely impact individuals, but not likely to cause a trend to federal listing or loss of viability in the planning area. Based on the few observations ever recorded and the limited amount of suitable habitat, the Black Hills does not appear to have an established population of regal fritillaries. Periodic appearance and disappearance may be a naturally occurring pattern for the species in this region (USDA-Forest Service 2000b p. 126), and therefore, management could occasionally have effects to a limited number of individuals. Prescribed fire, noxious-weed, and grazing treatments can have both positive and negative effects to the regal fritillary. Grassland restoration objectives in all Alternatives would gradually improve the amount of habitat available, but would likely have little effect on the overall abundance or distribution of the species in the Black Hills. The above determination is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction listed above for the various alternatives will be applied or implemented as written.

2. Activities will move conditions towards the grassland restoration objective in each alternative. The time required to reach this objectives is dependent on funding and other factors. As a result, it may take two or more decades to achieve these objectives.

4-3. SPECIES DESCRIPTIONS AND EFFECTS ANALYSIS – FISH

This section contains the distribution and status, natural history, direct and indirect effects, cumulative effects, resource conservation measures, and determination and rationale for Region 2 sensitive fish.

The 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). For mountain sucker, plains minnow and sturgeon, the cumulative effects analysis is bounded in space as the fourth level watersheds that encompass the Forest. This equates to the headwaters of the Belle Fourche and Cheyenne rivers, and their associated tributaries, downstream to the Belle Fourche/Cheyenne River confluence. The cumulative effects analysis for the finescale dace is bounded in space by the fourth-level Redwater River watershed. The cumulative effects analysis for the lake chub is bounded in space by the sixth-level watershed upstream of Deerfield Dam. This bounding was determined based on these species' distribution and because effects to water quality and/or quantity from Forest Service activities may extend downstream of the Forest boundary but become negligible at a downstream point due to the underlying Black Hills geology and the overriding effects of other non-Forest activities at an ever-increasing watershed/geographic scale.

4-3.1. Finescale Dace

The finescale dace is a northern species occurring from northwestern Canada to New England, south into northern Minnesota, Wisconsin, Michigan and New York (Wyoming Natural Diversity Database 2002). Isaak et al. (2003) assessed the status of finescale dace in the Black Hills where the species occurs as a disjunct population due to past glaciation. The distribution of

finescale dace was historically and is currently limited to a small area in the northern Black Hills, primarily the Redwater Creek Drainage (Evermann and Cox 1896, Bailey and Allum 1962, Wyoming Natural Diversity Database 2002). The distribution and numbers of finescale dace in Wyoming has been influenced by transplants (WYGFD 1996a). Abundance and trend in Wyoming is unknown (Wyoming Natural Diversity Database 2003) though the population in Hemler Reservoir seems secure (USDA-Forest Service 2005a). Hemler Reservoir is a privately constructed dam and reservoir operated under a Forest Service special use permit.

In Crook County, Wyoming finescale dace were reported in 1997 from the following creeks: Richardson, Tent Canyon, Ogden, Rocky Ford, Cow, Redwater (including Hemler Reservoir), and Spotted Tail creek which drains into Sand Creek (Wyoming Natural Diversity Database 2002). Evidence from the 1980's suggests populations may also exist in Geis Reservoir (Isaak et al. 2003). No populations have been documented in the South Dakota portion of the Forest (South Dakota Natural Heritage Program 2002, Isaak et al. 2003).

The life history of finescale dace is not well understood. The Wyoming Natural Diversity Database (WYNDD; 2002) reports their range-wide habitat to include pools of boggy headwaters, creeks and small rivers, lakes and ponds, and often common in beaver ponds usually over silt and near vegetation. In the Bear Lodge Mountains they seem to do best in standing water habitats in conditions to the point of being borderline for most trout (McDowell 2004 pers. comm.). In the past the WGFD have found them in decadent beaver ponds (Ogden Creek drainage), but seldom occupying the stream (flowing habitat) (McDowell 2004 pers. comm.). Spawning occurs from April to June under logs or other cover and the eggs quickly sink to the substrate where they receive no parental care (Isaak et al. 2003). The eggs hatch in about 4-6 days (Isaak et al. 2003). This species is sexually mature by age II (WYNDD 2002). Adults eat mainly insects, snails and fingernail clams (WYNDD 2002). Isaak et al. (2003) reported their diet included an equal proportion of zooplankton, aquatic insects and plant detritus based on a study in Canada.

Risk factors to stream populations include increased watershed afforestation, land uses that decrease aquifer recharge, human uses and reduced beaver populations (Isaak et al. 2003). Hydrologic factors pose additional threats for this species because large floods or lengthy drought could threaten the habitat in Geis (off-Forest) and Hemler Reservoirs. Populations in natural lakes and bog holes are vulnerable to seasonal dewatering or other factors that affect aquifer recharge (Isaak et al. 2003).

4-3.1.1 Direct and Indirect Effects

Direct effects to finescale dace may occur from in-water activities that injure or kill eggs, juveniles or adults. Examples of these activities include the placement or repair of road crossings, water withdrawals or disturbance of spawning habitat and population/habitat monitoring surveys. These activities are anticipated to have negligible effects because road-crossing activities generally occur across streams rather than beaver ponds or other impoundments where finescale dace are more likely to occur. The pace at which in-water construction activities occur is generally slow enough to allow finescale dace juveniles and adults to swim out of the construction area, which is generally small in size. The short egg incubation time (4-6 days) during late-spring limits their vulnerability to disturbance or

dewatering. Spawning and egg incubation generally occurs prior to, or minimally overlaps, the onset of grazing season to avoid or minimize disturbance from livestock watering at sites with finescale dace. Water withdrawals, such as at Hemler Reservoir, likely result in some mortality of finescale dace as aquatic habitat is reduced and fish are forced into less suitable habitat where competition, stress or predation may increase. Water levels in Helmer Reservoir are likely to be adequate through the spawning season when water demand is lower and rainfall amounts are generally higher. Fish population surveys use sampling equipment and handling techniques designed to avoid injury and stress, though some injury or mortality may still occur.

Management activities may result in both positive and negative indirect effects to finescale dace (Isaak et al. 2003). Livestock grazing and timber harvest may negatively affect finescale dace by compacting soil layers and decreasing the infiltration of precipitation that is required for aquifer recharge that sustains spring-fed natural lakes and beaver ponds. An exception may occur for a short period immediately after tree removal and before regrowth when evapotranspirative water losses are minimized, but such increases are short-term and decrease as tree growth in the watershed progresses (Isaak et al 2003).

The level of livestock use (Objective 301a) and the miles of road construction, reconstruction and obliteration (Objective 309) are the same across the range of Alternatives. Under Alternatives 3 and 6, Guideline 2507 is changed to a standard and allows livestock in fenced riparian pastures as long as the objectives of maintaining, enhancing, or conserving the riparian ecosystem and emphasis species persistence are met. Objective 200-03, under Alternatives 3 and 4 protects aquatic and shoreline vegetation around 50 ponds or water catchments over the life of the Plan. In Alternative 6, this objective protects aquatic, shoreline and upland vegetation around ponds or water catchments containing leopard frogs which may reduce soil compaction.

Standard 1103, common to all Alternatives, limits the sum of severely burned and detrimentally compacted, eroded or displaced land to no more than 15 percent of any land unit. Standard 1104, common to all Alternatives, minimizes soil compaction by reducing off-road vehicle passes, by skidding on snow, frozen ground or dry soil, or by off-ground logging systems. In addition, roads tend to direct precipitation to streams, increasing peak flows rather than allowing aquifer recharge. Standards 1105, 1106, 1109, 1113, 1114 and 1116 avoid and minimize road-related impacts to aquatic habitat.

Livestock grazing and timber harvest have probably contributed, along with increased human uses and evapotranspirative demand from a denser forest, to the general decrease in aquifer levels that has occurred across the northern Black Hills (Isaak et al. 2003). For similar hydrological reasons, populations of finescale dace that occur in streams or are associated with beaver ponds that are dependent on late-summer aquifer discharges for maintenance of suitable baseflows may also be negatively impacted by grazing and timber harvest.

Livestock grazing and timber harvest may also indirectly affect finescale dace by affecting beaver populations. Although other processes, including trapping and landowner removal, have contributed to the decline of beaver in the BHNF (Parrish et al. 1996), livestock grazing, to the extent that it occurs near streams, can be expected to have a negative effect on the growth of willows, cottonwoods, and aspens and by extension, beaver and finescale dace populations (Isaak et al 2003). Selective harvest of pines that have invaded riparian areas, by contrast, could

conceivably promote the regrowth of these riparian vegetation types and ultimately benefit finescale dace.

Timber and fire-related management activities that result in ground disturbance have the potential to affect finescale dace through the mobilization and transport of sediment that may affect water quality. Alternatives 1, 3 and 6 propose to treat the most acreage annually for commercial timber harvest followed by Alternative 4 and 2. These potential increases based on site-specific factors such as slope, soil types, proximity to water bodies, residual ground cover, revegetation, etc. Activities such as prescribed burning and pre-commercial thinning were assumed to use the road network serving commercial timber treatments. Treatment acres of small diameter fuels and prescribed burning vary between alternatives. Alternative 6 proposes the most treatment acres, followed by Alternative 3, 1, 2 and 4. Non-commercial treatments are expected to have minimal adverse effect to aquatic resources, based on the assumption that no roads will be constructed for these treatments, that most of these treatments are done by human labor using hand tools or limited mechanized rubber-tired equipment and that some of these small diameter treatment acres will overlap commercial treatment acres.

Implementation of standards and guidelines, watershed conservation practices and State BMPs mitigate these impacts at the project level but may not completely eliminate them. The WCP Handbook contains proven watershed conservation practices to protect soil, aquatic, and riparian systems. They are incorporated verbatim into Forest Plans as standards. Design criteria are specific ways to meet the WCP Handbook standards using current knowledge and technology. Proper implementation of watershed conservation practices meet or exceed State BMPs.

The Forest completed an assessment of standards, guidelines and BMPs to mitigate impacts of Forest-management activities (USDA-Forest Service 2003h). The evaluation compared the effectiveness of BMPs to specific elements/functions, (i.e. buffer zones, erosion and sediment, flow regime, ground cover, water quality) relevant to the Black Hills and provided key literature citations to support the effectiveness determination. In summary, the implementation of BMPs and standards and guidelines on the Forest will be as effective or more effective at preventing erosion, sediment delivery and flow regime changes, as those studied in the literature because of the less erodible soil types, the seasonal rainfall pattern and the gentler topography existing here.

Prescribed burning usually result in a low to moderate severity fire, which protects soil characteristics and allows for the rapid recovery of organic material and ground cover. This in combination with vegetative buffers, limits the potential for sediment input in aquatic ecosystems. Prescribed fire, when used in riparian areas that have been encroached upon by pine, could positively affect finescale dace by facilitating the growth of aspens and willows needed by the beaver. Prescribed fire could, in the short term, decrease evapotranspiration losses from trees and increase the recharge of aquifers that feed spring-fed lakes and streams. These benefits would lessen as the forest habitat returned. Wildfire burning through riparian areas could have the same short-term positive effects; however, wildfire could also lead to flooding and increases in the movement of sediment to streams and reservoirs. Alternative 6 provides the greatest reduction of high or very high fire hazard followed by Alternative 3, Alternative 1, and Alternative 2. Alternative 4 provides the least improvement in reduced fire hazard rating. Guideline 4102 protects streams, stream banks, lakes, and associated vegetation from wildfire suppression efforts under all alternatives. Under Alternative 2, this guideline is treated as a standard. Guideline 4102b, under all alternatives discourages applying fire-retardant chemicals

over riparian and wetland areas. These guidelines and standards would be generally beneficial to finescale dace, although not necessarily directly so.

Water impoundments and diversions can have both positive and negative impacts on finescale dace. Hemler Reservoir contains the most abundant population on the Forest though water levels are subjected to irrigation withdrawals. Water diversions can contribute to seasonally lower water levels in streams and may contribute to an increase of impassable barriers. If flows are diverted from areas where aquifer recharge occurs, finescale dace populations may be affected. Water impoundments and diversion can also lead to the isolation of the remaining finescale dace populations and limit the exchange of individuals. When designing and constructing stream crossings and other instream structures, Standard 1203 provides for the passage of flow and sediment and allows for free movement of resident aquatic life through these structures. Because finescale dace appear to be primarily pond species; however, it is not clear that keeping stream channels open would necessarily aid in the movement of this species from one location to another.

Mining currently has little relevance for finescale dace populations in the Black Hills as it does not constitute a major land-use activity in the range of this species (Isaak et al 2003) and the Bear Lodge Mountains have a low probability for mineral development (USDA-Forest Service 1996a).

Management actions to improve terrestrial and aquatic conditions are likely to benefit finescale dace where treatments overlap this species' range. Objectives 214 and 215 promote the restoration of riparian shrub communities and riparian rehabilitation projects, respectively. Alternative 3 would have the greatest benefit to riparian and wetland ecosystems because it would restore 1,000 acres of riparian shrub habitat. Five hundred acres are targeted for riparian shrub restoration in Alternatives 1, 2, 4 and 6. Under Alternatives 3 and 6 the number of stream reaches proposed for riparian rehabilitation is increased from three (Alternatives 1, 2, and 4) to five stream reaches (Objective 215) with the intent of raising the water table and restoring native wet-meadow vegetation. Alternative 3 and 6 target ten times the amount of aspen restoration acreage as compared to Alternatives 1 and 2, and five times as compared to Alternative 4. Objective 201 targets doubling the current aspen acreage (46,000 acres) and a 4,000 acre increase in bur oak (33% increase) in Alternative 3 and managing for 92,000 acres of aspen 16,000 acres of bur oak in Alternative 6, focusing on sites adjacent to riparian areas that once supported beaver. Alternatives 1 and 2 would restore about 5,000 acres of hardwoods. Alternative 4 would restore about 10,000 acres of hardwoods.

4-3.1.2 Cumulative Effects

Cumulative effects to the finescale dace may result from the incremental impact (direct and indirect effects) associated with the alternatives when added to past, present and reasonably foreseeable actions.

Management activities may increase sediment input into streams and reservoirs. Implementation of standards and guidelines, watershed conservation practices and State BMPs mitigate these impacts but may not completely eliminate them. Remaining impacts, though greatly reduced, are additive to similar effects that occur on non-NFS lands within or adjacent to the Forest, and

natural disturbance events (drought, floods, wildfire). Efforts to reduce the likelihood of catastrophic wildfire would reduce the potential for large amounts of sediment input post-burn. This sediment input is likely to reduce the amount of habitat over time where deposition occurs, such as beaver ponds or reservoirs which may be offset by new beaver activity or management actions that create additional replacement habitat.

The landscape has been altered over time by suppression of fires resulting in the increase of biomass. Higher leaf area from increased woody biomass will increase evaporation and interception, resulting in lower streamflows and the drying of springs (USDA-Forest Service 2003i). Alternatives that remove more trees may have an increase in available surface water and groundwater recharge by reducing the evapotranspiration losses and water uptake resulting from a denser forest. This effect would be additive to similar thinning/harvesting activities that may occur on non-NFS lands. This increase may not be sustainable as the remaining trees and understory vegetation grow. The more pine trees removed the greater benefit. Alternative 6 treats the most acres to meet timber, fire and insect objectives, followed by Alternatives 1, 2, 3 and 4, in descending order, but the real benefits would be contingent on these treatments being implemented in watersheds influencing the finescale dace.

The construction of dams and diversion structures since European settlement has fragmented stream habitats and prevented the types of stream movements many stream fishes make in association with spawning, overwintering, or refounding extirpated populations (Isaak et al. 2003). Existing water impoundments or diversions on non-NFS lands may create impassable stream barriers and affect stream flows. Alternatives 1 through 6 would not have an additive, negative impact on stream connectivity because Standard 1203 requires that all stream crossings and instream structures be designed and constructed to provide for the passage of flow and sediment and to allow free movement of resident aquatic life.

Though existing dams may fragment stream habitat they also create suitable habitat to support the finescale dace. Objectives to restore riparian stream reaches and to increase the number of beaver may improve existing or create additional habitat for the finescale dace. The benefits associated with beaver-created habitat would depend on the presence of existing conditions or the need to restore adequate hardwoods and the subsequent time delay, in order to support beaver.

Efforts by WGFD to transplant finescale dace have maintained or expanded this species range (USDA-Forest Service 2004a). The illegal introductions of sunfishes by recreational anglers appears to have a strong negative effect on populations of finescale dace in natural lakes and is probably responsible for the extirpation of populations from the Mirror lakes and Mud Lake (Isaak et al 2003). Recreational interests also result in the repeated stocking of non-native trout species into other finescale dace habitats, but these predators appear less likely to threaten the viability of finescale dace populations, given the continued coexistence of finescale dace with rainbow trout in Cox Lake. It is unknown, however, whether finescale dace would fare differently in association with a more piscivorous species of trout such as brown trout. Under Alternatives 3 and 6, Guideline 3206 includes wording to ensure the risks to high priority species are considered when determining the suitability and need for transplanting and re-introducing wildlife species for viability purposes. Risks to Region 2 sensitive species would be considered

under these alternatives and should lead to conservation of finescale dace populations, at least on the Forest.

Alternatives 3 and 6 would have the greatest cumulative benefit to finescale dace because they target the most stream reach restoration and have the greatest emphasis on hardwood restoration that may lead to more beaver-influenced aquatic habitat. All alternatives provide similar cumulative protections to finescale dace through the implementation of standards and guidelines, watershed conservation practices and BMPs.

4-3.1.3 Determination and Rationale

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. Direct effects to this species relate to in-water activities that are generally short-term or localized. Water withdrawals in Hemler Reservoir do not occur in successive years, allowing finescale dace numbers to rebound in favorable conditions. Implementation of standards and guidelines, watershed conservation practices and State BMPs avoid and minimize impacts to conserve and enhance the quality and connectivity of aquatic and riparian habitat for this species to support reproductive populations and maintain the distribution of finescale dace.

4-3.2. Lake Chub

The lake chub is found throughout central and eastern Canada and in the northern United States from the northern plains east to the Atlantic Coast. The Black Hills population is isolated and believed to be a glacial relic. Historical accounts suggest that the lake chub was widely distributed across the Black Hills (Isaak et al. 2003). Isaak et al. (2003) describe the current status of the lake chub in the Black Hills as being extirpated from four of the five drainages in South Dakota where they previously occurred. In the remaining drainage (Castle Creek) the lake chub no longer occurs in the stream, but is limited to Deerfield Reservoir.

Deerfield Reservoir is a 414-acre impoundment completed in the late 1940s. The dam is operated and maintained by the U.S. Bureau of Reclamation. The SDGFP (SDGFP) manages the fisheries within the reservoir. The Forest Service manages recreational facilities (boat ramps, campgrounds, etc.) surrounding the reservoir. Deerfield Reservoir is within MA 8.2 – Developed Recreation Complexes. Off-road motorized travel is prohibited, timber harvesting is restricted and livestock grazing may occur outside of fenced recreational complexes. Minor pollution occurs from silt and nutrients washing into the reservoir from Castle/Ditch Creek and Gold Run Creek as well as smaller drainages entering the reservoir (South Dakota Department of Game, Fish and Parks 2002).

The Deerfield Reservoir population has declined in recent years (Isaak et al. 2003, USDA-Forest Service 2005a). In the Wyoming portion of the Black Hills, sampling has not been as intense and population status is less clear. However, in an area adjacent to the Black Hills, Patton (1997) concluded that lake chub has declined in abundance since surveys conducted in the 20th century in eastern Wyoming.

The basic ecology of lake chubs has not been studied on the Forest and is poorly understood. Only generalized descriptions of habitat requirements are known. It is found in lakes and streams that usually have cool waters and clean gravel or cobble substrates (Isaak et al. 2003). The lake chubs' diet consists primarily of mobile aquatic and terrestrial insects and zooplankton. Spawning occurs in the spring in shallow waters over cobble substrates, and eggs are given no parental care (Isaak et al. 2003). Lake populations may spawn within the lake or make a short migration into tributaries (Isaak et al. 2003).

The currently restricted distribution of lake chub in the Black Hills places this species in a precarious position (Isaak et al. 2003). A stochastic event such as a dam failure or chemical renovation of Deerfield Reservoir could be catastrophic and could threaten the continued existence of the lake chub on the Forest. In addition, the recent introduction of rock bass in Deerfield Reservoir poses a significant threat to the lake chub population. Lastly, the deposition of sediments in Deerfield Reservoir is an ongoing process that is gradually decreasing the amount of lake chub habitat provided by the reservoir.

4-3.2.1 Direct and Indirect Effects

Activities to monitor fish populations are the primary direct effect to the lake chub. The Forest's population monitoring of lake chub relies exclusively on SDGFP's monitoring of reservoir fisheries. Sampling gear, such as gillnets and electrofishing, are used that may result in the death or injury of lake chub. Stress induced during general anesthesia and handling for data collection may also harm lake chub.

Management activities that result in ground disturbance and sediment mobilization and transport into Deerfield Reservoir may indirectly affect the lake chub by reducing the quality or quantity of habitat in the reservoir. Forest-wide treatment acres and road construction and reconstruction mileage across the range of alternatives does not give a good indication of potential impacts from ground disturbing activities because of this species current distribution only in Deerfield Reservoir. Upslope ground disturbance will have no impact if the related sediment is not mobilized and transported by the stream network into the reservoir.

Implementation of standards and guidelines, watershed conservation practices and State BMPs mitigate these impacts at the project level but may not completely eliminate them. Refer to the discussion for finescale dace regarding the effectiveness of resource conservation measures, including BMPs.

The collapse of stream banks and removal of riparian vegetation by livestock can increase the amount of sediment in streams, especially in upslope areas. Increased erosion rates associated with fires stem from the removal of vegetation in upslope areas (Isaak et al. 2003 p. 20). Use of best management practices can minimize the increase in sedimentation rates, although, over time, sediment due to these activities may be washed into Deerfield Reservoir. Under Alternatives 3 and 6, Guideline 2507 is changed to a standard and allows livestock into fenced riparian pastures as long as the objectives of maintaining, enhancing, or conserving the riparian ecosystem and species viability are met. Guideline 4102 protects streams, stream banks, lakes and associated vegetation from wildfire suppression efforts under all alternatives. Under Alternatives 3 and 6, Guideline 4102 adds protecting Region 2 sensitive species from wildfire

suppression efforts. Guideline 4102b, under all alternatives, discourages applying fire-retardant chemicals over riparian and wetland areas.

Mining currently has little relevance for the lake chub population in Deerfield Reservoir as it does not constitute a major land-use activity in the upstream watershed.

Wildfire could impact lake chub in Deerfield Reservoir if erosion occurs and sediment is transported into the reservoir that affects water quality. Vegetation may become reestablished post-fire as soon as the following growing season and usually by year 3; therefore, surface erosion is generally short-term and is further influenced by precipitation (amount and intensity). Alternative 6 provides the greatest reduction of high or very high fire hazard followed by Alternative 3, Alternative 1, and Alternative 2. Alternative 4 provides the least improvement in reduced fire hazard rating. These benefits would be contingent on treatments occurring in the Deerfield Reservoir drainage area.

4-3.2.2 Cumulative Effects

Cumulative effects to the lake chub may result from the incremental impact (direct and indirect effects) associated with the alternatives when added to past, present and reasonably foreseeable actions.

Non-NFS lands exist along Castle Creek and other tributary streams feeding into Deerfield Reservoir. Activities on these lands, such as livestock grazing or OHV use, may contribute sediment into Deerfield Reservoir. Shoreline erosion on the reservoir may also contribute sediment. A “no-wake” restriction is in effect for the whole reservoir, which minimizes the amount of wave action created by boats and subsequent shoreline erosion. All alternatives have the potential to contribute sediment that is additive to these other sources. Implementation of standards and guidelines, watershed conservation practices and State BMPs mitigate these impacts but may not completely eliminate them. Remaining impacts, though greatly reduced, are additive to similar effects that occur from natural disturbance events (floods, wildfire) and activities on non-NFS lands within or upstream of the reservoir.

The deposition of sediments and the natural process of eutrophication will gradually decrease the amount of habitat available for lake chub. This additive sediment is not likely to appreciably reduce the design life of the reservoir or degrade the water quality (USDA-Forest Service 2004a). Sabtan (1988 cited in Piroutek 1991) estimated a 0.3 percent annual loss in reservoir volume due to sedimentation and predicted a cumulative loss in reservoir volume of 14.8 percent by 2000. Habitat condition in Deerfield Reservoir is stable based on trophic state (total weight of plant biomass in a waterbody at a specific location and time). Sedimentation rates are low because of the small, vegetated drainage area with underlying rock formations that are resistant to erosion and the absence of large-scale agricultural activities or extensive development in the drainage.

All Phase II alternatives provide for aquatic habitat enhancement, contingent on funding and priorities. Habitat conditions in Deerfield Reservoir are stable and little enhancement effort is expected there. Habitat enhancement efforts in streams where lake chub were historically documented are possible but the benefits to lake chub are likely to be limited due to other native

and non-native fish currently occupying those streams and the need to reintroduce lake chub from Deerfield Reservoir. The potential to transplant lake chub to suitable habitat outside of Deerfield Reservoir exists under all alternatives. This effort would be orchestrated by and need the approval of SDGFP. Under Alternatives 3 and 6, Guideline 3206 includes wording to include transplanting wildlife species for viability concerns.

The construction of dams and other in-water structures since European settlement has fragmented stream habitats and prevented the types of stream movements many stream fishes make in association with spawning, overwintering, or refounding extirpated populations (Isaak et al. 2003). In the case of lake chub, these human-created impoundments are not entirely negative because it seems to provide the only aquatic habitat currently capable of supporting this species since no natural lakes exist on the Forest. Alternatives 1 through 6 would not have an additional negative impact on stream connectivity should re-introduction efforts occur. Standard 1203 requires that all stream crossings and instream structures be designed and constructed to provide for the passage of flow and sediment and to allow free movement of resident aquatic life.

Executive Order 12962 directs federal agencies to provide quality recreational fishing opportunities through habitat restoration, access and education. The introduction of non-native fish species into Deerfield Reservoir for recreational angling may affect lake chub if these non-native fish prey upon or compete with lake chub. Isaak et al. (2003) identify large non-native trout as a potential predator of lake chub. The SDGFP stocks fingerling and adult rainbow trout in Deerfield Reservoir. The level of stocking is likely to reflect the level of public demand as well as habitat conditions. The public demand for recreational fishing opportunities is likely to increase or stay at current levels. None of the Phase II alternatives directly increase the current stocking levels of desirable non-native aquatic species, such as trout. Illegal introductions of non-native fish species into Deerfield Reservoir have occurred; in the case of largemouth bass, this species did not become established. The illegal introduction of rock bass has resulted in an established population, but the effects of this fish species on lake chub are unknown (Isaak et al. 2003). While fish stocking does not directly affect aquatic habitat, it may affect fish populations if non-native species prey upon or compete with native species for limited resources, such as food or cover. Indirectly, the system of Forest roads allows easy access for the illegal introduction of aquatic species into lakes and streams. Several existing boat ramps provide vehicle access to the reservoir. None of the alternatives increase vehicle accessibility to the reservoir.

Native fish species management may affect lake chub populations. Deerfield Reservoir was chemically treated in 1982 to reduce the population of the native white sucker, which would have also reduced the lake chub population. None of the Phase II alternatives propose chemical treatment of the reservoir that may impact the lake chub, because the reservoir is a U.S. Bureau of Reclamation facility and the SDGFP manages the fisheries.

All alternatives provide similar cumulative protections to lake chub through the implementation of standards and guidelines, watershed conservation practices and BMPs that avoid and minimize water quality degradation in Deerfield Reservoir.

4-3.2.3 Determination and Rationale

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. Population monitoring activities may adversely impact individuals, but the sampling is infrequent and short-term and handling techniques that minimize injury/mortality are used. Habitat connectivity within Deerfield Reservoir will not be reduced. Site-specific implementation of standards and guidelines, watershed conservation practices and State BMPs in the Deerfield Reservoir watershed will avoid and minimize indirect impacts to reservoir habitat. Habitat suitability in the reservoir will not be appreciably reduced from the expected design life (100-plus years). All alternatives provide the opportunity to work with State resource agencies to identify the need and suitability of transplanting lake chub.

4-3.3. Mountain Sucker

Isaak et al. (2003) assessed the status of the mountain sucker on the Forest. Mountain sucker populations in the Black Hills are the eastern-most extension of the species. The nearest population outside of the Black Hills is in the Powder River drainage of Wyoming. It occurs most often in cool, clear mountain streams with moderate water velocities. It is rarely found in lakes (NatureServe 2004a). Stream substrate associated with mountain sucker habitat varies widely and ranges from mud to sand, gravel and boulders, although cobbles are most common. This species is found on the stream bottom and is closely associated with cover, (exposed roots, undercut banks, log jams and boulders). Mountain suckers are benthic feeders and their diet is primarily simple plants like diatoms and green algae, but small invertebrates are also ingested. Spawning occurs in the spring and a short migration may be made to spawning areas.

Historic surveys indicate the mountain sucker was widely distributed across the Black Hills (Evermann and Cox 1896, Bailey and Allum 1962, Stewart and Thilenius 1964). The Wyoming Game and Fish Department (1996a, 1996b) and Isaak et al (2003) provide a summary of historic and recent collection sites. Recent surveys suggest that mountain sucker occur in many of its historic drainages throughout the Black Hills (Isaak et al 2003). Erickson (2002) summarizes the current status of mountain sucker populations in South Dakota where populations were known to exist in the 1890s. Mountain sucker were absent at many off-Forest survey sites. Populations persist in French, Rapid, Spring and Whitewood creeks, but localized population reductions have occurred. Dams and water diversions, competition with non-native species and siltation may be affecting populations in South Dakota (USDA-Forest Service 2004f). Reservoirs result not only in habitat loss but also fragment populations and make them more vulnerable to extirpation (NatureServe 2004a).

4-3.3.1 Direct and Indirect Effects

Management activities have the potential to directly impact the mountain sucker. In-water activities, such as stream crossing installation or replacement and aquatic habitat enhancement projects may directly kill or injure mountain suckers. These activities have a low risk to species viability because the area being affected is generally small, construction activities generally proceed at a pace that allows fish to escape the area of disturbance and in-water construction activities generally occur in late summer/early fall when stream flows are lower thereby avoiding overlap with the spawning season and potential negative effects to egg survival. The placement

of in-water barriers to allow construction in the dry may entrap fish if these structures are installed quickly and encompass a large area. Fish may be subsequently killed if the area is dewatered or if the water quality is degraded, e.g. dissolved oxygen is depleted or the water temperature is increased.

Inventory and monitoring activities may directly kill or injury mountain suckers, especially fish population surveys that use sampling techniques that cause harm, such as electrofishing, as well as the stress induced during general anesthesia and handling for data collection. These activities have a low risk to species viability because the areas sampled are small (100 meters) compared to the available occupied habitat and the sampling is infrequent (once per year at most) and short-term (a matter of hours usually). Monitoring has the long-term positive effect to mountain sucker viability because it provides a feedback mechanism to adjust management activities for the species' benefit.

The demand and management emphasis (Executive Order 12962 –Recreational Fisheries) to provide for recreational fishing opportunities may impact the mountain sucker. Recreational fishing has created a demand for the introduction and maintenance of brook trout and brown trout populations. Isaak et al (2003) believed predation by larger brown trout might be impacting the mountain sucker. Direct effects due to angler harvest are minimal given this species non-game status. Incidental harvest of this species is negligible because of different life history traits (food items and feeding behavior) than game species such as trout and the selective fishing gear and techniques used to catch trout. Guideline 3206, common to all alternatives, determines the need and suitability of transplanting species in cooperation with State resource agencies. Alternatives 3 and 6 emphasize the transplantation and re-introduction of wildlife species for viability purposes, which could benefit the mountain sucker.

Management activities may affect habitat supporting the mountain sucker (USDA-Forest Service 1996a, Isaak et al. 2003). Implementation of standards and guidelines, watershed conservation practices, Best Minerals Management Practices (BMPs) and State BMPs avoid and minimize these impacts. Timber harvest and livestock grazing would likely have similar effects on mountain suckers and the streams in which they occur. These types of management activities can potentially result in increased peak flows and flood intensity while decreasing base flows (Isaak et al. 2003 p. 47). Sediment is transported to and through the stream network at accelerated rates due to compacted soil layers and due to the routing of runoff directly to streams along roads.

In addition to the harvest of timber itself, the construction of roads to facilitate harvest can result in larger erosion rates. Gucinski et al. (2001) provide a synthesis of scientific information specific to the direct physical and ecological effects Forest roads cause. Roads may result in aquatic/riparian habitat loss due to floodplain encroachment or stream channel realignment. Unpaved road surfaces are a long-term source of sediment input. Roads may divert and concentrate surface flows, altering the normal runoff pattern and thereby transporting more sediment into streams, lakes, or wetlands. Poorly designed, installed, or maintained culverts may create barriers to fish passage; fragment aquatic habitat; and contribute sediment during their placement or removal or fill-material washout due to debris blockage or design-flow overages during high-flow events.

Increased sediment concentrations in water bodies can impact fisheries and other aquatic life. Increased amounts of sediments may infiltrate and degrade high quality spawning substrates or

decrease the volume of pool habitats (Isaak et al. 2003). This may result in less successful spawning activity, a change in the macro invertebrate populations, or a change in the aquatic plant community (Gucinzki et al. 2001). Standards 1103, 1105, and 1106 and Guideline 1104 mitigate impacts to soil disturbance and compaction. Measures to minimize erosion through rehabilitation and re-vegetation to prevent resource damage are contained in Standard 1109 and Guidelines 1110 and 1111. Adverse effects from increased surface water erosion are addressed in Standards 1112, 1113, 1114 and 1116 and Guideline 1115. Guideline 1108 seeks to perform on-site slope stability examinations and limit intensive ground-disturbing activities on unstable slopes. The above standards and guidelines are common to all alternatives. Standard 1210, common to all Alternatives, requires enough water be maintained in perennial streams to sustain existing stream health

Management activities that result in ground disturbance may indirectly affect the mountain sucker through changes in sediment loads to streams. The larger the amount of ground disturbance and/or the closer proximity to aquatic habitat, the greater the potential for disturbed areas to be connected to the streams and riparian areas, and the greater potential to have an indirect impact to mountain sucker habitat. Alternatives 1, 3 and 6 propose to treat the most acreage annually for commercial timber harvest followed by Alternative 4 and 2.

Treatment acres of small diameter fuels and prescribed burning vary between alternatives. Alternative 6 proposes the most treatment acres, followed by Alternative 3, 1, 2 and 4. Non-commercial treatments are expected to have minimal adverse effect to aquatic resources, based on the assumption that no roads will be constructed for these treatments, that most of these treatments are done by human labor using hand tools or limited mechanized rubber-tired equipment and that some of these small diameter treatment acres will overlap commercial treatment acres.

The collapse of stream banks and removal of riparian vegetation by livestock can increase the amount of sediment in streams. An increased sediment load into streams may reduce spawning habitat and decrease the volume of pool habitats. Stream bank collapse can also affect parameters such as temperature and dissolved oxygen. Measures to maintain proper use or residual levels of vegetative cover promote bank stability adjacent to aquatic habitats and maintain the filtering function of riparian areas adjacent to water (Guidelines 2505 and 2506). Guideline 2505c limits the utilization of willows and other deciduous vegetation to 40 percent. This guideline becomes a standard in Alternatives 3 and 6 and is treated as a standard in Alternatives 2 and 4. Guideline 2505d removes livestock from the grazing unit or allotment when further utilization exceeds proper use or residual levels. Impacts from livestock grazing in fenced riparian pastures are mitigated through Guidelines 2507 and 2508. Under all alternatives, Objective 215 implements riparian rehabilitation projects for stream reaches where the water table has receded and the plant species composition has changed.

Removal of riparian vegetation through prescribed fire can increase stream productivity by allowing more sun, stimulating production, and increasing available food resources (Isaak et al. 2003 p. 48). The killing of trees in riparian areas by fire may also increase the addition of large woody debris to the stream system, adding diversity to fish habitat. Prescribed fire in riparian areas removes ground cover and may result in surface erosion and sediment input into adjacent streams until vegetation has regrown, which is usually less than a growing season.

Wildfire also leads to flooding and increases in the movement of sediment to streams and reservoirs. Wildfire has the short-term adverse effects of increasing water temperature (increased insolation) and changing water chemistry that can result in fish mortality. Alternative 6 provides the greatest reduction of high or very high fire hazard followed by Alternative 3, Alternative 1, and Alternative 2. Alternative 4 provides the least improvement in reduced fire hazard rating. Guideline 4102 protects streams, stream banks, lakes, and associated vegetation from wildfire suppression efforts under all alternatives. Under Alternatives 3 and 6, this guideline adds protecting Region 2 sensitive species from wildfire suppression efforts. Guideline 4102b, under all alternatives discourages applying fire-retardant chemicals over riparian and wetland areas. Guideline 4102c re-vegetates burned areas that will not naturally re-vegetate quickly in order to prevent soil erosion.

Mining activities can affect water quality through vegetation clearing and contamination of areas with toxic leachates. Runoff could directly impact mountain sucker populations by altering the water chemistry and causing mortalities. Food resources used by mountain sucker may also be impacted. These effects are likely to decrease as the distance of mountain sucker populations downstream from the mine increased. Standard 1505 and Guidelines 1506, 1507, and 1508 minimizes disturbance to riparian areas by mineral activities and by requiring monitoring of mitigation measures to ensure effectiveness. The discharge of new pollutant sources is mitigated by Standards 1211, 1212, and 1213 and BMPs.

Water impoundments and diversion create impassable barriers and change the characteristics of aquatic habitat from flowing to standing waters that may limit the movement of mountain sucker or reduce the habitat suitability. When designing and constructing stream crossings and other instream structures, Standard 1203 provides for the passage of flow and sediment and allows for free movement of resident aquatic life through these structures.

4-3.3.2 Cumulative Effects

Cumulative effects to the mountain sucker result from the incremental impact (direct and indirect effects) associated with the alternatives when added to past, present, and reasonably foreseeable actions.

All alternatives have the potential to impact mountain sucker habitat. Implementation of standards and guidelines, watershed conservation practices and State BMPs mitigate these impacts but may not completely eliminate them. Remaining impacts, though greatly reduced, are additive to similar effects that occur on non-NFS lands within or adjacent to the Forest, and natural disturbance events (drought, floods, wildfire). This additive increment is reduced to levels that allow streams to maintain their dynamic equilibrium (the continual adjustment of land-and-stream forms and processes within a natural range of conditions, interrupted only by extreme disturbance events) and subsequently mountain sucker habitat.

The construction of dams and diversion structures since European settlement has fragmented stream habitats and prevented the types of stream movements many stream fishes make in association with spawning, overwintering, or refounding extirpated populations (Isaak et al. 2003). Existing barriers, such as dams, that block the passage of mountain sucker will persist on NFS/non-NFS lands. Construction of new water diversions or impoundments on non-NFS lands

could further fragment stream habitat. Natural factors, such as drought, will continue to dry up stream habitat on a variable basis and the underlying geology disrupts stream connectivity at the "loss zone" within or surrounding the Forest. Drought conditions may favor the persistence of native over non-native species because native fish have adapted to those conditions and may survive better than non-native fish that have not. This adaptive advantage favoring native species may be limited if aquatic habitat is fragmented by impassable barriers and the expansion into unoccupied suitable habitat is blocked.

Alternatives 1 through 6 would not have an additive, negative impact on stream connectivity because Standard 1203 requires that all stream crossings and instream structures be designed and constructed to provide for the passage of flow and sediment and to allow free movement of resident aquatic life. All alternatives have the potential to improve stream connectivity by remove existing instream barriers, such as "perched" culverts at road crossings, as part of general road system improvements or as connected actions to vegetation management treatments. Alternative 6 would have the greatest potential to remove existing barriers at stream crossings, assuming the miles of road reconstructed is proportional to the acres of vegetation treated and that stream crossings are proportional to road miles.

Beaver were more abundant prior to European settlement and were heavily exploited in the late 1800s (Parrish et al. 1996). Management efforts to create conditions more favorable for beaver may result in additional beaver dams that may be migration barriers to mountain suckers (Wydoski and Wydoski 2002). Beaver and mountain sucker co-existed prior to European settlement so this is not expected to be a substantial additive impact on fish passage and may be offset by the ecological benefits derived from beaver dams/ponds (moderated peak flows and increased duration of flows). The beaver population will be limited by available habitat and human tolerance. It will take time to achieve the desired acreage of riparian hardwoods in Alternatives 3 and 6. Given the amount of private inholdings that exist adjacent to streams and the number of stream crossing associated with the road network, damage complaints are expected to increase and "nuisance" beaver may be removed.

The illegal or legal stocking or introduction of non-native aquatic species may adversely impact the mountain sucker. Indirectly, the system of Forest roads allows easy access for the illegal introduction of aquatic species into lakes and streams. Some non-native species may be adapted to only survive in standing water habitat (ponds, lakes, reservoirs), thereby, limiting their expansion into unsuitable stream habitat. The reverse may apply to stream adapted aquatic species. An increase in road system mileage would improve or open access to more of the Forest, but impacts would be contingent on proximity to streams.

Executive Order 12962 directs federal agencies to provide quality recreational fishing opportunities through habitat restoration, access and education. The public demand for recreational fishing opportunities is likely to increase or stay at current levels. Both South Dakota and Wyoming stock trout in Forest reservoirs and streams for recreational fishing. The level of stocking is likely to reflect the level of public demand as well as habitat conditions. None of the Phase II alternatives directly increase the current stocking levels of desirable non-native aquatic species, such as trout. While stocking does not directly affect aquatic habitat, it may decrease native fish populations in lakes and perennial streams if non-native species prey upon or compete with native species for limited resources, such as food or cover. The diet of

larger trout may include an increased percentage of other fish (Isaak et al. 2003). Habitat enhancement efforts, including beaver restoration, that maintain or improve stream conditions may benefit the mountain sucker but these benefits may be reduced if habitat conditions also favor non-native fish species that are detrimental to mountain sucker survival.

Alternatives 3 and 6 would have the greatest cumulative benefit to mountain sucker because they target the most stream reach restoration. All alternatives provide similar cumulative protections to mountain suckers through the implementation of standards and guidelines, watershed conservation practices and BMPs.

4-3.3.3 Determination and Rationale

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. The wide distribution and abundance of mountain sucker in the Black Hills, even after more than a century of intensive land use and the introduction of several non-native predators, suggests the current risks for this species are minimal (Isaak et al. 2003). As a result, land uses and the attendant impact to stream habitats would have to deviate strongly and on a forest-wide scale from historic and current norms before the existence of mountain sucker populations in the Black Hills would be jeopardized (Isaak et al 2003). None of the alternatives are likely to deviate that strongly from the historic or current norms. Direct impacts to the species are localized and of short duration. Management activities that indirectly impact this species are mitigated by the site-specific implementation of Forest-wide standards and guidelines, watershed conservation practices, and State BMPs. These conservation measures maintain habitat suitability and connectivity upstream and downstream of major barriers so that mountain sucker distribution and numbers should be maintained within their historic range on the Forest.

4-3.4. Plains Minnow

Rees et al. (2005) assessed the status of the plains minnow in the Rocky Mountain Region and is summarized here. The plains minnow is found in Kentucky, Tennessee, Illinois, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Montana, Wyoming, Colorado and New Mexico and they have been introduced into Utah. While this species is doing relatively well in Oklahoma, South Dakota, Montana, Nebraska and Iowa, its range has been restricted within these states. The plains minnow is a short-lived (two years) fish. It typically inhabits large, often-turbid rivers that have exposed, shallow, sand-filled channels. In Wyoming, Patton (1997) found plains minnow in the Belle Fourche River and in the Cheyenne River and Beaver Creek, tributary to the Cheyenne River. In South Dakota, this species has been documented in the Cheyenne River and Belle Fourche River downstream of the Forest boundary (Bailey and Allum 1962).

The plains minnow spawns from April to August, with the peak occurring in June. Spawned eggs are non-adhesive, semi-bouyant and settle to the bottom where they quickly absorb water and expand. Detailed studies on feeding habits of plains minnow are generally lacking, but a diet of algae and detritus has been reported.

Habitat degradation through loss, fragmentation, or modification and interactions with non-native species were identified by Rees et al. (2005) as the primary threats to the plains minnow.

4-3.4.1 Direct and Indirect Effects

The plains minnow will not be directly impacted because this species has not been documented on the Forest. Potential indirect effects would be associated with changes in water quality or quantity off of the Forest. The effects of Forest management activities on water quality are described in the mountain sucker discussion. Under all alternatives, implementation of standards and guidelines, watershed conservation practices and BMPs protect water quality on the Forest. A reduction in Black Hills stream flows has been attributed to the increase in trees due to fire suppression (Stewart and Thilenius 1964). All Alternatives affect evapotranspiration losses by harvesting or thinning trees. The effects of tree removal on stream flow are dependant on a number of factors, including watershed characteristics, precipitation patterns, size and number of trees removed, etc. Changes in stream flow downstream of the Forest are not likely to be detectable under any Alternative given the amount of tree harvest and regrowth at a watershed and Forest-level. Standard 1209, common to all Alternatives, requires that vegetation treatments be managed so that stream flows are not changed to the extent that long-term stream health is degraded.

Other water losses on the Forest are limited to evaporation, seepage and livestock use at water catchments in addition to small amounts used from drinking water wells. Forest Service water impoundments are generally maintained and operated for recreational uses, though some small stock ponds for livestock water may impound streams. The Forest manages fifteen engineered dams. Sheridan Lake, which is managed for recreational activities, is the only dam where flows are controlled by the Forest. Releases from the dam are normally consistent with flows coming into the dam. On occasion, additional water has been released to accommodate the downstream brown trout fishery. This management is not expected to change in the foreseeable future. Water loss in Sheridan Lake is limited to minor amounts lost to evaporation. The fourteen remaining small dams operate on a flow-through basis. Water flowing out of the dams is dependant on water flowing into the reservoir. Water loss in these reservoirs is limited to evaporation.

The effect of Forest water development activities on downstream flows is further minimized because the majority of uses occur on water sources that do not flow off of the Forest. Changes in stream flow or water quality resulting from management activities are not likely to be detectable in the main stem Cheyenne and Belle Fourche Rivers. During periods of base flow, most streams lose their entire flow when crossing the “loss zone” comprised of the Madison Limestone and Minnelusa Formation peripheral to the Forest; only Rapid Creek and Whitewood Creek maintain perennial flows through the loss zone on the South Dakota portion of the Forest (Carter et al. 2002). Stream flows entering the loss zone may recharge the groundwater aquifer or resurface as springs.

4-3.4.2 Cumulative Effects

Fire suppression following white settlement has resulting in an increased tree density that has been attributed to reduced stream flows. All Alternatives remove or thin trees but the additive incremental impact is not likely to be detectable on stream flows off of the Forest because of the geology of the Black Hills and the influence of other large non-NFS water storage facilities that alter flows. Water storage and release by other non-Forest Service entities influence flows on the Belle Fourche and Cheyenne rivers. Two major reservoirs, Pactola and Deerfield Reservoirs,

impound Rapid Creek and are located within the Forest. Two other irrigation reservoirs are located along the periphery of the Black Hills on the Cheyenne River (Angostura Reservoir) and Belle Fourche River (Orman Dam). These four reservoirs are operated by the Bureau of Reclamation.

Mining activities have altered aquatic habitat and may create a contaminant source affecting water quality depending on the material being mined and the process for extraction/separation. Historically the northern Black Hills has had extensive precious minerals extraction and the southern Black Hills has had industrial mining activity. During the past two years the location of mining claims has increased in an area of the northern Black Hills known for precious metals deposits and rare earth minerals. There is also active location of claims in the southern part of the Black Hills that was extensively mined for uranium in the 1950s. Much of the current activity in the Forest minerals program is focused on locatable operations (quartz, feldspar, mica, mica schist, etc), some saleable minerals (slate, decorative rock, fill material, building stone, etc), and the reclamation of old abandoned mining sites (2,000 to 2,500 sites). Most mineral proposals approved on the Forest are exploration activities and extraction of mineral resources involving sites 10 acres or less with many being less than five acres. The proposals are often for re-entry into an old site, utilize small cuts, use existing roads, are easily reclaimed, and don't use toxic substances, such as mercury or other heavy metals, for processing.

Placer mining, small surface pits and shallow underground mines were common in the northern Black Hills. Underground gold mining at the Homestake Mine constituted most of the mining activity in Lawrence County from the late 1800's through about 1980 (Williamson and Hayes 2000). The Homestake Gold Mine closed at the end of 2001 (SDDENR 2004b). During the 1980's, significant economic development and population growth began to occur in Lawrence County. Rising gold prices and heap-leach extraction methods allowed the economic recovery of marginal gold ore deposits, resulting in development of several large-scale, open-pit gold mines in Lawrence County (Williamson and Hayes 2000).

Environmental conditions have improved stemming from the increased environmental regulation beginning in the 1970s. Previous studies in the 1970s and 1984 revealed mercury levels in game fish that exceeded recommended Food and Drug Administration levels for consumption (SDDENR 2004a). The mercury appeared to originate from gold mining operations in the northern Black Hills region and entered the Cheyenne via the Belle Fourche River. Mining operations had used mercury in their gold recovery process but mercury use was discontinued in 1970. As a result, mercury concentrations seemed to have declined in fish and sediment of the Belle Fourche River, Cheyenne River, and the Cheyenne River arm (Foster Bay) of Lake Oahe between 1970-71 and 1984-88. Results of fish flesh samples collected in 1998 concluded mercury levels in fish from the Cheyenne River Basin were not significantly higher than mercury in fish from the Moreau River (SDDENR 2004a).

Commercial streamside placer mining activities are no longer a significant source of water quality problems in Black Hills streams (SDDENR 2004a). There were no new mine permits issued to large-scale gold and silver mining operations in 2003 (SDDENR 2004b). About 55 percent of the land in the Black Hills that was disturbed by permitted large scale gold mines has now been reclaimed (SDDENR 2004b).

Forest Service management actions under all Alternatives may have a positive or negative additive impact, but this increment will be negligible in the context of geology of the Black Hills and its effect on surface water and stream flow at the loss zone and other non-NFS water developments that influence stream habitat in the Cheyenne and Belle Fourche.

All alternatives provide similar levels of cumulative protections to the plains minnow through the implementation of standards and guidelines, watershed conservation practices and BMPs that maintain water quality and quantity downstream of the forest boundary.

4-3.4.3 Determination and Rationale

No impact. This species does not occur on the Forest and would not be directly affected. Management actions will not result in further habitat loss, fragmentation, or modification dwonstream of the Forest boundary nor increase the negative interaction with non-native species off of the Forest. Subsequently, populations off of the Forest are likely to persist.

4-3.5. Sturgeon Chub

The sturgeon chub was historically found in the fourteen plains states through which run the Missouri and Mississippi rivers and their larger tributaries (NatureServe 2004a). This species is adapted to highly turbid, warm, medium-to large-rivers. The sturgeon chub has been recorded in the Cheyenne River upstream of the confluence with the Belle Fourche River (Bailey and Allum 1962), but has not been documented on the Forest. Patton (1997) did not detect sturgeon chub in the Wyoming reaches of the Belle Fourche or Cheyenne rivers and their tributaries.

This species has declined mainly due to human-induced changes in river conditions. Dams have flooded river habitat, altered temperature and flow regimes, reduced sediment transport and turbidity, fragmented populations, and reduced movement opportunities (NatureServe 2004a).

4-3.5.1 Direct and Indirect Effects

The sturgeon chub will not be directly impacted because this species does not occur on the Forest. Indirect effects would be similar to the effects described above for the plains minnow

4-3.5.2 Cumulative Effects

Cumulative effects to the sturgeon chub would be similar to those described for the plains minnow.

4-3.5.3 Determination and Rationale

No impact. This species does not occur on the Forest and would not be directly affected. Management actions will not have a detectable impact on habitat or downstream populations of the sturgeon chub. Subsequently, populations of this species off of the Forest are likely to persist.

4-4. SPECIES DESCRIPTIONS AND EFFECTS ANALYSIS – AMPHIBIANS

This section contains the distribution and status, natural history, direct and indirect effects, cumulative effects, resource conservation measures, and determination and rationale for Region 2 sensitive amphibians.

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).

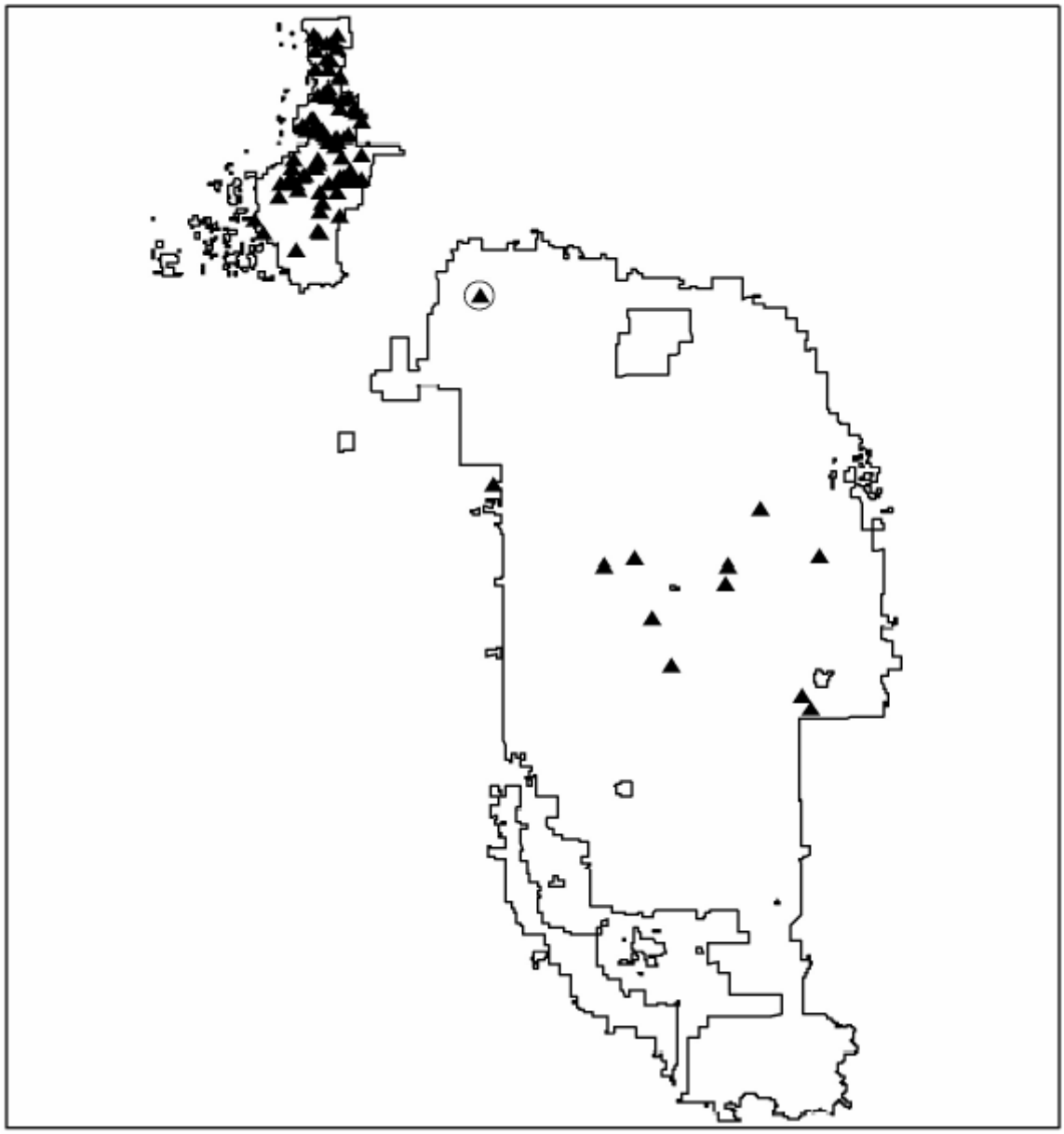
The spatial scale for cumulative effects analysis of Phase II Amendment alternatives generally encompasses the Black Hills Ecoregion as defined by Bailey (Bailey 1995). This area was chosen because it encompasses similar ecosystem components and species that occur on the Black Hills National Forest. A larger area would include the surrounding plains, which includes a vastly different suite of species and ecosystem components.

4-4.1. Northern Leopard Frog

The 1996 Final EIS BA/BE (USDA-Forest Service 1996 Appendix H), provides an overview of northern leopard frog distribution and natural history and is incorporated here by reference. Additional information from a recent conservation assessment of the northern leopard frog by Smith (2003) is also integrated.

Northern leopard frogs are considered common in suitable habitat in the Black Hills (USDA-Forest Service 2000a; Smith 2003) and are found at all elevations, though systematic surveys have not been done in the Black Hills to verify this (Smith 2003). They appear to be more common in the northern Black Hills (Smith 2003). Current leopard frog distribution appears reasonably high based on index sites sampled since 2001 (USDA-Forest Service 2004b). In the Black Hills, it is believed this species has been reduced from its historical abundance due to the reduced number of beaver and the habitat associated with their dams (Parrish et al. 1996; USDA-Forest Service 2000a). Offsetting this decline somewhat has been the development of reservoirs and stock dams (USDA-Forest Service 1996).

General distribution of northern leopard frog observations on the Black Hills National Forest



Source: NRIS FAUNA Database, Accessed 6/15/2005

The northern leopard frog occurs in a wide variety of habitats including creeks, lakes, ephemeral wetlands, and ponds (Fischer et al. 1999; Smith 2003). Based on the National Wetlands Inventory data, there are approximately 5,800 acres of wetland habitat within the Forest administrative boundary (see Riparian and Wetland Ecosystem, Section 3-2.3). This species probably breeds in May or June depending on elevation (Smith 2003). Emergent vegetation is important in providing protective cover in ponds and lakes that contain predatory fish (Smith 2003). After maturing, sub-adult frogs migrate to suitable feeding sites that are usually adjacent uplands. These dispersal movements may be along riparian corridors or upslope areas. After

breeding, adult frogs can be found feeding in upland habitats of grasslands, meadows, and pastures adjacent to breeding areas. Adult frogs are highly mobile, moving at night or when vegetation is wet (USDA-Forest Service 1996). They have been found up to two miles from water (Smith 2003). Northern leopard frogs overwinter submerged in permanent water that does not freeze solid (USDA-Forest Service 1996, 2000a, Smith 2003).

Risk factors identified by Smith (2003) include inadequate regulatory protection of smaller (< 5ha) seasonal and semi-permanent ponds, introduced predatory fish, lack of protection at overwintering sites, water quality degradation due to chemicals, loss of migratory pathways, introduced diseases, and road-related mortality.

4-4.1.1 Direct and Indirect Effects

The direct and indirect effects to the leopard frog resulting from management activities are described in USDA-Forest Service (1996, 2000a). Eggs, larval, and adult leopard frogs may be killed or injured by variety of activities such as on/off-road vehicle traffic associated with recreation or in the course of vegetation management treatments (timber harvest, prescribed burning, wildfire suppression, noxious-weed treatment). Livestock foraging or watering may also kill or injure eggs, larval, or adult frogs. Implementation of standards and guidelines, watershed conservation practices, and State best-management practices (BMPs) emphasize the protection of riparian and aquatic habitats but would not completely avoid the direct effects to this species.

Indirect effects occur to this species in a variety of ways. Management activities may displace or compact soils and remove or disturb ground litter. Compaction by any activity can reduce infiltration capacity. Stream crossings can damage channel stability and increase sediment input. Disposal of slash can result in sediment input from pile/slash burning or fireline construction. Fire prevention and suppression activities can result in ground disturbance within riparian areas and increase the potential for sediment input into aquatic habitat. Water quality may be affected by chemical applications or contaminated surface water runoff.

Indirect effects to the leopard frog are mitigated through a wide variety of standards and guidelines, watershed conservation practices and State BMPs. These effects are analyzed in detail in the Riparian and Wetlands Ecosystems and the Aquatic Ecosystems effects analysis in the FEIS and are summarized below.

Effects to upland and aquatic habitat related to soil disturbance and surface water runoff are mitigated across all alternatives. The amount of soil disturbance and soil compaction is minimized by Standards 1103, 1105, 1106, and Guideline 1104. The adverse effect of increased surface water runoff is reduced by Standards 1112, 1113, 1114, and 1116. Guideline 1115 directs the use of vegetative buffer strips to mitigate sediment input into aquatic habitat. Guideline 4111 locates slash piles scheduled for burning out of meadows that contribute to Waters of the United States.

All alternatives contain direction to avoid the effects of vehicle traffic on riparian and aquatic habitat. Objective 105 strives to prohibit motorized vehicles in wetlands, wet meadows, and riparian areas. Guideline 4102 protects streams, lakes, and adjacent riparian areas from wildfire-suppression efforts, including the use of earth-moving equipment in stream channels. Guideline