3-3.3.5. Species Of Local Concern – Mammals

3-3.3.5.1. Long-Eared Myotis *(Myotis evotis)*

Affected Environment

The long-eared myotis ranges across much of montane western North America, extending from central British Columbia; the southern half of Alberta and the southwestern corner of Saskatchewan; south to Baja California along the Pacific coast; along the western edges of the Dakotas; and most of Wyoming and Colorado to northwestern New Mexico and northeastern Arizona (Schmidt 2003a).

The only records of long-eared myotis in the Black Hills come from unpublished reports (Schmidt 2003a). Clark and Stromberg (1987) report long-eared myotis to occur in suitable habitat throughout Wyoming although the majority of the records are from the western half of the state. Luce et al. (1999) reported long-eared myotis in 22 of the 28 surveys in Wyoming but in only one of the two in the Black Hills counties of Wyoming. It is unknown whether the Black Hills supports a self-sustaining population (Schmidt 2003a).

This species is associated with coniferous montane habitats and has been reported foraging among trees and over woodland ponds (Schmidt 2003a). Limited data suggest that the long-eared myotis uses ponderosa pine snags as summer and maternity roosts in other regions (Rabe et al. 1998, Vonhof and Barclay 1997). Rabe et al. (1998) summarize some key snag characteristics for the long-eared myotis and four other bat species in Arizona: roost snags were generally in larger dbh, had more loose bark, and were found at higher densities. Stumps, also of large diameter, have been documented as summer roost sites for the long-eared myotis in British Columbia (Vonhof and Barclay 1997).

Moths and beetles are believed to be important prey for this species (Schmidt 2003a). Although relatively little is known about this bat's specific hibernation needs, hibernation sites include caves and mines (Higgins et al. 2000), but there are no known reports of them hibernating in the Black Hills (Schmidt 2003a). Reproductive females have been found in buildings, rock crevices, and hollow trees. The female produces a single pup in July or August (Higgens et al. 2000). Reported day roosts for this species include buildings (often abandoned), under loose tree bark, in hollow trees, among timbers of an unused railroad trestle, in caves and mines, in cliff fissures, and in portable latrines (Schmidt 2003a). This bat often uses caves and mine tunnels as nightly roosts (Higgins et al. 2000, Schmidt 2003a).

No specific limits to persistence were identified for this species, but general limitations include the availability of roost sites, hibernacula, and foraging areas (Schmidt 2003a).

Direct And Indirect Effects

Human disturbance in or near hibernacula may cause site abandonment and local population losses. Recreational activities including spelunking can disturb hibernating bats. Habitat loss can occur with the closure of abandoned mines or destruction of buildings used by bats. Disturbance to cave and mine openings that change airflow patterns, temperature regimes, and access can also impact bats. Studies of long-eared myotis in other regions have documented the use of snags as maternity and summer roosts. Alteration of forest structure, which reduces the availability of suitable roost snags, particularly larger snags, could negatively affect this species. Timber-harvest activities of any sort that occur close to known roosting sites during the maternity roosting period (July to August) are anticipated to have negative impacts (Schmidt 2003a).

For all alternatives, the cave ecosystem in general would be managed according to Objectives 109, 110, 112, and 113, and Guideline 1401, as well as the Federal Cave Resources Protection Act of 1988. Most caves would be managed as wild caves, with no facilities to aid or impede use, unless specific needs are identified. Ground disturbance would be avoided within 100 feet of natural cave openings for all alternatives except Alternative 2 (Guideline 1401). In Alternative 2, ground-disturbing activities would be avoided within 500 feet of natural cave openings, which is consistent with Pierson et al. (1999). Guideline 3102 (all alternatives) protects caves and their microclimate when designing management activities where caves are important bat nursery or hibernacula sites. This guideline also protects bat day-and-night roosts. In all alternatives, measures would also be taken to prevent human-caused changes to the cave ecosystem, and if gating is needed to protect cave resources, it will allow free passage of bats, air, and water (Guideline 1401). For more information on caves see Section 3-2.5 Cave Ecosystems in Chapter 3 of the Final EIS.

Additional specific direction for bats is contained in each alternative. All alternatives provide for seasonal closures for known nursery roosts and hibernacula where there are conflicts with people (Guideline 3208). However, Alternatives 3 and 6 specifically mention mines in addition to caves and elevate the guideline to a standard. All alternatives are designed to conserve known bat nursery roosts and hibernacula (Standard 3207). Alternatives 3 and 6 clarify this standard to avoid vegetative changes within 500 feet of caves and mines that serve as nursery roosts or hibernacula. This is consistent with Pierson et al. (1999) and provides more emphasis on bat conservation. Standard 3209 (Alternatives 2, 3, 4, and 6) requires evaluation of abandoned mines for bat habitat prior to closure, and closures shall be designed to ensure bat movement, thereby providing future bat-habitat use. Standards 1503 and 1504 (all alternatives) provide cave protection related to mineral and energy resource development by assuring operating plans or leasing activities avoid damage; assuring protection of cave resources around Jewel Cave National Monument (potential hibernacula of long-eared myotis; and Minnelusa, Paha Sapa; or Madison Limestone areas. If these measures are followed, cave ecosystems and abandoned mines used by bats will likely be maintained in good condition in all alternatives.

The Forest ecosystem is also important for long-eared myotis, particularly the occurrence of snags. Alternative 1 is designed to maintain 1.08 snags per acre at least 10 inches in diameter and at least 15-feet tall (Objective 211). This is further supported by Standard 2301. In Alternative 1, the low standard for snag density and the 15-feet minimum height standard and the lack of direction for snags larger than 10 inches in diameter poses a higher risk for those species requiring a larger diameter or taller snags at higher densities. Still, this alone is not likely to cause the species to not persist on the Forest. Snags do not occur evenly across the landscape. There will likely be some areas with higher snag densities that will allow the species to persist. They would likely persist at much lower densities. Certainly, managing for these conditions present an increased risk to snag-dependant species, and a higher level of uncertainty as to whether the species will persist on the Forest.

Alternatives 2 and 4 are designed to maintain two snags at least 10 inches in diameter and 25-feet tall per acre in ponderosa pine on north- and east-facing slopes and four snags per acre on south- and west-facing slopes. This is also supported by Standard 2301. Alternatives 3 and 6 are designed to maintain three snags per acre at least 9 inches in diameter and at least 25-feet tall. This is further supported by Standard 2301 that requires that all snags over 20 inches be retained unless they are a safety hazard, and requires that all snags be retained unless they are a safety hazard if the snag densities are below the snag objective (211) within project areas. The snag objective in all alternatives is below the snag density suggested by Rabe et al. (1998) of 4.29 snags per acre. The South Dakota Bat Management Plan (South Dakota Bat Working Group 2004) includes a goal to manage for 8.5 snags per acre greater than 12 inches in diameter. However, snags generally do not occur evenly across the landscape. Some areas are likely to have more snags, such as the areas of recent fires and insect outbreaks, while other areas are likely to have few. As a result, some areas of the Forest will likely have snag densities similar to that suggested by Rabe et al. (1998). Alternative 6 reduces the fire hazard and insect risk, and therefore has the greatest potential to reduce future snag recruitment compared to the other alternatives. In Alternatives 1, 2, and 4, Standard 2302 requires projects to move toward the desired snag density if deficient in the analysis area. Restrictions on cutting standing dead trees occur across the range of alternatives through Standard 2304. Guideline 2306 (Alternatives 1, 2, and 4) assures that new snags are recruited by retaining a sufficient number of larger diameter live trees. Based on this analysis, Alternative 1 presents a higher risk to long-eared myotis due to the lower objective for snags. Alternatives 2, 3, 4, and 6 provide adequate snags for long-eared myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. For more information on snags, see Section 3-2.1 Forest Ecosystems earlier in this chapter.

Snag densities suggested by Rabe et al. (1998) and the South Dakota Bat Working Group (2004) will most likely occur in stand-replacing fires and insect outbreaks. Objective 11-03 in Alternatives 3, 4, and 6 provides management guidance for retaining a portion of these conditions as they occur. Alternative 4 provides the highest likelihood these conditions will be maintained. In Alternatives 3 and 6, Objective 11-03 will likely provide sufficient areas of dense snags while allowing some post-fire value recovery. Alternatives 1 and 2 do not include Objective 11-03. However, Mohren (2002) found areas of higher snag density on the Forest even though there was not direction in the Forest Plan similar to Alternatives 1 and 2. There will likely be some areas on the Forest with higher snag densities under Alternatives 1 and 2, but the absence of Objective 11-03 leads to a higher level of uncertainty these conditions will exist.

Structural stages 4 and 5 provide the snag resource suitable for the long-eared myotis. In Alternatives 1, 2, and 4, late successional pine forest comprises 5 percent of the forested land base. In Alternatives 3 and 6, structural stage objectives for specific MAs (MA 4.1-203, 5.1-204, 5.4-206, 5.43-204, and 5.6-204) also target 5 percent of the forested land base to be late successional habitat with additional specificity to provide a certain percentage of larger diameter trees. This provides present and future snags for the long-eared myotis.

The riparian ecosystem provides important foraging areas for the long-eared bat. All alternatives are designed to maintain or restore historic wet areas, wet meadows, and beaver (Objective 215). Standards 1306 and 1505 and Guidelines 1303 and 9108 (all alternatives) will likely maintain the integrity of existing riparian areas from activities such as timber management, mining, roads, livestock grazing, and traffic. Guidelines 2505 and 2507 (Alternatives 1, 2, and 4) manage grazing in riparian areas to a residual objective; under Alternatives 3 and 6, these are elevated to standards to meet the objective of enhancing riparian habitats. Riparian areas will be maintained or enhanced in all alternatives. For more information on effects to riparian areas, see Section 3-2.3 Riparian and Wetland Ecosystems.

The long-eared myotis is thought to feed primarily on moths and beetles. Alternatives 3 and 6 provide increased protection of potential bat prey by prohibiting the use of insecticides for gypsy moth control within two miles of a known bat hibernacula or maternity roost (Standard 3200-02). This will likely avoid widespread killing of non-target moths and butterflies (prey) in the vicinity of bat concentrations.

This species is likely to persist on the Forest over the next 50 years because all alternatives provide for roosting sites, the amount and availability of foraging areas is maintained, and potential cave hibernacula sites are protected. Alternatives 2, 3, 4, and 6 provide adequate snags for long-eared myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest risk to the species due to the lower snag density and height requirements.

The previous evaluation is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.
2. Management will move conditions towards the structural stage objectives for Alternatives 3 and 6. The time required to reach these objectives is dependent on funding and forest growth rates, which are not included in this analysis. As a result, it may take two or more decades to achieve these objectives.
3. Management will move conditions towards snag objectives in each alternative.

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 NFS 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 could affect long-eared myotis populations if present on the Forest. These federal and state lands may have suitable habitats for bats; however, no hibernacula or maternity roosts of long-eared myotis have been documented in the Black Hills area. It is presumed that bats move readily between the Forest and adjacent lands. However, the extent of movements of between hibernacula and summer or maternity roosts is not known for this species (Schmidt 2003a). Human disturbance to roosting-or-hibernating bats or roosting-habitat modification in areas adjacent to the Forest could negatively impact bats using the Forest at other times of the year.

Privately owned lands within and adjacent to the Forest boundary may also provide suitable bat habitat, but resource management and conservation by private citizens and companies depends on a number of factors (e.g., desired goals, market prices, development potential). Some loss of hibernacula and summer/maternity roosts has most likely occurred as a result of abandoned mine closures, recreational caving activities, and timber harvest on private lands. Potential bat habitat is assumed to occur on private lands across the Black Hills; however, the extent and persistence of such habitat is uncertain. However, given the conservation measures designed into the alternatives for caves, abandoned mines, and riparian areas on NFS land and the efforts at Jewel Cave National Monument, long-eared myotis are likely to persist in the Black Hills over the next 50 years.

All alternatives provide for roosting sites, maintain the amount and availability of foraging areas, and protect potential cave hibernacula sites on the Forest. Alternatives 2, 3, 4, and 6 provide adequate snags for long-eared myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest potential for cumulative effects to the species due to the lower snag density and height requirements.

3-3.3.5.2. Long-Legged Myotis *(Myotis volans)*

Affected Environment

The long-legged myotis is common across the western United States. Its range extends across most of western North America, from southeastern Alaska through the western and southern half of British Columbia and the southern half of Alberta, down the western edge of the Great Plains states and into central Mexico (Schmidt 2003b). This species is considered to be the most common and widely distributed member of the genus *Myotis* in the Black Hills region and has been reported from all counties occupied by the Black Hills in both South Dakota and Wyoming (Schmidt 2003b, Luce et al. 1999, Clark and Stromberg 1987, Turner 1974).

The long-legged myotis is primarily associated with montane forest. In the Black Hills, this species occurs primarily at elevations between 4,500 and 6,500 feet (Turner 1974). This species has been documented using ponderosa pine snags as summer/maternity roosts in the Black Hills (Cryan et al. 2001) and in other regions (Rabe et al. 1998). Cryan et al. (2001) found the long-legged myotis roosting in rock crevices in the Black Hills where they may be subject to disturbance by rock climbing activities. Snags used for roosting in the Black Hills were larger in diameter, in a greater state of decay, and were in higher densities when compared to random snags (Cryan et al. 2001). Roosts were generally on south-facing slopes within late successional pine forests. Day roosts are usually under the bark of ponderosa pine and in snags. These bats prefer dead snags characterized by reduced needles and twigs, loose bark, broken tops, hard-to-spongy heartwood, and spongy-to-soft sapwood. Roost snags are generally taller than surrounding trees, close to other available trees, and surrounded by a relatively open canopy (Schmidt 2003b). Reproductive females have been found roosting in buildings, rock crevices, under the bark of trees, and in hollow trees (Schmidt 2003b). Reproductive output is limited to one offspring per year. Hibernating individuals are known to use caves in the Black Hills, including Bush's and Jewel Caves (Schmidt 2003b, Luce et al. 1999, Turner 1974).

The long-legged myotis forages over meadows, ponds, streams, and open mesic habitats of the Black Hills where it feeds on flying insects, particularly moths (Luce et al. 1999, Turner 1974). It is noted for emerging relatively early to feed, often while there is still sufficient daylight to be readily seen. Turner (1974) reported foraging by this species over campgrounds, meadows, and watercourses in the Black Hills. Moths appear to comprise the majority of this species' diet, and it is known to feed on the spruce budworm moth, a major forest pest (Schmidt 2003b).

Although this species is the most common and widely distributed bat in the Black Hills (Turner 1974), general limits to persistence include availability of roost sites, hibernacula, and foraging areas (Schmidt 2003b). The reported preference of this bat for roosting in snags suggests that the availability of mature forests with abundant snags may be a limiting factor (Schmidt 2003b).

Direct And Indirect Effects

The long-legged myotis hibernates in caves; human disturbance in or near hibernacula may cause site abandonment and local population losses. Recreational activities including spelunking can disturb hibernating bats. Habitat loss can occur with the destruction of cave features used by bats. Disturbances to cave and mine openings that change airflow patterns, temperature regimes, and bat access can also impact bats (USDA Forest Service 2001a). Changes in forest structure that reduce the availability of suitable roost snags, particularly larger snags, can negatively affect bats. Timber management or mining activities, particularly the associated loud noise, can also disturb roosting or hibernating bats.

For all alternatives, the cave ecosystem in general would be managed according to Objectives 109, 110, 112, and 113, and Guideline 1401, as well as the Federal Cave Resources Protection Act of 1988. Most caves would be managed as wild caves with no facilities to aid or impede use unless specific needs are identified. Ground disturbance would be avoided within 100 feet of natural cave openings for all alternatives except Alternative 2 (Guideline 1401). In Alternative 2, ground-disturbing activities would be avoided within 500 feet of natural cave openings, which is consistent with Pierson et al. (1999). Guideline 3102 (all alternatives) protects caves and their microclimate when designing management activities where caves are important bat nursery or hibernacula sites. This guideline also protects bat day-and-night roosts. In all alternatives, measures would also be taken to prevent human-caused changes to the cave ecosystem, and if gating is needed to protect cave resources it will allow free passage of bats, air, and water (Guideline 1401). For more information on effects to caves see Section 3-2.5 Cave Ecosystems.

Additional specific direction for bats is contained in each alternative. All alternatives provide for seasonal closures for known nursery roosts and hibernacula where there are conflicts with people (Guideline 3208). However, Alternatives 3 and 6 specifically mention mines, in addition to caves, and elevate the guideline to a standard. All alternatives are designed to conserve known bat nursery roosts and hibernacula (Standard 3207). Alternatives 3 and 6 clarify this standard to avoid vegetative changes within 500 feet of caves and mines that serve as nursery roosts or hibernacula. This is consistent with Pierson et al. (1999) and provides more emphasis on bat conservation. Standard 3209 (Alternatives 2, 3, 4, and 6) requires evaluation of abandoned mines for bat habitat prior to closure, and closures shall be designed to ensure bat movement thereby providing future bat-habitat use. Standards 1503 and 1504 (all alternatives) provide cave protection related to mineral and energy resource development by assuring operating plans or leasing activities avoid damage and assure protection of cave resources around Jewel Cave National Monument, Minnelusa, Paha Sapa, or Madison Limestone areas. If these measures are followed, cave ecosystems and abandoned mines used by bats will likely be maintained in good condition in all alternatives.

The forested ecosystem is also important for long-legged myotis, particularly the occurrence of snags. Alternative 1 is designed to maintain 1.08 snags per acre at least 10 inches in diameter and at least 15-feet tall (Objective 211). This is further supported by Standard 2301. In Alternative 1, the low standard for snag density and the 15-feet minimum height standard and the lack of direction for snags larger than 10 inches in diameter poses a higher risk for those species requiring a larger diameter or taller snags at higher densities. Still, this alone is not likely to cause the species to not persist on the Forest. Snags do not occur evenly across the landscape. There will likely be some areas with higher snag densities that will allow the species to persist. They would likely persist at much lower densities. Certainly, managing for these conditions present an increased risk to snag-dependant species, and a higher level of uncertainty as to whether the species will persist on the Forest.

Alternatives 2 and 4 are designed to maintain two snags at least 10 inches in diameter and 25-feet tall per acre in ponderosa pine on north- and east-facing slopes and four snags per acre on south- and west-facing slopes. This is also supported by Standard 2301. Alternatives 3 and 6 are designed to maintain three snags per acre at least 9 inches in diameter and at least 25-feet tall. This is further supported by Standard 2301 that requires that all snags over 20 inches be retained unless they are a safety hazard and requires that all snags be retained unless they are a safety hazard if the snag densities are below the snag objective (211) within project areas. The snag objective in all alternatives is below the snag density suggested by Rabe et al. (1998) of 4.29 snags per acre. The South Dakota Bat Management Plan (South Dakota Bat Working Group 2004) includes a goal to manage for 8.5 snags per acre greater than 12 inches in diameter. However, snags generally do not occur evenly across the landscape. Some areas are likely to have more snags, such as the areas of recent fires and insect outbreaks, while other areas are likely to have few. As a result, some areas of the Forest will likely have snag densities similar to that suggested by Rabe et al. (1998). Alternative 6 reduces the fir-hazard and insect-risk and, therefore, has the greatest potential to reduce future snag recruitment compared to the other alternatives. In Alternatives 1, 2, and 4, Standard 2302 requires projects to move toward the desired snag density if deficient in the analysis area. Restrictions on the cutting of standing dead trees occur across the range of alternatives through Standard 2304. All soft snags should be retained under Guideline 2305 in Alternative 1; this guideline is treated as a standard in Alternatives 2 and 4 and becomes a standard in Alternatives 3 and 6. Guideline 2306 (Alternatives 1, 2, and 4) assures that new snags are recruited by retaining a sufficient number of larger diameter live trees. Based on this analysis, Alternative 1 presents a higher risk to long-legged myotis due to the lower objective for snags. Alternatives 2, 3, 4, and 6 provide adequate snags for long-legged myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. For more information on snags, see Section 3-2.1 Forest Ecosystems earlier in this Chapter.

Snag densities suggested by Rabe et al. (1998) and the South Dakota Bat Working Group (2004) will most likely occur in stand-replacing fires and insect outbreaks. Objective 11-03 in Alternatives 3, 4, and 6 provides management guidance for retaining a portion of these conditions as they occur. Alternative 4 provides the highest likelihood these conditions will be maintained. In Alternatives 3 and 6, Objective 11-03 will likely provide sufficient areas of dense snags while allowing some post-fire value recovery. Alternatives 1 and 2 do not include Objective 11-03. However, Mohren (2002) found areas of higher snag density on the Forest even though there was not direction in the Forest Plan similar to Alternatives 1 and 2. There will likely be some areas on the Forest with higher snag densities under Alternatives 1 and 2, but the absence of Objective 11-03 leads to a higher level of uncertainty these conditions will exist.

Structural stages 4 and 5 provide the snag resource that the long-legged myotis appears to require. In Alternatives 1, 2, and 4, late successional pine forest comprises 5 percent of the forested land base. In Alternatives 3 and 6, structural stage objectives for specific MAs (MA 4.1-203, 5.1-204, 5.4-206, 5.43-204, and 5.6-204) also target 5 percent of the forested land base to be late successional habitat with additional specificity to provide a certain percentage of larger diameter trees. This provides present and future snags for the long-legged myotis.

This species' foraging habitat may be affected by management activities. These impacts are mitigated by the implementation of standards and guidelines to achieve resource objectives. The long-legged myotis forages in montane meadows. Alternatives 1, 2, and 4 specify restoration guidelines for grassland communities (montane meadows and prairies) of 10 percent over 1995 conditions. Alternatives 3 and 6 would increase the extent of grassland habitats by treating 12,000 acres of prairie grasslands and 2,400 acres of meadow habitats. Grassland and meadows are expected to be maintained or enhanced in all alternatives. For more information on effects to the grassland ecosystem, see Section 3-2.2 Grassland/ Shrubland Ecosystems.

The riparian ecosystem provides important foraging areas for the long-legged myotis. All alternatives are designed to maintain or restore historic wet areas, wet meadows, and beaver (Objective 215). Standards 1306 and 1505 and Guidelines 1303 and 9108 (all alternatives) will likely maintain the integrity of existing riparian areas from activities such as timber management, mining, roads, livestock grazing, and traffic. Guidelines 2505 and 2507 (Alternatives 1, 2, and 4) manage grazing in riparian areas to a residual objective; under Alternatives 3 and 6, these are elevated to standards to meet the objective of enhancing riparian habitats. Riparian areas will be maintained or enhanced in all alternatives. For more information on effects to riparian areas, see Section 3-2.3 Riparian and Wetland Ecosystems.

The long-legged myotis is thought to feed primarily on moths and beetles. Alternatives 3 and 6 provide increased protection of potential bat prey by prohibiting the use of insecticides for gypsy moth control within 2 miles of a known bat hibernacula or maternity roost (Standard 3200-02). This will likely avoid widespread killing of non-target moths and butterflies (prey) in the vicinity of bat concentrations.

This species is likely to persist on the Forest over the next 50 years because all alternatives provide for roosting sites, the amount and availability of foraging areas is maintained, and potential hibernacula sites are protected. Alternatives 2, 3, 4, and 6 provide adequate snags for long-legged myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest risk to the species due to the lower snag density and height requirements.

The above evaluation is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.
2. Management will move conditions towards structural stage objectives for alternatives 3 and 6. The time required to reach these objectives is dependent on funding and forest growth rates, which are not included in this analysis. As a result, it may take two or more decades to achieve these objectives.
3. Management will move conditions towards snag objectives in each alternative.

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 NFS 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 could affect long-legged myotis populations on the Forest. These federal and state lands have suitable habitats for bats, and roosts and hibernacula have been reported (e.g., Jewel Cave). It is presumed that bats move readily between the Forest and adjacent lands. However, the extent of movements between hibernacula summer/maternity roosts for long-legged bats is not well known (Schmidt 2003b). Human disturbance to roosting or hibernating bats or habitat modification in areas adjacent to the Forest could negatively impact bats using the Forest at other times of year. Timber harvest strategies that reduce snag resources and late successional forests could also impact long-legged bat populations on and off the Forest.

Privately owned lands within and adjacent to the Forest boundary may also provide suitable bat habitat, but resource management and conservation by private citizens and companies depends on a number of factors (e.g., desired goals, market prices, development potential). Some loss of hibernacula and summer/maternity roosts has most likely occurred as a result of caving activities or development on private lands. Private lands managed for timber harvest may tend to have fewer acres in late successional stage forest and fewer snags. Potential bat habitat is assumed to occur on private lands across the Black Hills; however, the extent and persistence of such habitat is uncertain. However, given the conservation measures designed into the alternatives to protect roosting, foraging, and hibernacula sites on NFS land and the efforts at Jewel Cave National Monument, long-legged myotis are likely to persist in the Black Hills over the next 50 years.

All alternatives provide for roosting sites, maintain the amount and availability of foraging areas, and protect potential cave hibernacula sites on the Forest. Alternatives 2, 3, 4, and 6 provide adequate snags for long-legged myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest potential for cumulative effects to the species due to the lower snag density and height requirements.

3-3.3.5.3. Meadow Jumping Mouse (*Zapus hudsonius campestris*)

Affected Environment

Meadow jumping mice range across Alaska through Canada, the northern and eastern United States, and across the Great Plains to the eastern foothills of the Rocky Mountains (WYNDD 2002, Whitaker 1972). *Zapus hudsonius campestris*, commonly referred to as the Bear Lodge meadow jumping mouse, is a separate subspecies that occurs in the Black Hills region (Beauvais 2001) and is listed as rare in Wyoming (Luce et al. 1999). There are seven recorded occurrences of this species on the Bearlodge Mountains of the Black Hills, including the type specimen collected in 1864 (WYNDD 2002). Turner (1974) collected a total of 207 specimens from across the Black Hills and Bear Lodge Mountains in South Dakota and Wyoming. He collected the species as far south as Wind Cave National Park. Turner (1974) characterized the species as common throughout the study area (Black Hills and Bear Lodge Mountains).

This species is strongly associated with riparian habitats along small streams in meadows and habitats beneath forests with an understory of deciduous shrubs, grasses, forbs, and fallen logs and is presumed to disperse primarily along stream corridors (Luce et al. 1999). The meadow jumping mouse is a profound and continuous hibernator, retreating to burrows in dry ground from October to May. Burrows are also used for nests. Diet includes grasses, grass seeds, fungi, buds, berries, leaves, nuts, and insects (Luce et al. 1999).

Domestic animal overgrazing, which consistently removes dense vegetation along eastern creeks in Wyoming, is thought to have contributed to this species' scarcity (WYNDD 2002). However, there is little evidence that the mouse is scarce relative to historic abundance. Zapus in general tend to occur at relatively low abundance, and it is uncertain whether current abundance is different than the past. Limits to abundance and distribution include reduction of understory shrubs, grasses, and forbs in low-to-mid elevation riparian areas (Luce et al. 1999, WYNDD 2002). Fragmentation of appropriate riparian habitat may limit this species' ability to disperse..

Direct And Indirect Effects

Management activities may indirectly affect this species by modifying the quality or extent of riparian habitat. Indirect effects to the meadow jumping mouse are mitigated through a wide variety of standards and guidelines, watershed conservation practices, and State BMPs that protect riparian areas. All alternatives are expected to maintain or enhance riparian areas on the Forest. These effects are analyzed in detail in Section 3-2.3 Riparian and Wetlands Ecosystems and Section 3-2.4 Aquatic Ecosystems and are summarized below.

Forest-wide standards and guidelines protect riparian areas, water influence zones, and wetlands. Under all alternatives, long-term riparian ecosystem health and ecological function are provided for by not allowing actions that would be detrimental to riparian-ecosystem condition (Standards 1301, 1302). Riparian and wetland areas that contain emphasis species are given additional protection from direct and indirect disturbances under all alternatives (Guidelines 3106a,b, c or 3107a,b, c). In Alternatives 3 and 6, Guideline 3106 becomes a standard. Standard 1306 prohibits log landings, decking areas, and mechanical-slash piling within riparian areas unless the integrity of riparian areas can be protected.

Improper livestock grazing can have numerous adverse effects on riparian and wetland ecosystems such as water quality degradation and over utilization of riparian vegetation (USDA Forest Service 1996a). Human activities in the past have altered the riparian areas in the Black Hills though grazing, decline in beaver, and changes in hydrology (Parrish et al. 1996). Most of these impacts have been moderated during the last century under improved management (Parrish et al. 1996). The level of livestock use will remain constant across the range of alternatives (Objective 301a, 128,000 Animal Unit Months). Under Alternatives 3 and 6, the Forest-wide guideline (2505) on residual levels (the remaining height of key plant species after livestock grazing) is changed to a standard and modified so that residual levels in riparian and wetland areas would have to be prescribed in allotment management plans (AMPs) or AOI letters. 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.

All alternatives contain direction to avoid the effects of roads and vehicle traffic on riparian and wetland habitat. Objective 105 strives to prohibit motorized vehicles in wetlands, wet meadows, and riparian areas. Standard 1113 minimizes sediment discharge into streams, lakes, and wetlands during road construction and other site disturbances. Guideline 4102 protects streams, lakes, and adjacent riparian areas from wildfire-suppression efforts, including the use of earth-moving equipment in stream channels and the use of fire-retardant chemicals would be avoided in riparian areas, wetlands, and open water. Guideline 9107 prohibits land vehicles from entering perennial steams where resource damage would occur. Guideline 9108 restricts vehicle traffic to roads and trails in riparian areas. Both of these guidelines become standards in Alternatives 3 and 6.

The effects of pollutants on water quality are mitigated across the range of alternatives to maintain wetland habitat. Standards 1211, 1212, and 1213 require the placement of new chemical and pathogenic pollutants where they will not reach surface or groundwater; require the application of runoff controls to disconnect new pollutant sources from surface and ground water; and require the application of chemicals using methods to minimize the risk of entry to surface and ground water, respectively. In all alternatives, Guidelines 4304 and 4305 minimize the impact from chemical treatment applications through selective application at the lowest effective rates. Standard 4308 requires the use of buffers around water sources, lakes, wetlands, and streams to keep concentrations of chemical agents in the water well below those harmful to drinking, irrigation, aquatic life, and non-target vegetation. The treatment of individual plants with aquatic-labeled chemical agents may occur in buffers.

Standard 1505 and Guidelines 1506, 1507, and 1508 minimize 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. Standard 1305 locates camping sites for contractual purposes (e.g., mining, logging, etc.) such that channel and riparian areas are not impacted.

All alternatives contain measures to minimize direct and indirect impacts to riparian and wetland habitats; however, Alternatives 3 and 6 contain additional provisions that provide additional conservation measures for these areas. Alternatives 2 and 4 continue to treat a number of environmentally protective guidelines as standards.

Under all alternatives, the meadow jumping mouse is likely to persist on the Forest over the next 50 years because the amount and distribution of suitable habitat would be maintained or enhanced. Alternative 3 benefits riparian habitats more than the other three alternatives, with double the restored acres in addition to converting some riparian guidelines to standards. Alternatives 3 and 6 also restore an additional two stream sections above the three stream segments targeted under the other three alternatives.

The above evaluation is based on the assumption that the conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.

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 NFS 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.

Limitations on management actions and the achievement of riparian-habitat objectives will have a positive additive impact on maintaining habitat for this species over the next 50 years. Private in-holdings occur frequently within riparian areas. These private lands provide suitable habitat, but conditions may have been altered by private land management activities such as livestock grazing or draining to convert to drier site conditions for subsequent haying. Efforts to conserve and enhance riparian habitat for this species on the Forest may be constrained by habitat conditions on adjacent non-NFS lands.

Under all alternatives, the amount and distribution of suitable habitat would be maintained or enhanced on the Forest. Alternative 3 benefits riparian habitats more than the other alternatives, with double the restored acres in addition to converting some riparian guidelines to standards. Alternatives 3 and 6 also restore an additional two stream sections above the three stream segments targeted under the other three alternatives. Alternatives 1, 2, and 4 retain riparian and stream restoration currently in place and offer the least potential benefit to riparian habitat.

3-3.3.5.4. Mountain Goat (*Oreamnos americanus*)

The revised LRMP (USDA Forest Service 1996a, Appendix H) gives a thorough overview of the mountain goat distribution and natural history and is incorporated by reference.

Affected Environment

The range of the mountain goat extends from the northern United States Rocky Mountains to Southeast Alaska (Clark and Stromberg 1987). Mountain goats are characteristically found in sub alpine and alpine tundra areas in the Northern Rockies and coastal mountain ranges of western North America (Higgins et al. 2000). This species inhabits rugged terrain including cliffs, rock faces, ledges, and talus slopes, typically above timberline.

Mountain goats may begin breeding at 2½ years of age. Mating occurs during November and early December, with typically one young goat (kid) born in May or June. Mountain goats feed throughout the morning, rest at midday, and resume feeding in the late afternoon, continuing into the evening. A wide range of forage is utilized including chokecherry, Russian buffaloberry, grasses and sedges, quaking aspen, serviceberry, wild rose, willow, and hazel (Richardson 1971). Usually the most available forage rather than the most palatable forage is consumed (Richardson 1971). Hunting, winter starvation, accidental deaths from rockslides, and predation are some causes of mortality (Higgins et al. 2000).

Six mountain goats were introduced into the Black Hills in 1924 from Alberta, Canada. Primary range and habitat of the mountain goat in the Black Hills covers about 2,000 acres and is centered around Harney Peak and The Needles (Richardson 1971). The Black Hills population, estimated in 1971 by Richardson, was approximately 300 to 400 animals. At that time, the population was considered static and occupying all suitable habitat in the Black Hills. The current population is estimated at 150 to 175 animals (USDA Forest Service 1996a, Appendix H).

The mountain goat population occurs largely within the Black Elk Wilderness (MA 1.1A) and the Norbeck Wildlife Preserve (MA 5.4A). Current mountain goat populations (approximately 160) are smaller and more fragmented than estimates in 1971 (Richardson 1971), but are higher than estimates in 1987 (SDGFP 2003). Population estimates steadily increased from 1987 through 1995 and then decreased to the current levels in 1998 (SDGFP 2003). SDGFP has issued two to four licenses each year since 1997 and hunter success has been 100 percent for each year except one (SDGFP 2003). According to SDGFP 2002 Annual Report on Big Game Harvest Projections (SDGFP 2003), mountain-goat populations have been stable over the last 5 years.

South Dakota Natural Heritage Program or Wyoming Natural Diversity Database does not track the mountain goat. In the Black Hills, limits to persistence include a small population size and limited availability of preferred habitat, recreation-activity disturbances, and loss of foraging habitat due to pine encroachment.

The mountain goat is found most abundantly on rock outcrops and high elevation meadows. Foraging habitat is alpine meadow, grassland, and montane shrubland (Benzon and Rice 1987). This habitat is limited on the Forest and thus a limiting factor for the mountain goat.

Direct And Indirect Effects

The mountain goat population is mostly located within MA 5.4A (the Preserve) and 1.1A (the Wilderness). Resource conservation measures designed for these MAs likely to benefit the mountain goat include the following:

Objectives 1.1A-401 and 1.1A-405, Standard 1.1A-5101, and Guidelines 1.1A-5102, 1.1A-5103, and 1.1A-5105 (all of which would be implemented under all alternatives) would likely benefit mountain goat by protecting and restoring wilderness ecosystems.

Objective 5.4A-203 and 5.4A-210b (all alternatives) are designed to provide a balance of forage and cover for big game including mountain goats. Guideline 5.4-4102 emphasizes the use of prescribed fire as a tool to enhance the vigor and palatability of grass and woody vegetation for the benefit of wildlife and domestic livestock under all alternatives.

Management actions on the Forest would be unlikely to impact mountain goats due to their limited distribution and preference for high elevation rocky habitat. Objectives, standards, and guidelines designed to promote meadow habitat and reduce tree encroachment may increase forage for the mountain goat if implemented near rocky areas in the Preserve.

All alternatives continue the current management of the Black Elk Wilderness and the Norbeck Wildlife Preserve. The wilderness designation for MA 1.1A will likely maintain habitat conditions over the next 50 years similar to existing conditions. MA 5.4A includes objectives to manage 15 to 20 percent of conifer-forested areas for forage, 25 to 50 percent in early or mature stages, 20 to 25 percent in late successional stages (Objective 5.4A-203), and to enhance shrub productivity (Objective 5.4A-205). Managing towards these objectives will likely provide forage in close proximity to escape terrain (cliffs). Due to the stable condition of the goat population and the objective, standards, and guideline for the Preserve and the Wilderness, mountain goat populations are expected to persist over the next 50 years.

The above evaluation is based on the assumption that the conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.

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 NFS 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.

Mountain goats could potentially use habitat at Mount Rushmore National Memorial and in Custer State Park, but there is no information on how they might be affected by human activity in these areas.

Privately owned meadow, montane shrubland, and rock outcrop habitat adjacent to the Preserve may also provide mountain goat habitat. Resource management by private citizens and companies depends on a number of factors (e.g., desired goals, market prices, development potential) making it difficult to predict future trends. Urban development is expected to continue in the Black Hills. Some development may occur in meadows adjacent to the Norbeck Wildlife Preserve. However, the rocky, high elevation portion of the Black Elk Wilderness and the Norbeck Wildlife Preserve will likely remain in the present conditions.

The Alternatives are not expected to differ significantly in cumulative effects because all alternatives continue the current management of the Black Elk Wilderness and the Norbeck Wildlife Preserve.

3-3.3.5.5. Northern Flying Squirrel (*Glaucomys sabrinus*)

Affected Environment

This nocturnal mammal is a resident of the mountainous areas of the western United States and boreal forests of North America. Its range includes eastern Alaska, the montane western United States, most of Canada, and the northeastern United States (Whitaker 1980). The northern flying squirrel in the Black Hills is an isolated population with the nearest population located in the forests of western Wyoming (Clark and Stromberg 1987, Wells-Gosling and Heaney 1984).

Throughout their range, northern flying squirrels inhabit a wide variety of woodland habitats, typically dominated by conifers or mixed coniferous/deciduous forests (Wells-Gosling and Heaney 1984). Optimal northern flying squirrel habitat has been reported as cool, moist, mature forest with abundant standing and down snags. It is often most abundant near surface water (swamps and streams) (NatureServe 2004). Recent studies have indicated northern flying squirrels occupy a variety of forest types and are not necessarily old growth dependent (Cotton and Parker 2000).

Northern flying squirrels typically nest in tree cavities or abandoned woodpeckers holes in winter and summer. They may also build nests of twigs, bark, and roots use abandoned bird nest platforms in summer (Wells-Gosling and Heaney 1984).

There is a lack of specific data on habitat use by northern flying squirrels in the Black Hills. Turner (1974) noted that the highest densities are likely found in white-spruce forests in moist canyons of the northern Black Hills. Duckwitz (2001) found flying squirrels in Wind Cave National Park in ponderosa pine types that had an open canopy allowing understory grasses to prosper. Open pine types may provide the “openness” necessary for gliding. Locations where flying squirrels were found in Wind Cave National Park did have large pines. Stands of dense dog hair pine were avoided (Duckwitz 2001).

Northern flying squirrel diet includes lichens, fungi, various nuts, seeds, insects, eggs, and nestling birds (Luce et al. 1999). Two to seven young are born in the spring (Whitaker 1980).

Flying squirrels tend to avoid large openings, possibly because they cannot cross them by gliding in the air (USDA Forest Service 1996a). They use hollow trees, cavities, abandoned woodpecker holes, or dense portions of trees as nest sites (USDA Forest Service 1996a, Wells-Gosling and Heaney 1984).

Direct And Indirect Effects

Forest-management activities that reduce the amount of mature mesic forest or increase forest fragmentation could negatively affect northern flying squirrels. Alteration of forest structure that reduces the availability of suitable nesting snags could also negatively affect these squirrels. Timber harvest activities that occur within occupied flying squirrel nesting habitats during the nesting season could directly displace, harm, or kill young, non-mobile flying squirrels.

There are currently 25,000 acres of white spruce, which represents 2 percent of the Forest. Under Alternatives 1, 2, and 4, Objective 204 calls for managing and conserving white spruce as well as lodgepole pine, limber pine, and Douglas fir. Objective 200-01 was established under Alternative 3 to provide for late successional stages within white spruce; favoring hardwood restoration where spruce has encroached upon hardwoods; and favoring spruce where it is encroaching into pine stands, especially where it improves connectivity between spruce stands. Spruce still may be treated where it occurs within 300 feet of buildings to provide for defensible space for fires. In Alternative 6, Objective 200-01 manages for 20,000 acres of spruce habitat across the Forest. In Alternative 6, spruce could be treated within 200 feet of buildings, where spruce has encroached into hardwoods, and for emphasis species management.

Spruce habitat has likely increased since historic times (Parrish et al. 1996) and has continued to increase some since 1995. The effects to the spruce ecosystem are discussed in Section 3-2.1.2 White Spruce Ecosystems earlier in this chapter and are summarized here. Alternatives 3 and 6 would have the largest direct impact, as more spruce would be removed under the more aggressive approaches to hardwood and riparian restoration. These losses, however, are expected to be balanced by the preference of spruce over ponderosa pine in other areas in Alternative 3. Alternatives 1, 2, and 4 would also directly remove spruce but to a lesser extent. Overall, however, the amount of spruce (about 25,000 acres) is not expected to change into the future under these alternatives because only marginal changes at the edges of existing spruce stands are expected. These changes would result from direct management to benefit hardwoods or reduce fire hazard around buildings or from the natural encroachment of spruce in aspen stands. Alternative 6 manages for less spruce than current estimates (Objective 200-01) and has the most potential to affect spruce habitat. This is largely due to treatments to increase aspen where spruce has encroached and for emphasis species management. However, spruce habitat is expected to remain at levels similar to that which was estimated in 1995.

Although flying squirrels are thought to prefer mesic, mature, spruce forests in the Black Hills, mature and late successional stage pine forests (Structural Stages 4C and 5) on more mesic sites may also contain the snag resource northern flying squirrels appear to require. The effects on ponderosa pine are discussed in Section 3-2.1.1 Ponderosa Pine Ecosystem earlier in this chapter and are summarized here for flying squirrels. Alternative 4 could have the most acreage in these structural stages, followed by Alternatives 3 and 6, respectively. These projections are based on the expected achievement of structural stage objectives. Alternatives 1 and 2 do not have an objective for structural stage 4C, so the amount of this type of habitat that would be available on the landscape in the future is less certain. Certainly, there would be some of each of structural stage present in Alternative 1 and 2, but how much is unclear.

Large trees may also be important for this species. Alternative 1 does not include direction for providing large trees on the landscape. Alternatives 2 and 4 contain direction (Guideline 2306 treated as a standard) to manage for an average of one 20-inch diameter tree, or the largest size class available, per acre within the associated watershed designed to provide large trees that may become large snags. Alternative 3 contains direction in the structural stage objectives (Objectives 4.1-203, 5.1-204, 5.4-206, 5.43-204, and 5.6-204) to maintain 15 percent of the structural stage 4 and 5 basal area in the 15- to 19-inch diameter class, and 10 percent of the structural stage 4 and 5 basal area in the greater than 19-inch diameter class. This will provide medium and large diameter trees and snags throughout the mature and late successional ponderosa pine type. Alternative 6 contains direction in the structural stage objectives to manage 10 percent of the structural stage 4 ponderosa pine acreage in the management area with a tree size of very large (16 inches diameter or greater). This will provide roughly 100,000 acres with abundant large trees, which also serve as a future source of abundant large snags. Alternatives 2, 3, 4, and 6 will likely provide sufficient large trees well distributed across the Forest.

Although there is little information on snag density or size requirements for northern flying squirrels, it is assumed that higher snag densities would be better than lower densities. The snag standard in Alternative 1 requires 1.08 hard snags per acre in conifer habitats. Alternatives 2 and 4 require two to four hard snags per acre in ponderosa pine greater than 10 inches dbh with at least 25 percent of snags in pines of 20 inches dbh or more. Alternatives 2 and 4 also require six hard snags per acre in other forest types. Alternatives 3 and 6 simplify the snag requirement to three hard snags per acre in ponderosa pine and six snags per acre in hardwood forests. Alternative 3 and 6 retain snags greater than nine inches, 25 percent of which must be greater than 14 inches dbh, and retain all snags greater than 20 inches dbh. Alternatives 3 and 6 give emphasis to species requiring large snags. All alternatives provide guidance to retain all soft snags unless they are a safety hazard; however, this guideline is changed to a standard in Alternatives 3 and 6, providing more emphasis for snag-dependent species.

Standards 2301a, 2301c, 2301d, and 2301e provide for snags in pine and other forest types and require retaining snags in the largest size class available. Standard 2302 and Guideline 2303 manage for meeting the minimum hard-snag direction and snags that are well distributed within the watershed respectively under Alternatives 1, 2, and 4. These conservation measures are deleted under Alternatives 3 and 6 because they are covered under Objective 201 and Standard 2301. Alternatives 2, 3, 4, and 6 are consistent with current snag inventories and recent snag studies (see Section 3-2.1.1 Ponderosa Pine Ecosystem). They will likely provide sufficient snags well distributed across the landscape. Alternative 1 manages for snag densities below these recent estimates and snag studies, which increases the risk to northern flying squirrels. In Alternative 1, the low standard for snag density and the 15-feet minimum height standard and the lack of direction for snags larger than 10-inch diameter poses a higher risk for those species requiring a larger diameter or taller snags at higher densities. Still, this alone is not likely to cause the species to not persist on the Forest. Snags do not occur evenly across the landscape. There will likely be some areas with higher snag densities that will allow the species to persist. They would likely persist at much lower densities. Certainly, managing for these conditions present an increased risk to snag-dependant species, and a higher level of uncertainty as to whether the species will persist on the Forest.

Habitat fragmentation is a concern for flying squirrels. Spruce and late successional habitat is distributed as patches at low abundance, and there are gaps where habitat is absent or only present in low abundance. Alternatives 3 and 4 may improve the distribution of dense mature and late successional pine habitat and maintain the distribution of spruce habitat. Alternatives 1, 2 and 6 may reduce the distribution of these habitats. Still, there will be sufficient habitat to allow for dispersal among populations. Alternatives 3 and 6 may improve the distribution of large trees on the landscape, thus improving dispersal conditions for flying squirrels.

Flying squirrels are likely to persist on the Forest over the next 50 years. Basic habitat components including snags for nesting, mesic spruce forests, and late successional forests were used in this analysis. There is no predicted change in acreage of spruce forests in Alternatives 1, 2, 3, and 4. Alternative 6 may result in fewer acres of spruce on the Forest, but spruce habitat is expected to remain at levels similar to that which was estimated in 1995. Alternative 4 could have the most acreage in these dense mature and late successional structural stages, followed by Alternatives 3 and 6, respectively. Spruce and late successional habitat will be distributed as patches at low abundance and there may be gaps where habitat is absent or only present in low abundance. However, where spruce and late successional pine occurs, habitat will typically be large enough and close enough to permit dispersal and interaction among the population. Snag density requirements for flying squirrels are not known. Alternatives 2, 3, 4, and 6 provide for similar snag densities. Snag densities would be lowest with Alternative 1, presenting more risk than the other alternatives.

The above evaluation is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.
2. Management will move conditions towards structural stage objectives for alternatives 3 and 6. The time required to reach these objectives is dependent on funding and forest growth rates, which are not included in this analysis. As a result, it may take two or more decades to achieve these objectives.
3. Management will move conditions towards snag objectives in each alternative.

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 NFS 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.

Northern flying squirrels have relatively small ranges, generally less than 42 acres (Cotton and Parker 2000), and are nonmigratory. Because of these small ranges, management activities on national and state parks adjacent to the Forest are not likely to affect northern flying squirrel populations on the Forest. These federal and state lands may have suitable habitats for northern flying squirrels, but there is probably limited movement between the Forest and adjacent lands.

Privately-owned lands within and adjacent to the Forest boundary may also provide suitable northern flying squirrel habitat, but resource management and conservation by private citizens and companies depend on a number of factors (e.g., desired goals, market prices, development potential). Private lands managed for timber harvest may tend toward fewer acres in the late successional stage forest and fewer snags. Potential northern flying squirrel habitat is assumed to occur on private lands would occur across the Black Hills; however, the extent and persistence of such habitat over the next 50 years is uncertain.

There is no predicted change on the Forest in acreage of spruce forests in Alternatives 1, 2, 3, and 4. Alternative 6 has the most potential for cumulative effects to spruce habitat because it may result in fewer acres of spruce on the Forest, but spruce habitat is expected to remain at levels similar to that which was estimated in 1995. Alternative 4 could have the most acreage in dense mature and late successional pine structural stages, followed by Alternatives 3 and 6, respectively. Alternatives 2, 3, 4, and 6 would have similar cumulative effects among them because they provide for similar snag densities. Snag densities would be lowest with Alternative 1, presenting more cumulative effects than the other alternatives.

3-3.3.5.6. Northern Myotis (*Myotis septentrionalis*)

Affected Environment

The northern myotis ranges across most of eastern North America, extending from central Quebec, Ontario, and the southern half of Manitoba, south through all of the Dakotas, eastern Nebraska, Kansas, and Oklahoma, and then east to the Atlantic coast. Turner (1974) reported northern myotis from Pennington and Custer counties in South Dakota and Weston County in Wyoming. The South Dakota Natural Heritage Program reported records of this species from Meade, Lawrence, Jackson, and Harding counties as well. Luce et al. (1999) reported records of northern myotis from latitude 7 and longitude 21, which includes Crook and Weston Counties, Wyoming and one historical record from the western part of the state.

At the western edge of its range, the northern myotis is found in the wooded riparian zone in badlands and prairies to higher elevation coniferous and deciduous woodlands (Schmidt 2003c). In the Black Hills region, this species has been captured at elevations ranging from 4,000 feet to 6,500 feet (Schmidt 2003c). Luce et al. (1999) listed habitat associations as dense ponderosa pine and mixed coniferous/deciduous forest.

Hibernacula include caves and mines. Individuals tend to wedge into crevices and are not easily detected or counted (Schmidt 2003c). During the summer, nonreproductive bats roost singly or in small groups of fewer than 10 individuals. Day roosts of males and nonreproductive females have been reported in buildings; under shingles; behind shutters of buildings; underneath exfoliating tree bark; inside cavities or crevices of trees; and in caves, mines, and quarries (Schmidt 2003c). Maternity roosts have been reported in buildings, under loose bark, and in crevices and cavities of deciduous trees and ponderosa pines. Northern myotis have been documented using ponderosa pine snags as summer/maternity roosts in the Black Hills (Cryan et al. 2001) and in other regions (Rabe et al. 1998). Rabe et al. (1998) summarize some key snag characteristics for the northern myotis and four other *Myotis* species in Arizona; roost snags were generally larger in diameter, had more loose bark, and were found at higher densities. Cryan et al. (2001) reported the average snag size for roosts in the Black Hills was about 15.6 inches. Maternity roosts are typically small and comprise 5 to 65 individuals (Schmidt 2003c). A single offspring is born in late July (Higgins et al. 2000).

The northern myotis forages both by aerial hawking and gleaning among vegetation (Schmidt 2003c). Foraging areas may include hillsides, ridge tops, and riparian woodlands (Luce et at. 1999, Schmidt 2003c). This species is not as dependent as other bats in the genus *Myotis* on water bodies for foraging (Higgins et al. 2000). Butterflies and moths, followed by beetles, make up most of this bat's diet (Schmidt 2003c).

The availability of suitable hibernacula, maternity roosting sites, and foraging areas all represent potential risk factors for this species (Schmidt 2003c).

Direct And Indirect Effects

The northern myotis hibernates in caves and abandoned mines; human disturbance in or near hibernacula may cause site abandonment and local population losses. Recreational activities including spelunking can disturb hibernating bats. Habitat loss can occur with the closure of abandoned mines or destruction of buildings used by bats. Disturbance to cave and mine openings that changes airflow patterns, temperature regimes, and bat access can also impact bats (USDA Forest Service 2001c). Changes in forest structure that reduce the availability of suitable roost snags, particularly larger snags, can negatively affect these bats.

For all alternatives, the cave ecosystem in general would be managed according to Objectives 109, 110, 112, and 113, and Guideline 1401, as well as the Federal Cave Resources Protection Act of 1988. Most caves would be managed as wild caves, with no facilities to aid or impede use unless specific needs are identified. Ground disturbance would be avoided within 100 feet of natural cave openings for all alternatives except Alternative 2 (Guideline 1401). In Alternative 2, ground-disturbing activities would be avoided within 500 feet of natural cave openings, which is consistent with Pierson et al. (1999). Guideline 3102 (all alternatives) protects caves and their microclimate when designing management activities where caves are important bat nursery or hibernacula sites. This guideline also protects bat day-and-night roosts. In all alternatives, measures would also be taken to prevent human-caused changes to the cave ecosystem and if gating is needed to protect cave resources, it will allow free passage of bats, air, and water (Guideline 1401). For more information on caves see Section 3-2.5 Cave Ecosystems earlier in this Chapter 3.

Additional specific direction for bats is contained in each alternative. All alternatives provide for seasonal closures for known nursery roosts and hibernacula where there are conflicts with people (Guideline 3208). However, Alternatives 3 and 6 specifically mention mines in addition to caves and elevate the guideline to a standard. All alternatives are designed to conserve known bat nursery roosts and hibernacula (Standard 3207). Alternatives 3 and 6 clarify this standard to avoid vegetative changes within 500 feet of caves and mines that serve as nursery roosts or hibernacula. This is consistent with Pierson et al. (1999) and provides more emphasis on bat conservation. Standard 3209 (Alternatives 2, 3, 4, and 6) requires evaluation of abandoned mines for bat habitat prior to closure, and closures shall be designed to ensure bat movement, thereby providing future habitat use by bats. Standards 1503 and 1504 (all alternatives) provide cave protection related to mineral and energy resource development by assuring operating plans or leasing activities avoid damage and assure protection of cave resources around Jewel Cave National Monument; Minnelusa; Paha Sapa; or Madison Limestone areas. If these measures are followed, cave ecosystems and abandoned mines used by bats will likely be maintained in good condition in all alternatives.

The forested ecosystem is also important for northern myotis, particularly the occurrence of snags. Alternative 1 is designed to maintain 1.08 snags per acre at least 10 inches in diameter and at least 15-feet tall (Objective 211). This is further supported by Standard 2301. In Alternative 1, the low standard for snag density and the 15-feet minimum height standard and the lack of direction for snags larger than 10-inch diameter poses a higher risk for those species requiring a larger diameter or taller snags at higher densities. Still, this alone is not likely to cause the species to not persist on the Forest. Snags do not occur evenly across the landscape. There will likely be some areas with higher snag densities that will allow the species to persist. They would likely persist at much lower densities. Certainly, managing for these conditions present an increased risk to snag-dependant species, and a higher level of uncertainty as to whether the species will persist on the Forest.

Alternatives 2 and 4 are designed to maintain two snags at least 10 inches in diameter and 25-feet tall per acre in ponderosa pine on north- and east-facing slopes and four snags per acre on south- and west-facing slopes. This is also supported by Standard 2301. Alternatives 3 and 6 are designed to maintain three snags per acre, at least 9 inches in diameter and at least 25-feet tall. This is further supported by Standard 2301 that requires that all snags over 20 inches be retained unless they are a safety hazard and requires that all snags be retained unless they are a safety hazard if the snag densities are below the snag objective (211) within project areas. The snag objective in all alternatives is below the snag density suggested by Rabe et al. (1998) of 4.29 snags per acre. The South Dakota Bat Management Plan (South Dakota Bat Working Group 2004) includes a goal to manage for 8.5 snags per acre greater than 12 inches in diameter. However, snags generally do not occur evenly across the landscape. Some areas are likely to have more snags, such as the areas of recent fires and insect outbreaks, while other areas are likely to have few. As a result, some areas of the Forest will likely have snag densities similar to that suggested by Rabe et al. (1998). Alternative 6 reduces the fire hazard and insect risk the most and, therefore, has the greatest potential to reduce tree mortality and future snag recruitment compared to the other alternatives. In Alternatives 1, 2, and 4, Standard 2302 requires projects to move toward the desired snag density if deficient in the analysis area. Restrictions on cutting standing dead trees occur across the range of alternatives through Standard 2304. All soft snags should be retained under Guideline 2305 in Alternative 1; this guideline is treated as a standard in Alternatives 2 and 4 and becomes a standard in Alternatives 3 and 6. Guideline 2306 (Alternatives 1, 2, and 4) assures that new snags are recruited by retaining a sufficient number of larger diameter live trees. Based on this analysis, Alternative 1 presents a higher risk to northern myotis due to the lower objective for snags. If objectives are met, Alternatives 2, 3, 4, and 6 provide adequate snags for northern myotis, including snags greater than 20 inches, that are most likely to have loose bark for roosting. For more information on snags, see Section 3-2.1 Forest Ecosystems in Chapter 3 of the Final EIS.

Snag densities suggested by Rabe et al. (1998) and the South Dakota Bat Working Group (2004) will most likely occur in stand-replacing fires and insect outbreaks. Objective 11-03 in Alternatives 3, 4, and 6 provides management guidance for retaining a portion of these conditions as they occur. Alternative 4 provides the highest likelihood these conditions will be maintained. In Alternatives 3 and 6, Objective 11-03 will likely provide sufficient areas of dense snags while allowing some post-fire value recovery. Alternatives 1 and 2 do not include Objective 11-03. However, Mohren (2002) found areas of higher snag density on the Forest even though there was not direction in the Forest Plan similar to Alternatives 1 and 2. There will likely be some areas on the Forest with higher snag densities under Alternatives 1 and 2, but the absence of Objective 11-03 leads to a higher level of uncertainty these conditions will exist.

Structural stages 4 and 5 provide the snag resource that the northern myotis appears to require. In Alternatives 1, 2, and 4, late successional pine forest is targeted to be 5 percent of the forested land base. In Alternatives 3 and 6, structural stage objectives for specific MAs (MA 4.1-203, 5.1-204, 5.4-206, 5.43-204, and 5.6-204) also target 5 percent of the forested land base to be late successional habitat with additional specificity to provide a certain percentage of larger diameter trees. This provides present and future snags for the northern myotis. See the Forested Ecosystem section for a more detailed discussion of this community.

Resource conservation measures designed for specific MAs are also likely to benefit the northern myotis because they emphasize and enhance the vegetative, structural, and compositional diversity on the Forest. These measures include Objectives 3.32-401, 3.7-201, 4.2B-203, 5.1-202, 5.1-203, 5.1A-201, 5.1A-202, 5.4-203, and 5.4A-203 and Goals 4.1-201, 4.1-202, 4.2A-401, 5.4-201, 5.43-2 01, 5.43-202, 5.4A-201, and 5.4A-202.

The riparian ecosystem may be used as foraging areas for the northern myotis. All alternatives are designed to maintain or restore historic wet areas, wet meadows, and beaver (Objective 215). Standards 1306 and 1505 and Guidelines 1303 and 9108 (all alternatives) will likely maintain the integrity of existing riparian areas from activities such as timber management, mining, roads, livestock grazing, and traffic. Guidelines 2505 and 2507 (Alternatives 1, 2, and 4) manage grazing in riparian areas to a residual cover objective; under Alternatives 3 and 6, these are elevated to standards to meet the objective of enhancing riparian habitats. Riparian areas will be maintained or enhanced in all alternatives. For more information on effects to riparian areas, see Section 3-2.3 Riparian and Wetland Ecosystems.

The northern myotis is known to feed primarily on flying insects; however, foraging habitat is poorly defined in the Black Hills (Schmidt 2003c). The literature documents a wide range of foraging habitat, including riparian areas, hillsides, and ridge tops, and areas below, within, and above the forest canopy. These areas and conditions will continue to be well distributed on the Forest under all alternatives.

Alternatives 3 and 6 provide increased protection of potential prey by prohibiting the use of insecticides for gypsy moth control within 2 miles of a known bat hibernacula or maternity roost (Standard 3200-02). This will likely avoid widespread killing of non-target moths and butterflies (prey) in the vicinity of bat concentrations.

This species is likely to persist on the Forest over the next 50 years because all alternatives provide for roosting sites, the amount and availability of foraging areas is maintained, and potential hibernacula sites are protected. Alternatives 2, 3, 4, and 6 provide adequate snags for long-eared myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest risk to the species due to the lower snag density and height requirements.

The above evaluation is based on the following assumptions:

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

2. Management will move conditions towards snag objectives in each alternative.

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 NFS 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 could affect northern myotis populations on the Forest. These federal and state lands have suitable habitats for bats, and a few roosts and hibernacula have been reported. It is presumed that bats move readily between the Forest and adjacent lands. However, the extent of movements between hibernacula and summer/maternity roosts is not well known (Schmidt 2003c). Human disturbance to roosting or hibernating bat or habitat modification in areas adjacent to the Forest could negatively impact bats using the Forest at other times of year.

Privately owned lands within and adjacent to the Forest boundary may also provide suitable bat habitat, but resource management and conservation by companies and private citizens depends on a number of factors (e.g., desired goals, market prices, development potential). Some loss of hibernacula and summer/maternity roosts has most likely occurred as a result of abandoned mine closures, recreational caving activities, and commercial development of caves on private lands. Potential bat habitat is expected to occur on private lands across the Black Hills; however, the extent and persistence of such habitat is uncertain. Given the conservation measures designed into the alternatives to protect roosting, foraging, and hibernacula sites on NFS land and the efforts at Jewel Cave National Monument, northern myotis are likely to persist in the Black Hills over the next 50 years.

All alternatives provide for roosting sites, maintain the amount and availability of foraging areas, and protect potential cave hibernacula sites on the Forest. Alternatives 2, 3, 4, and 6 provide adequate snags for northern myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest potential for cumulative effects to the species due to the lower snag density and height requirements.

3-3.3.5.7. Rocky Mountain Bighorn Sheep (*Ovis canadensis*)

Affected Environment

The range of Rocky Mountain bighorn sheep includes southern British Columbia and southwest Alberta south to southeast California, Arizona, and New Mexico (Whitaker 1980). *Ovis canadensis auduboni* were once native to the Black Hills but were extinct by 1916 (Benzon and Halseth 1999). In 1991 and 1992, 31 Rocky Mountain bighorn sheep (*O. c. canadensis*) were transplanted into Spring Creek Canyon in the Black Hills (Benzon and Halseth 1999). Current estimate of the population is approximately 220 sheep (SDFG 2003). Population estimates have steadily increased since re-introduction (SDGFP 2003). SDGFP has issued two licenses each year since 2000, and hunter success has been 100 percent for each year (SDGFP 2003).

There are two main populations of bighorn sheep in the Black Hills. The Custer State Park herd in located in Custer State Park and consists of three sub-herds. The Rapid City herd is located primarily on NFS land and consists of three sub-herds: the Sheridan Lake, Dark Canyon, and Spring Creek. The Rapid City herd is located between Hill City, Pactola Reservoir, and Rapid City (Merwin 2000).

Rocky Mountain bighorn sheep inhabit alpine meadows, foothills, cliffs, and rock outcrops (Luce et al. 1999, Clark and Stromberg 1987). Their diet includes a variety of grasses, forbs, and browse (Luce et al. 1999). Merwin (2000) noted that bighorn sheep often selected areas with good visibility (less than 40 percent canopy closure) within suitable distance of water and escape terrain.

Limits to persistence include limited availability of habitat on the Forest, vulnerability of habitat to residential development on adjacent private lands, and disturbance from recreation (Benzon and Halseth 1999). Bighorn sheep are often susceptible to diseases that could affect populations. Diseases can be transmitted from domestic sheep and goats.

Direct And Indirect Effects

The Dark Canyon and Spring Creek subheads occur mostly in MA 5.4 (Big Game Winter Range), but include some MA 3.7 (late successional). The Sheridan Lake sub-herd uses MAs 5.4 and 5.1 (Timber Production Emphasis).

Structural stage objectives under Alternatives 3 and 6 target a diversity of structural stages in ponderosa pine in MAs 5.1 and 5.4. For more detail, refer to Section 3-2.1.1 Ponderosa Pine Ecosystems of this document. In general, structural stages will offer forage and good horizontal visibility in the open-canopied stands with less than 40-percent canopy cover (structural stages 1, 2, 3A, and 4A).

In MA 5.4, structural stage objectives are designed to provide open forest for forage and visibility. In Alternative 3, structural stage objectives (5.4-206) are designed to provide 50 percent of the forested acres in forage producing (and good visibility) structural stages (structural stages 1, 2, 3A, and 4A). In Alternative 6, structural stage objectives (5.4-206) are designed to provide 45 percent of the forested acres in these structural stages (structural stages 1, 2, 3A, and 4A). The above objectives do not include natural meadows and grasslands that would provide additional forage.

In MA 5.1 (timber production emphasis), structural stage objectives are designed to provide less open forest for forage than MA 5.4. In Alternative 3, structural stage objectives are designed to provide 40 percent of the forested acres in forage producing (and good visibility) structural stages (structural stages 1, 2, 3A, and 4A). In Alternative 6, structural stage objectives are designed to provide 45 percent of the forested acres in these structural stages (structural stages 1, 2, 3A, and 4A). The above objectives do not include natural meadows and grasslands that would provide additional forage.

Alternatives 1, 2, and 4 do not contain structural stage objectives that are designed to provide open forest conditions.

Different structural stages in ponderosa pine offer different levels of habitat requirements for bighorn sheep. Open forest conditions (structural stages 1, 2, 3A, and 4A) offer the best forage and the best potential for horizontal visibility. Alternatives 3 and 6 predict a slight decrease in the total acres in structural stages 1 and 4A Forest-wide if structural stage objectives are achieved. This is expected to be reflected in MAs according to the structural stage objectives mentioned above. This acreage includes only the ponderosa pine cover type and does not include meadows and natural openings that would provide additional forage. Objectives, standards, and guidelines designed to promote meadow habitat and reduce tree encroachment into meadows may increase forage for the bighorn sheep if meadow and grassland restoration objectives are achieved. Alternatives 1, 2, and 4 do not have an objective for these structural stages, so the amount of this type of habitat that would be available on the landscape in the future is less certain. Certainly, there would be some of each of structural stage present in Alternative 1, 2, and 4, but how much is unclear.

Standard 3200-01 states that where livestock management conflicts with bighorn sheep lambing areas, preference shall be given to bighorn sheep from April 1 through June 30 under Alternatives 3 and through June 15 for Alternative 6. This is designed to reduce disruption during the lambing period from May through mid-June (Merwin 2000).

Re-introduced populations of bighorn sheep on the Forest have increased substantially since 1990 (SDGFP 2003). Under all alternatives, there will be adequate habitat for maintaining bighorn sheep populations over the next 50 years.

The above evaluation is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.
2. Management will move conditions towards structural stage objectives for Alternatives 3 and 6. The time required to reach these objectives is dependent on funding and forest growth rates, which are not included in this analysis. As a result, it may take two or more decades to achieve these objectives.

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 NFS 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 in the national and state parks adjacent to the Forest may affect the Rocky Mountain bighorn sheep. Recreation at these locations may affect bighorn sheep (Benzon and Halseth 1999). Rocky Mountain bighorn sheep could potentially use habitat at Mount Rushmore National Memorial. Human activity in Custer State Park may have minor impacts to bighorn sheep.

Vehicle-bighorn sheep collisions on highways throughout the Black Hills resulting in animal losses are likely to continue into the foreseeable future. Sheep mortality rates could increase if additional highways in the Black Hills are improved and speed limits increased. Although NFS- land roads are typically designed for lower speeds, some additional loss may occur.

Privately owned lands within and adjacent to the Forest boundary may also provide suitable habitat for bighorn sheep. Resource management and conservation 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. Urban development will likely continue to impact traditional bighorn sheep habitats in the Black Hills and may place more importance on habitat on the Forest over the next 50 years. There would be no additive urban development on NFS land.

Bighorn sheep are often susceptible to diseases that could affect populations. Diseases can be transmitted from domestic sheep. Some private landowners in the Black Hills have domestic sheep. These sheep may transmit diseses to wild sheep. There are no permitted domestic sheep allotments on the Forest and none are foreseen in the future. Therefore, there will be no additive impacts to sheep from diseases as a result of range management on the Forest.

3-3.3.5.8. Small-Footed Myotis (*Myotis ciliolabrum*)

Affected Environment

The small-footed myotis ranges across most of western North America, extending from central British Columbia, southern Alberta and southwestern Saskatchewan, south to the central States of Mexico (Schmidt 2003d). It has been reported from all five South Dakota counties of the Black Hills (Turner 1974). Luce et al. (1999) reported records from latitude 7, and longitude 21 and 28 in Wyoming, which is most of the area bordering South Dakota with the possible exception of Weston County. However, Turner (1974) reported seven records from Weston County, Wyoming and recorded this species as widespread but not abundant in the Black Hills.

The small-footed myotis is found in a variety of habitats ranging from arid desert and badland habitats to riparian zones and grasslands. It is usually associated with rocky areas like bluffs, dissected breaks, ridges, cliffs, and major rock outcroppings within these habitats. In the Black Hills region, this species has been captured at elevations ranging from 3,800 feet to 6,000 feet (Schmidt 2003d).

Hibernacula for this species include mines and caves. Relatively warmer areas of caves, with the least climatic fluctuations, seem to be preferred microsite. Mine hibernacula are also documented (Turner 1974). Maternity and summer roosts are usually associated with rock features (e.g., bluffs, ridges, cliffs, boulders, and major outcroppings) within a variety of habitats (Schmidt 2003d). The small-footed myotis is one of the few bat species that actually roosts in cavities at ground level. Day roosts include buildings, behind the bark of pine trees, in rock crevices, under rocks on the ground, in holes in banks and hillsides, and in abandoned swallow nests (Schmidt 2003d). A single pup is born in late June or July (Higgins et al. 2000).

A wide and sometimes conflicting variety of foraging habitat for this species has been described in the literature. Accounts range from in-flight over rocky outcroppings, and rarely over water to primarily over water, riparian areas, and at the margin of woods (Schmidt 2003d). They forage from 1 meter off the ground up to the top of the canopy. Prey species are generally soft-bodied invertebrates. Moths seem to be a primary prey item (Schmidt 2003d).

The availability of suitable hibernacula, maternity roosting sites, and foraging areas all represent potential risk factors for this species (Schmidt 2003d).

Direct And Indirect Effects

Human disturbance in or near hibernacula may cause site abandonment and local population losses. Recreational activities including spelunking can disturb hibernating bats within caves. Habitat loss can occur with the closure of abandoned mines or destruction of cave features bats use. Disturbance to cave and mine openings that change airflow patterns, temperature regimes, and bat access can also impact bats (USDA Forest Service 2001a). The small-footed myotis is usually associated with rock features; summer roosts have been identified in horizontal cracks or fractures within outcrops and boulders, in overhangs, and under rocks (Schmidt 2003d). Rock-climbing activities could affect these roosting bats.

For all alternatives, the cave ecosystem in general would be managed according to Objectives 109, 110, 112, and 113, and Guideline 1401, as well as the Federal Cave Resources Protection Act of 1988. Most caves would be managed as wild caves with no facilities to aid or impede use unless specific needs are identified. Ground disturbance would be avoided within 100 feet of natural cave openings for all alternatives except Alternative 2 (Guideline 1401). In Alternative 2, ground-disturbing activities would be avoided within 500 feet of natural cave openings, which is consistent with Pierson et al. (1999). Guideline 3102 (all alternatives) protects caves and their microclimate when designing management activities where caves are important bat nursery or hibernacula sites. This guideline also protects bat day-and-night roosts. In all alternatives, measures would also be taken to prevent human-caused changes to the cave ecosystem, and if gating is needed to protect cave resources, it will allow free passage of bats, air, and water (Guideline 1401). For more information on effects to caves see Section 3-2.5 Cave Ecosystems.

Additional specific direction for bats is contained in each alternative. All alternatives provide for seasonal closures for known nursery roosts and hibernacula where there are conflicts with people (Guideline 3208). However, Alternatives 3 and 6 specifically mention mines in addition to caves and elevate the guideline to a standard. All alternatives are designed to conserve known bat nursery roosts and hibernacula (Standard 3207). Alternatives 3 and 6 clarify this standard to avoid vegetative changes within 500 feet of caves and mines that serve as nursery roosts or hibernacula. This is consistent with Pierson et al. (1999) and provides more emphasis on bat conservation. Standard 3209 (Alternatives 2, 3, 4, and 6) requires evaluation of abandoned mines for bat habitat prior to closure, and closures shall be designed to ensure bat movement thereby providing future bat-habitat use. Standards 1503 and 1504 (all alternatives) provide cave protection related to mineral and energy resource development by assuring operating plans or leasing activities avoid damage and assuring protection of cave resources around Jewel Cave National Monument, Minnelusa, Paha Sapa, or Madison Limestone areas. If these measures are followed, cave ecosystems and abandoned mines used by bats will likely be maintained in good condition in all alternatives.

This species may use snags with loose bark as day roosts. Alternative 1 is designed to maintain 1.08 snags per acre at least 10 inches in diameter and at least 15-feet tall (Objective 211). This is further supported by Standard 2301. In Alternative 1, the low standard for snag density and the 15-feet minimum height standard and the lack of direction for snags larger than 10 inch diameter poses a higher risk for those species requiring a larger diameter or taller snags at higher densities. Still, this alone is not likely to cause the species to not persist on the Forest. Snags do not occur evenly across the landscape. There will likely be some areas with higher snag densities that will allow the species to persist. They would likely persist at much lower densities. Certainly, managing for these conditions present an increased risk to snag-dependant species, and a higher level of uncertainty as to whether the species will persist on the Forest.

Alternatives 2 and 4 are designed to maintain two snags at least 10 inches in diameter and 25-feet tall per acre in ponderosa pine on north- and east-facing slopes and four snags per acre on south- and west-facing slopes. This is also supported by Standard 2301. Alternatives 3 and 6 are designed to maintain three snags per acre at least 9 inches in diameter and at least 25-feet tall. This is further supported by

Standard 2301 that requires that all snags over 20 inches be retained unless they are a safety hazard and requires that all snags be retained unless they are a safety hazard if the snag densities are below the snag objective (211) within project areas. The snag objective in all alternatives is below the snag density suggested by Rabe et al. (1998) of 4.29 snags per acre. The South Dakota Bat Management Plan (South Dakota Bat Working Group 2004) includes a goal to manage for 8.5 snags per acre greater than 12 inches in diameter. However, snags generally do not occur evenly across the landscape. Some areas are likely to have more snags, such as the areas of recent fires and insect outbreaks, while other areas are likely to have few. As a result, some areas of the Forest will likely have snag densities similar to that suggested by Rabe et al. (1998). Alternative 6 reduces the fire hazard and insect risk the most and, therefore, has the greatest potential to reduce tree mortality and future snag recruitment compared to the other alternatives. In Alternatives 1, 2, and 4, Standard 2302 requires projects to move toward the desired snag density if deficient in the analysis area. Restrictions on cutting standing dead trees occur across the range of alternatives through Standard 2304. Guideline 2306 (Alternatives 1, 2, and 4) assures that new snags are recruited by retaining a sufficient number of larger diameter live trees. If objectives are met, Alternatives 2, 3, 4, and 6 provide adequate snags for small-footed myotis including snags greater than 20 inches that are most likely to have loose bark for roosting. For more information on snags, see Section 3-2.1 Forest Ecosystems earlier in this chapter.

The literature documents a wide range of foraging habitat. These areas and conditions will continue to be well distributed on the Forest under all alternatives. However, captures of this species are nearly always associated with water sources. All alternatives are designed to maintain or restore historic wet areas, wet meadows, and beaver (Objective 215). Standards 1306 and 1505 and Guidelines 1303 and 9108 (all alternatives) will likely maintain the integrity of existing riparian areas from activities such as timber management, mining, roads, livestock grazing, and traffic. Guidelines 2505 and 2507 (Alternatives 1, 2, and 4) manage grazing in riparian areas to a residual cover objective; under Alternatives 3 and 6, these guidelines are elevated to standards to meet the objective of enhancing riparian habitats. Alternatives 1, 2, 4, and 6 strive for restoration of 500 acres of riparian areas. Alternative 3 emphasizes riparian restoration (1,000 acres) to benefit emphasis species and vegetative diversity across the Forest. See the Riparian and Wetlands Ecosystems section for a more detailed discussion of this community. Riparian areas will be maintained or enhanced in all alternatives. For more information on effects to riparian areas, see Section 3-2.3 Riparian and Wetland Ecosystems.

The small-footed myotis is known to feed on moth and beetle species. Alternatives 3 and 6 provide increased protection of potential prey by prohibiting the use of insecticides for gypsy moth control within 2 miles of a known bat hibernacula or maternity roost (Standard 3200-02). This will likely avoid widespread killing of non-target moths and butterflies (prey) in the vicinity of bat concentrations.

This species is likely to persist on the Forest over the next 50 years because all alternatives provide for roosting sites, the amount and availability of foraging areas is maintained, and potential hibernacula sites are protected. Alternatives 2, 3, 4, and 6 provide adequate snags for small-footed myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest risk to the species due to the lower snag density and height requirements.

The above evaluation is based on the following assumptions:

1. The conservation objectives and protective standards and guideline direction for the various alternatives will be applied or implemented as written.
2. Management will move conditions towards snag objectives in each alternative.

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 NFS 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 could affect the size of population of the small-footed myotis populations on the Forest. These federal and state lands have suitable habitats for bats. It is presumed that bats move readily between the Forest and adjacent lands. However, the extent of movement between hibernacula and summer/maternity roosts is not known for this species (Schmidt 2003d). Human disturbance to roosting or hibernating bat or habitat modification in areas adjacent to the Forest could negatively impact bats using the Forest at other times of year.

Privately owned lands within and adjacent to the Forest boundary may also provide suitable bat habitat, but resource management and conservation by companies and private citizens depends on a number of factors (e.g., desired goals, market prices, development potential). Some loss of hibernacula has most likely occurred as a result of abandoned mine closures, recreational caving activities, and commercial cave development on private lands. As a general rule, potential bat habitat on private lands would occur across the Black Hills; however, the extent and persistence of such habitat is uncertain. Given the conservation measures designed into the alternatives to protect roosting, foraging, and hibernacula sites on NFS land and the efforts at Jewel Cave National Monument, small-footed myotis are likely to persist in the Black Hills over the next 50 years.

All alternatives provide for roosting sites, maintain the amount and availability of foraging areas, and protect potential cave hibernacula sites on the Forest. Alternatives 2, 3, 4, and 6 provide adequate snags for small-footed myotis, including snags greater than 20 inches that are most likely to have loose bark for roosting. Alternative 1 presents the highest potential for cumulative effects to the species due to the lower snag density and height requirements.

3-3.3.6. Management Indicator Species – Fishes

3-3.3.6.1. Mountain Sucker *(Catastomus platyrhynchus)*

Selection Rationale

The selection of management indicator species (MIS), including the mountain sucker, is detailed in SAIC (2005). Management activities have the potential to affect the amount, quality, or connectivity of instream fisheries habitat. The mountain sucker is a native species to the Black Hills and is also a Region 2 sensitive species. Selection of mountain sucker as an MIS addresses aquatic habitat condition and connectivity and should aid in balancing habitat management for native fish species populations and desirable non-native recreational fisheries. Mountain sucker were not chosen as an MIS because of concerns regarding species viability but to meet other broader management objectives. Selection of mountain sucker as an MIS will help evaluate the effects of Forest Plan implementation and the natural change on the ability of streams to support characteristic fish species that rely on a variety of aquatic conditions to meet their needs.

The Forest recently completed an inventory of selected stream habitat conditions and is establishing reference reaches which will aid in monitoring habitat trend. Mountain sucker are relatively well distributed on the Forest and easily monitored. Some baseline data exists from past and ongoing state survey efforts to aid in detecting changes in numbers or distribution. Forest Plan direction to maintain or improve aquatic and riparian condition should be reflected in stable or improving mountain sucker populations.

Affected Environment

Distribution And Natural History

Isaak et al. (2003) assessed the biology and overall conservation status of the mountain sucker on the Forest. Their assessment is summarized throughout this discussion. Where specific information was lacking for this species in the Black Hills, such information from other parts of its range was provided when available.

Mountain suckers occur in much of western North America from Nevada, Utah, and eastern California and north to British Columbia, Alberta, and Saskatchewan. Mountain sucker populations in the Black Hills are the eastern-most extension of the species. Bailey and Allum (1962) consider Black Hills populations to be glacial relicts, but they also discuss a stream piracy event wherein the headwaters of the Belle Fourche River captured the headwaters of the Little Missouri River. Because the primary range of the mountain sucker lies to the west, a piracy event seems to be an equally plausible explanation for the occurrence of mountain suckers in the Black Hills. The nearest populations outside the Cheyenne and Belle Fourche river drainages that have been sampled in recent years occur in the Powder River drainage of Wyoming.

Early surveys indicate that mountain suckers were widely distributed in streams across the Black Hills (Evermann and Cox 1896). During surveys conducted in 1892 and 1893, Evermann and Cox collected mountain suckers from three different Beaver creeks, French Creek, Redwater Creek, Chicken Creek, Crow Creek, Spearfish Creek, Spring Creek, Rapid Creek, Whitewood Creek, and the Cheyenne River. Collection activities that occurred from the 1930s to the early 1950s added Castle Creek, Fall River, Iron Creek, and Grace Coolidge Creek to this list (Bailey and Allum 1962). In the most comprehensive survey of the time, Stewart and Thilenius (1964) observed mountain sucker in most of the previous streams and in many new streams that included the following: Elk Creek, Grizzly Creek, Kirk Creek, Cascade Creek, Bear Butte Creek, Thompson Ditch, Slate Creek, Hot Brook, and several tributaries to Castle Creek. Recent stream surveys suggest that mountain sucker occur in much of the historic Black Hills range. Recent surveys have also found mountain sucker in Battle Creek, Bogus Jim Creek, Boxelder Creek, Crow Creek, Deer Creek, Flynn Creek, Horse Creek, Jim Creek, Meadow Creek, Slate Creek, Swede Gulch Creek, Buskala Creek, False Bottom Creek, Foster Creek, Newton Fork, and Tillson Creek. Some of these sites may be peripheral to the Forest.

Mountain suckers are benthic feeders as evidenced by adaptations that include a subterminal mouth and cartilaginous mouth edges used to scrape organic matter from rocks. The diet consists mainly of simple plants like diatoms, green algae, and blue-green algae; only a very small proportion of its diet is composed of aquatic insect larvae. Mountain sucker form an important part of the food chain and energy pyramid between primary producers (algae) and secondary consumers such as trout (Wydoski and Wydoski 2002).

Mountain suckers are spring spawners, but the exact timing probably varies in response to local variations in water temperature. Hauser (1969) documented spawning in two Montana streams during June and early July when water temperatures were between 17° and 19° C. However, Smith (1966) reported spawning occurs in late spring to early summer when the water temperature is 11° to 19° C, but he recorded ripe females as early as late May in a Utah stream. Decker (1989) believed mountain suckers did not spawn until mid-August in a California stream. In northwest Wyoming, spawn timing differed by more than a month between a mountain stream and a higher-elevation alpine lake (Baxter and Stone 1995). Wydoski and Wydoski (2002) recorded spawning in Utah from late May until late June with peak spawning in mid-June at water temperatures between 9° and 11° C.

Decker and Erman (1992) speculated that mountain sucker made a short migration into a stream from a reservoir before spawning—an activity that Wydoski and Wydoski (2002) also observed. It is unknown whether this behavior occurs in stream-resident populations that may have better access to suitable spawning habitat. Mountain sucker eggs are demersal (found on or near the bottom of a stream or lake) (Hauser 1969). Scott and Crossman (1973) speculate that the construction of nests by mountain suckers is unlikely and that eggs are probably broadcast over the substrate.

Male mountain sucker mature between ages 2 and 4 live up to 6 years, and reach a maximum total length of less than 7 inches. Females in the same population generally take an additional year to mature but grow larger (up to 8.5 inches) and live longer than males. Fecundity of individual females ranges between 990 and 3,710 eggs (Hauser 1969) and has been directly related to female total length (Wydoski and Wydoski 2002). Females are likely to spawn in consecutive years, based on observed egg development.

Because of their size (generally less than 8 inches long), mountain suckers would be vulnerable to other large piscivorous (fish-eating) fish throughout their lives and could be affected by predation (Wydoski and Wydoski 2002). Brook trout, brown trout, and rainbow trout are reported to prey on mountain suckers (Wydoski and Wydoski 2002).

Species-Habitat Relationships

Uncertainties in the scientific knowledge base exist in two key areas for mountain sucker populations (USDA Forest Service 2005e). One area of uncertainty exists with regard to understanding those stream features that are important to mountain suckers. No empirical models linking mountain sucker occurrence or density to instream habitats have been constructed and knowledge regarding suitable habitats is limited to a few observational accounts of mountain sucker in certain habitat types. These observational accounts are summarized below and in Isaak et al. (2003).

Mountain suckers have been observed in large rivers, lakes, and reservoirs (Moyle 1976, Baxter and Stone 1995, Wydoski and Wydoski 2002) and in small prairie streams but most often occur in cool, clear mountain streams that are 3 to 12 meters wide (Smith 1966; Decker and Erman 1992). These fish prefer temperatures between 13° and 23°C and moderately swift water velocities (Smith 1966; Sigler and Sigler 1996). In a study of the fish distributions within a stream, Gard and Flittner (1974) noted that mountain sucker occurred only in a downstream section where channel gradients were lowest and temperatures were warmer than upstream areas suitable only for trout. Underwater observations made by Decker (1989) revealed that mountain sucker were always found on the stream bottom, usually occurred in small groups, and were closely associated with cover (e.g., exposed willow or tree root masses, undercut banks, log jams, and boulders). Average depth at these locations was 0.61 meter and average water velocity was 0.2 meter/second (Decker 1989). Substrate composition associated with mountain sucker habitat varies widely and ranges from mud to sand, gravel, and boulders although cobbles are most common (Smith 1966; Decker 1989).

In terms of channel physical characteristics, mountain sucker occur most often near the transitions between pools and runs (Hauser 1969, Decker 1989). Riffle habitats are rarely used except for spawning (Hauser 1969, Wydoski and Wydoski 2002). Wydoski and Wydoski (2002) suggest that 75 percent of the mountain sucker they observed spawning occupied water depths between 11 and 30 centimeters with velocities of 6 to 20 centimeters/second.

The mountain sucker is rarely found in lakes (NatureServe 2004) though others have reported reservoir populations in California and Utah (Decker and Ermann 1992; Wydoski and Wydoski 2002). No natural lakes occur on the Forest (Stewart and Thilenius 1964); subsequently, lentic (standing water) habitat was not available for this species prior to European settlement. Recent fisheries surveys in reservoirs that impound historic mountain sucker streams have not collected this species (SDGFP 2000; 2002b). Impoundments surveyed included Pactola, Sheridan, Deerfield, Stockade, and Lakota lakes. Reservoirs do not appear to be a major habitat component for this species on the Forest.

Habitat Condition And Trend

Habitat condition is influenced by natural events, such as droughts or floods, and human activities. The Black Hills have been subjected to extensive development beginning in the mid-1870s. In 1875, Dodge (1965) provided a quantitative description of stream flows on selected streams and already mentioned the impact of sluice mining on dewatering French Creek, just a year after the 1874 Custer Expedition.

Evermann and Cox (1896) described stream conditions during October 1892 and July-August 1893. The potential of Spearfish Creek for a fish hatchery and the presence of planted brook trout are mentioned. They declared Whitewood Creek at Deadwood was ruined by the tailings from the numerous stamp mills. French Creek consisted of a few stagnant pools containing moribund fish. At Hill City, Spring Creek was not over 10 feet wide and contained very little running water.

Reduced stream flows have been attributed to the increased tree density and canopy closure resulting from fire suppression (Stewart and Thilenius 1964). Other land-use activities, such as logging, grazing, mining, water diversions/dams, and road construction have historically and continue to affect aquatic habitats. The effects of these activities on mountain sucker habitat have been reduced compared to past conditions due to more stringent environmental laws, regulation, and policy. However, the legacy of these past activities continues to affect stream habitat through drier site conditions, loss of streamside willow and shrub communities, modified stream courses, and toxic leachates.

The construction of dams 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). Reservoirs also result in a loss of stream habitat favored by the mountain sucker. The effects of these dams on habitat fragmentation have existed for many decades. A lot of the smaller dams were constructed during the Civilian Conservation Corps era of the 1930s-1940s. Stockade Dam on French Creek and Sheridan Dam on Spring Creek were constructed in the 1930s. Deerfield Dam on Castle Creek was completed in 1948. Pactola Dam on Rapid Creek was completed in 1956.

Modified streamflows and habitat enhancements downstream of major reservoirs provide the conditions for high quality recreational trout fisheries. Generally more stable flows exist compared to natural conditions. These tailwater conditions occur at Deerfield Dam and Pactola Dam. Releases from Sheridan Dam are contingent upon inflow and maintaining the reservoir level; therefore, trout-fishery maintenance has been sporadic especially in dry years. These altered conditions combined with the management emphasis on trout and the habitat fragmentation caused by the dam itself may be to the detriment of some native fish species such as mountain sucker.

On a more localized level, projects have been implemented to improve the quality or quantity of stream habitat in cooperation with state resource agencies and local partners (USDA Forest Service 2005d). These efforts have included projects to improve streamside vegetation and bank stability as well as in-stream diversity on Castle Creek, Rapid Creek, French Creek, Iron Creek, Box Elder Creek, and other perennial streams.

Population Status And Trend

The mountain sucker is ranked as nationally secure at N5 (NatureServe 2004). In South Dakota, the mountain sucker's state conservation status is vulnerable at S3 (NatureServe 2004). Vulnerable species may be found locally (even abundantly at some of its locations) in a restricted range. In Wyoming, this species' conservation status is secure at S5 (NatureServe 2004).

Historic accounts provide a general description of the mountain sucker's abundance. Evermann and Cox (1896) reported "this small sucker is abundant in most of the smaller, clearer streams in and about the Black Hills. It seems most abundant in the streams tributary to the Cheyenne." Churchill and Over (1938) reported mountain suckers are "found only in streams of the Black Hills but abundant in several of these." Bailey and Allum (1962) reported "the only records of occurrence in South Dakota are in or near the Black Hills in the Cheyenne River system, where the species is common."

Quantitative estimates of mountain sucker populations on the Forest during the late-1950s and early-1960s are summarized below from Stewart and Thilenius (1964).

Table 3-17. Mountain Sucker Populations During The Late-1950s And Early-1960s (Number Of Fish Per Mile)

Stream	Reach/Site	Date	Population
Battle Creek	Grizzly Creek confluence to 0.5 mile above Hayward	8/62	176
Bear Butte Crk	0.5 mile below Chicken Inn to Strawberry Creek confluence	7/60	20
Castle Creek	Deerfield Dam to 0.25 mile below Kinney Canyon Road	7/59	20
	0.25 mile below Kinney Canyon Road to 0.5 mile above Golden West Mine	7/59	10
	0.5 mile above Golden West Mine to 0.5 mile below Mystic	7/59	10
	0.5 mile below Mystic to Rapid Creek confluence	7/59	10
		7/61	20
Castle Creek (Middle Fork)	Soholt Ranch to South Fork Castle Creek confluence	7/59	80
	Miller Brothers Ranch to South Fork Castle Creek confluence	7/59	130
Castle Creek (South Fork)	Ditch Creek confluence to North Fork Castle Creek confluence	7/59	170
Elk Creek	Hall Ranch to Highway 385 (at Brownsville)	7/61	300
French Creek	Stockade Lake to Highway 87	7/60	130
	0.5 mile above to 1 mile below Narrows picnic area	7/60	10
Grizzly (Bear) Creek	0.25 mile above to 0.5 mile below Grizzly Creek Campground	7/60	10
Iron Creek	Headwaters to 0.5 mile below Camp Remington	8/62	140
	Camp Remington to 0.25 mile below Highway 16A	7/60	10
	0.25 mile below Highway 16A to Harney Ranger Station	7/60	17,424
Rapid Creek	Rochford to Seal Spur	8/59	440
	0.25 mile below Seal Spur to Castle Creek confluence	9/59	180
	Pactola Reservoir to 0.25 mile below Placerville	9/60	40
	1.5 mile above Johnson Siding to 1 mile below Hisega	8/59	380
	1 mile below Hisega to 1 mile below McGee Siding Road	5/60	260
Rapid Creek (North Fork)	Tillson Creek confluence to 1 mile below Melcher Ranch	8/59	410
Rapid Creek (South Fork)	Melcher Sawmill to North Fork Rapid Creek confluence	7/59	220
Slate Creek	Slate Creek Dam to Rapid Creek confluence	9/59	420
Spring Creek	Whitehorse Creek confluence to 1 mile east of Hill City	9/59	76,560
	1 mile east of Hill City to Mitchell Lake	9/59	3,890
	Sheridan Lake to 0.25 mile below eastern most access to Sheridan Lake Drive	8/59	620
	0.25 mile below eastern most access from Sheridan Lake Drive to 0.5 mile above Coon Hollow	8/62	120
	0.5 mile above Coon Hollow to 0.5 mile below Coon Hollow	8/62	40
	0.5 mile above to 0.5 mile below Stratosphere Bowl Ranch	8/62	30

Source: Stewart and Thilenius (1964)

Quantitative population estimates for the mid-1980s to the present day are shown in **Table 3-18** below. Survey sites from the past two decades were selected within stream reaches reported by Stewart and Thilenius (1964) for comparison.

Table 3-18. Mountain Sucker Populations During The Mid-1980s And 1990s (Number Of Fish Per 100 Meters)

Stream	Reach/Site	Date	Population
Battle Creek	Below Keystone (1984 site 6; 1994 site 10)	7/84 7/94	1 1
Bear Butte Creek	1 mile below FDR 534 and Hwy 385 junction (1985 site 6; 1990s site 10)	6/85 6/95	14 142
Castle Creek	Below Deerfield Dam (1990s Site 2)	10/92 10/93 11/94 9/95 9/96 9/97 9/98 9/00	0 0 0 0 0 0 0 0
	Above Mystic Road (1984 site 23; 1993 Site 5)	8/84 10/93	2 0
Castle Creek (Middle Fork)	Above Soholt Draw confluence (1984 site 4; 1993 site 9)	8/85 6/93	1 0
	First bridge above Deerfield Store (1993 site 7)	6/93	0
Castle Creek (South Fork)	Above confluence with Castle Creek (1986 site 7; 1994 Site 1)	7/86 6/94	0 0
Elk Creek	Near Brownsville (1984 site 5; 1997 site 5)	9/84 8/97	89 250
French Creek	1 mile below Glen Erin Creek confluence (1992 site 6)	5/92	1
	Near Hazelrodt Campground (1984 site 12; 1990s site 8)	7/84 5/92 7/93	27 36 7
Grizzly Creek	1 mile upstream of Grizzly Bear Campground (1984 site 5)	7/84	0
Iron Creek	0.5 mile upstream of Camp Remington (1984 site 5; 1992 site 2)	7/84 6/92 7/93 7/94 8/98	0 0 0 0 0
	0.25 mile above Hwy 16A (1984 site 9; 1999 site 4)	7/84 7/93	0 0
	Below Lakota Lake (1984 site 11; 1994 site 6)	7/84 7/94	11 17
Rapid Creek	Rochford to Seal Spur (1984 site 10)	9/84	10
	Near Cluder Gulch (1984 site 10; 1992 site 5)	10/84 9/92	6 10
	Near Placerville (1993 site 17)	9/93	0
	Below Johnson Siding (1984 site 25; 1993 site 16)	8/84 9/93	0 0
	Below McGee (1984 site 32; 1992 site 11)	9/84 10/92	0 0
Rapid Creek (North Fork)	Above confluence with South Fork (1984 site 8; 1994 site 1)	9/84 7/94	10 3
Rapid Creek (South Fork)	1 mile below Black Fox Campground (1984 site 4; 1994 site 2)	8/84 7/94	0 0
Slate Creek	Dam to Rapid Creek confluence (1985 site 12; 1995 site 1)	6/85 8/95	11 3

Stream	Reach/Site	Date	Population
Spring Creek	Near Oreville Campground (1984 site 12; 1993 site 5)	7/84 6/93	14 0
	Above Mitchell Lake (1984 site 17; 1993 site 3)	7/84 7/93	21 28
	Below Sheridan Dam (1984 site 24; 1993 site 1)	7/84 7/93	0 0
	Between 1st and 2nd bridges on Sheridan Lake Road (1996 Site 10)	9/96	0
	Storm Mountain Camp (1984 Site 28; 1998 site 14)	8/84 9/98	0 0
	Below Stratosphere Bowls (1994 Site 8)	9/94	0

Source: Ford (1988); SDGFP Fisheries Database (April 14, 2005).

The other area of scientific uncertainty is the weakness of potential trend assessments for this species (USDA Forest Service 2005e). Past data collection efforts have rarely been undertaken in a systematic manner designed to specifically assess mountain sucker populations. Differences between sampling techniques, sites, and timing and statistical methods used to derive population estimates confound a direct comparison, but general inferences can be made of past to present population trends by converting 1980-to-1990s population estimates into the number of fish per mile for comparison to 1950s-to-1960s estimates.

Mountain sucker persist in Battle Creek and population estimates were similar in 1984 and 1994 but lower than those estimated in the 1960s.

Presently, Bear Butte Creek and Elk Creek appear to have substantially more mountain suckers compared to the 1960s.

Of the two sites on French Creek downstream of Stockade Lake, mountain sucker persist at both. The lower site upstream of the Custer State Park boundary had increased numbers of fish compared to the 1960s. Mountain sucker populations were variable, but lower numbers were reported in 1993 compared to 1984 and 1992. At the upper site, mountain sucker numbers appear lower when compared to the 1960s.

Mountain suckers are still present on Slate Creek, but overall population trend appears to be downward.

Mountain sucker have not been recently documented in some stream reaches where this species was present in the 1960s. Mountain suckers were not collected in Grizzly Creek in 1984, but no subsequent surveys have been completed. Mountain suckers were not collected in recent surveys on portions of Castle, Rapid, and Spring Creeks.

The trend in mountain sucker populations appears downward in Castle Creek upstream and downstream of Deerfield Dam. Upstream of the dam, mountain suckers were largely absent from sites surveyed in the 1980s to 1990s. No mountain suckers have been collected during annual surveys done in the 1990s immediately below the dam. In 1984, mountain sucker were present at a sample point about midway between the dam and the confluence with Rapid Creek in numbers similar to those in the early 1960s but were not collected in the same vicinity in the early 1990s. (Mountain sucker populations in Castle Creek may have been affected by SDGFP projects to eradicate Deerfield Dam during the late 1970s. Fish toxicants were used above and below the dam to eradicate non-desired species.)

Mountain sucker populations on Rapid Creek upstream of Pactola Reservoir show a stable or declining trend at various sites in comparison to 1950-to-1960 estimates. Mountain sucker are absent from survey sites downstream of Pactola Reservoir within the Forest boundary. Mountain sucker are collected sporadically and in low abundance at sites downstream of the Forest boundary.

Mountain sucker persist on Spring Creek upstream of Sheridan Reservoir. Populations appear stable upstream of Mitchell Lake but not in the abundance reported at several upstream sites surveyed in 1959. Stewart and Thilenius (1964) did not collect any mountain sucker between Mitchell Lake and Sheridan Lake, but this species (n=12) was collected at a site within this reach in 1997 (SDGFP 1998). See the Erickson (2002) discussion below for the mountain sucker population trend below Sheridan Dam.

On Iron Creek, mountain sucker are reported downstream of Lakota Lake but not upstream. The fish population in the Camp Remington area (Iron Creek) has changed considerably since the early 1960s (SDGFP 1993). A 1962 survey found very few trout and a very large population of longnose dace, mountain suckers, and white suckers. In the mid-1980s, trout dominated the fish population. Surveys conducted by SDGFP (1999) in Iron Creek (Camp Remington area) in 1992, 1993, 1994, and 1999 documented primarily brook trout, but brown trout, rainbow trout, and longnose dace were also sampled. Mountain suckers continue to be collected downstream of Lakota Lake on Iron Creek. The population estimate in 1994 was greater than in 1984 (SDGFP 1995), but numbers appear greatly reduced from 1960s levels.

Erickson (2002) summarized the current status of mountain sucker populations in South Dakota. Five streams (Bear Butte, Elk, Flynn, French, and Whitewood Creeks) produce densities greater than 30 mountain suckers per 100 meters of stream. Erickson (2002) also compared the current status of mountain sucker populations in South Dakota where populations were known to exist in the 1890s. Mountain suckers persist in French, Rapid, Spring, and Whitewood Creeks, but localized population reductions have occurred. Mountain suckers were absent at many off-Forest survey sites. The population status of mountain sucker is summarized below from Erickson (2002).

Since 1993, no mountain suckers have been collected at five electrofishing sites established along Beaver Creek from the headwaters downstream to the SDGFP Buffalo Gap Game Production Area. The two most upstream sites are within the Forest boundary but are located on private inholdings. Other sites are downstream on Wind Cave National Park, private, or State lands.

A small population of mountain suckers still exists in French Creek. Mountain suckers were captured in 13 of the 19 electrofishing surveys completed by SDGFP from 1992 to 1996. These sites occur on NFS and private lands and Custer State Park. Population densities ranged from 1 to 46 mountain suckers per 100 meters of stream. Highest mountain sucker densities were reported at sites within Custer State Park.

An occasional mountain sucker is still collected during electrofishing surveys on Rapid Creek. SDGFP collected one or more mountain suckers in 18 of 131 electrofishing surveys conducted on Rapid Creek since 1992. When present, population densities were low (1 to 44 mountain suckers per 100 meters of stream).

A total of 40 electrofishing surveys have been conducted at 24 sites along the main stem of Spearfish Creek since 1992. Mountain suckers were not found. Annie Creek is the single tributary within the entire Spearfish watershed known to have a population of mountain suckers on the Forest.

It appears mountain suckers no longer exist below Sheridan Lake on Spring Creek. No mountain suckers were captured during 22 electrofishing surveys at seven sites below Sheridan Lake between 1992 and 2000. There appears to be a small population of mountain suckers in Spring Creek upstream of Sheridan Lake. Mountain suckers were found at four of the seven electrofishing sites sampled above the lake during this time period. Population densities were low (1 to 28 mountain suckers per 100 meters of stream).

Since 1992, there have been 82 electrofishing surveys conducted at a total of 22 sites on Whitewood Creek. Mountain suckers have been sampled at nine of the 22 sites. Few specimens have been collected upstream of Gold Run. However, the population appears to be stable from Gold Run downstream to the Belle Fourche River. The majority of Whitewood Creek is on non-NFS land and includes the historic mining communities of Lead and Deadwood.

Isaak et al. (2003) summarized density estimates for mountain sucker derived from SDGFP fisheries surveys. Based on the surveys from 1993 through 1999, mountain sucker densities ranged from 7 to 13,399 fish/ha with an average of 1,262 fish/ha and a median of 265 fish/ha for 59 sites where this species occurred.

Overall, the population objective for all alternatives is to maintain the Forest-wide distribution of mountain sucker recognizing that there may be fluctuations in local populations due to a variety of natural and human-related causes.

Direct And Indirect Effects

Ecosystem Approaches By Alternative

Across all alternatives, the ecosystem approach maintains and enhances the amount and quality of stream habitat through the implementation of standards and guidelines, watershed conservation practices, and BMPs to conserve the physical, biological, and chemical aspects of streams, riparian areas, and uplands. The connectivity of the existing stream network is maintained by avoiding the placement of any new in-stream barriers to fish passage or sediment transport. Management actions allow for ecological processes to function, ensuring the recruitment of large woody debris and sediment transport within a stream's dynamic equilibrium. The direct and indirect effects are disclosed in the Aquatic Ecosystems and the Riparian and Wetlands Ecosystems sections. Conclusions regarding how management activities will affect mountain sucker populations are speculative, given the lack of detailed information on habitat requirements and the likelihood of simultaneous management activities having interactive and possibly unpredictable effects on stream habitats (USDA Forest Service 2005e).

Effects Of Species-viability Management On Mountain Sucker

The mountain sucker was not chosen as an MIS because of concerns regarding its viability but because of its link to aquatic habitat on the forest. However, Forest management direction focused on species viability has the potential to influence habitat for mountain suckers.

Species-viability management has the potential to affect the amount and quality of mountain sucker habitat across the range of alternatives by maintaining and improving the quality of stream habitat through resource conservation measures and habitat restoration efforts and by increasing the extent of perennial stream miles.

Implementation of standards and guidelines, watershed conservation practices, and State BMPs conserve the amount and quality of mountain sucker habitat by protecting the chemical, physical, and biological components of aquatic ecosystems. Watershed conservation practices and State BMPs are common to all alternatives and therefore protect mountain sucker habitat to the same degree. Twenty-one guidelines that provide specific protection to aquatic/riparian resources in Alternative 1 are treated as standards in Alternative 2 and 4. Alternatives 3 and 6 make four of the Alternative 2 "guidelines treated as standards" (2507, 3106, 9107, and 9108) into standards. The remaining Alternative 2 "guidelines treated as standards" revert to guidelines. Overall, the standards and guidelines in all alternatives maintain or improve the amount and quality of mountain sucker habitat, but Alternatives 2 and 4 have the more stringent protections.

Objective 214 targets the restoration of 500 acres of riparian-shrub communities in Alternatives 1, 2, and 4. Under Alternatives 3 and 6, the amount of riparian-shrub communities restored is 1,000 acres. Alternative 6 prioritizes these restoration acres near ARC and the WUI. Objective 215 targets riparian rehabilitation project implementation in at least three stream reaches in Alternatives 1, 2, and 4. Five stream reaches are targeted for restoration in Alternatives 3 and 6.

Overall, species-viability management under the range of alternatives is likely to maintain the Forest-wide mountain sucker population at the current levels. Alternative 3 has the most potential to increase the mountain sucker population because it enhances the most riparian and aquatic habitat, followed by Alternatives 6, 1, 2, and 4. The benefits of stream-reach restoration are contingent on that restoration occurring on a reach that is currently degraded mountain sucker habitat or is unoccupied suitable habitat that the mountain sucker would use in the future.

Effects Of Research Natural Area Management On Mountain Sucker

RNA management has the potential to affect the amount and quality of mountain sucker habitat across the range of alternatives by restricting or precluding land management activities (mineral extraction, motorized or mechanized travel, and public access) that may impact water quality. One of the goals of the RNA program is to select RNAs in areas where conflicts with existing land uses are limited (USDA Forest Service 1997b), so dramatic reductions of management activities are not expected to occur.

All alternatives include the existing Upper Pine Creek RNA, which includes about 3.5 miles of Pine Creek and Grizzly Bear Creek. Mountain sucker are not documented in either of these creeks. Benefits from Upper Pine Creek RNA management would be from indirect effects relating to water quality to mountain suckers residing downstream in Battle Creek. The quantity, quality, or duration of streamflow in Battle Creek is probably not measurably changed due to this RNA, because of its small size in relation to the Battle Creek watershed and the presence of Horsethief Lake on Pine Creek, downstream of the Upper Pine Creek RNA.

The mountain sucker occurs in North Fork Castle Creek. Alternatives 4 and 6 propose designation of the North Fork Castle Creek Botanical Area as an RNA. About 1.8 miles of stream would be within this RNA, though all habitat may not be suitable for the mountain sucker. Botanical Area status currently limits management activities to some degree. A measurable improvement in the amount or quality of aquatic habitat that would benefit the mountain sucker is not expected because a dramatic reduction of ongoing management activities will not occur and the RNA comprises only about 8 percent of the seventh-level watershed.

About 5.4 miles of Rapid Creek and Slate Creek form parts of the boundary of the Canyon City candidate RNA. Both streams provide suitable for mountain sucker. The Canyon City RNA is proposed in Alternatives 3, 4, and 6. The benefits to aquatic and riparian systems that occur on an RNA boundary will be contingent on the site-specific management actions undertaken to preserve the ecological condition for which the RNA was established. Where these site-specific actions limit uses that may degrade riparian, streambank and aquatic habitat, the benefits are likely to be positive to the mountain sucker. These benefits are limited because of the amount of stream miles affected by the Canyon City RNA in relation to the total stream miles of Slate Creek and Rapid Creek, upstream of Pactola Reservoir.

The designation of other candidate RNAs is not expected to have a measurable effect on the mountain sucker because this species is not documented in the vicinity of these other RNAs.

Overall, RNA management under all of the alternatives is not anticipated to have a measurable effect on the Forest-wide mountain sucker population because the amount of stream habitat and watershed acreage potentially influenced by RNA designation is a small percentage of the Forest-wide mountain sucker stream habitat and land base.

Effects Of Fire-hazard and Insect-risk Management On Mountain Sucker

Fire-hazard and insect-risk management is likely to affect the amount and quality of mountain sucker habitat across the range of alternatives in three primary ways: the removal of tree biomass may affect water yield and stream flows; treatment activities may affect water quality; and treatment-related activities, primarily road construction, has the potential to fragment stream habitat.

A denser forest and the subsequent effect on water production was believed to be the biggest single factor in the loss of stream flow in the Black Hills (Stewart and Thilenius 1964). Forest density has further increased the past 40 years. Management activities or natural disturbance (fire, insect, disease, etc.) that reduce tree density may increase water yield and potential ground water recharge although streamflows may not necessarily increase (USDA Forest Service 1996a). The change is proportional to the amount of trees removed, but usually 25 to 30 percent of the growing stock in a forested watershed must be removed before there is a measurable increase in water in the stream leaving the watershed (Sheppard and Battaglia 2002). Conversely, the introduction of new trees or the growth of existing trees will potentially decrease available water to augment stream flows. In the next decade, Alternative 6 with its increased emphasis to reduce fire-hazard and insect-risk ratings by reducing tree density is likely to have the greatest potential to affect water yield, followed by Alternative 3, Alternatives 1 and 2, and Alternative 4, but sustainable flow increases in streams containing mountain sucker are not expected. In the short-term, vegetation treatments and road construction associated with fire-hazard and insect-risk reduction have the potential for affecting the amount and quality of mountain sucker habitat due to soil erosion and water quality changes. Loss of vegetative cover and ground disturbance during these activities increases the potential for runoff and soil erosion from the affected area and may influence water quality in streams but only if sediment from these disturbed areas is transported into the stream network. Surface runoff from a disturbed site is related to a variety of site-specific factors, such as the slope of the land, soil characteristics, time of disturbance, proximity to the stream network, vegetative buffers, and intensity of rainfall events.

Alternatives 1, 3, and 6 propose to treat the most acreage annually (Appendix B; **Table B-1**) for commercial timber harvest followed by Alternative 4 and 2. Treatment acres of small diameter fuels and prescribed burning vary between alternatives (Appendix B; **Table B-1**). Alternative 6 proposes the most treatment acres, followed by Alternative 3, 1, 2 and 4. Impacts between alternatives based on small-diameter tree removal are expected to be minor because these treatments result in minimal ground disturbance and no roads are needed to complete these treatments. 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. Implementation of standards and guidelines, watershed conservation practices, and BMPs would mitigate the effects of timber harvest and road construction under all alternatives. Standard 1203, common to all alternatives, avoids additional stream fragmentation due to road-stream crossings. Additional resource conservation measures are described in the 3-2.3 Riparian and Wetlands Ecosystems, 3.2.4 Aquatic Ecosystems and 3-14 Water Resources sections.

Many species, like the fishes found in the mountain streams of the west, are actually adapted to and even dependent on disturbances like fire to maintain a diversity of habitats necessary to sustain spatially diverse and productive populations (Rieman et al 2005). Changing fire regimes and the potential for larger more disruptive fires may threaten the loss of aquatic habitat diversity and lead to accelerated extinction of some vulnerable populations (Rieman et al 2005). Fire-hazard reduction positively affects surface water quality if it reduces the amount or severity of burned acres that would contribute sediment into the stream network.

All the alternatives reduce the area of high fire hazard and the potential for high-intensity wildfires. With the potential for fewer acres exposed to stand-replacing fires, there would be a decrease in the potential for soil exposure and increased runoff potential. When ranked on the basis of the greatest acreage reduction of high and very-high hazard ratings, Alternative 6 provides the greatest reduction followed by Alternative 3, Alternative 1, and Alternative 2, respectively. Alternative 4 provides the least improvement in reduced fire-hazard rating and has the highest amount of acreage rated high and above.

Summary

Under all alternatives, the amount and quality of stream habitat will be maintained to support mountain sucker. Further stream-habitat fragmentation is avoided under all alternatives. Alternative 3 has the greatest potential to increase the amount and quality of mountain sucker habitat because it has the highest levels of riparian and stream enhancement in combination with a mid-range level of ground disturbing activities. Alternatives 1, 2, and 4 have the lowest acres of riparian enhancement. Under all alternatives, implementation of standards and guidelines, watershed conservation practices, and BMPs would mitigate the potential impacts to mountain sucker habitat.

Cumulative Effects

The cumulative effects analysis area 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 downstream to their confluence. This bounding was determined 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 in an ever-increasing watershed scale. The cumulative effects analysis area is bounded in time as the next 10-15 years. This temporal scale corresponds to projections for the desired future condition described for each alternative (Chapter 2).

Increased tree density and the associated increased water uptake are likely to reduce water available to supplement existing stream flows. All alternatives remove tree biomass which would have a positive incremental impact to reduce evapotranspiration losses from ponderosa pine. Fire-hazard and insect-risk reduction is likely to occur on NFS and non-NFS land. Alternative 6 removes the most biomass and has the greatest potential to increase water yield, but these increases may be limited due to a number of other factors and will likely not be detectable in streams containing mountain suckers.

All alternatives conserve or enhance aquatic ecosystems through the implementation of resource conservation measures. These measures may not completely eliminate all potential adverse effects, therefore some incremental impacts, such as sediment input into streams is likely to occur that is additive to natural sediment sources and sediment contributed by activities on non-NFS lands. These additive impacts may be small in volume but may occur cumulatively over a long period of time and as in the case of sedimentation may degrade stream habitat were gradient and/or flows are insufficient to transport sediment or may accelerate the filling in of ponds and reservoirs.

A variety of structures currently fragment mountain sucker habitat. Dams that provide recreational opportunities and/or municipal water supplies are not likely to be removed. Smaller stream impoundments on NFS and non-NFS land that provide water for livestock or irrigation use are also likely to persist, and additional ones may be constructed. Newly constructed in-stream structures on NFS land will not have an additive incremental impact that further fragments stream habitat because Standard 1203 requires the free movement of fish at all stream-crossings and other in-stream structures.

Stream-habitat enhancement projects would have a positive incremental impact to improve conditions for the mountain sucker. Policy direction (Executive Order 12962) to provide for recreational fisheries is likely to remain, and the public demand for recreational fishing opportunities is likely to continue or increase, both of which may limit the actual increase in mountain sucker populations even though the amount or quality of habitat has been improved.

The amount and quality of mountain sucker habitat is also influenced by land management and development on private inholdings, most of which occur along streams. Stewardship of private lands varies and likewise the contribution of these lands in maintaining mountain sucker populations also varies.

Projected global warming could have a profound effect on the distribution of many aquatic species (Isaak et al. 2003). Increases in air temperature are likely to have an increase in stream temperatures, which may reduce the amount of suitable stream habitat. Most often this shift will entail decreased fish abundance in downstream habitats that have become too warm and increased abundance in cooler upstream areas (Isaak et al. 2003). Management activities that maintain or improve stream flows or temperatures would have a positive effect on mountain sucker. Meeting Forest Plan objectives, standards, and guidelines is intended to avoid those physical barriers or water quality degradations that would have a negative incremental impact additive to the effects of global warming that may limit the mountain sucker's ability to migrate and occupy suitable habitat.

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.

Monitoring Approach

The Forest will monitor instream fisheries habitat or mountain sucker populations. Monitoring of populations will be discretionary as provided by 36 CFR 219.14f. Monitoring will be designed to examine Forest-wide trends and based on the language in 219.14.f, site-specific monitoring or surveying of a proposed project or activity area is not required, but may be conducted at the discretion of the Responsible Official. Monitoring will be done in cooperation with State resource agencies, to the maximum extent practicable. One or more parameters of stream health may be measured. Commonly used measures include streambank stability, stream channel width-to-depth ratios or streambed substrate/ embeddedness. Habitat monitoring will include repeat sampling at sites where mountain sucker occur at, or in close proximity to sites sampled in the Common Water Unit - Integrated Resource Inventory. Habitat connectivity would be evaluated by tracking the status over time of natural and human-created barriers that may block the movement of mountain sucker. Human-created barriers are most likely to be dams or culverts at road crossings. Fish monitoring would occur at established electrofishing sites to determine mountain sucker distribution and persistence within a fifth-level watershed (e.g., Rapid Creek, French Creek, Spring Creek, etc.). Fish monitoring efforts would rely on ongoing state resource agency sampling efforts or could be supplemented with additional surveys conducted by the Forest Service. Population monitoring frequency would be on a two-three year cycle. All fish survey sites should be sampled, typically using a backpack electroshocker, in the same year during base flow periods in late summer or early fall to minimize environmental variance. Rapid Creek, French Creek, Spring Creek, etc.). Fish monitoring will use established state protocols to ensure that the data collected are compatible with current state fisheries methodologies and/or databases. Monitoring frequency will be on a 3- to 5-year cycle. All fish survey sites would be sampled, typically using a backpack electroshocker, in the same year during base flow periods in late summer or early fall to minimize environmental variance.