Management Indicator Species/Range Suitability/Capability Analysis

Contents

Introduction

The Forest Plan for the Shoshone National Forest is being revised under the provisions of the 1982 planning rule. The 1982 regulations require forest plans to identify and select certain vertebrate and/or invertebrate species present in the area as management indicator species. (36 CFR 219.19 (a)(1) and 36 CFR 219.20) Management indicator species (MIS) are identified as part of the revision process. Appendix 3 in the Land Management Plan 2014 Revision contains a synopsis of the selection process for management indicator species.

This MIS Report is provided to demonstrate Forest Plan compliance with 36 CFR 219.20, regarding MIS habitat capability and suitability in relation to capable grazing lands. This report focuses on the following items: 1) the distribution, status and trend of the species 2) the condition and trends of species habitat, 3) how various management activities affect the habitat and species population, and 4) how the species will be monitored.

36 CFR 219.20 requires that Forest Plans determine "the suitability and potential capability of NFS lands for producing forage for grazing animals and for providing habitat for management indicator species…The present and potential supply of forage for livestock, wild and free-roaming horses and burros, and the capability of these lands to produce suitable food and cover for selected wildlife species shall be estimated. Lands in less than satisfactory condition shall be identified and appropriate action planned for their restoration."

The objective of this document is to summarize key information from the FEIS and draft revised plan relevant to management of MIS habitat on the Shoshone National Forest. All of the MIS information presented here was extracted from the FEIS and draft revised plan.

Rangeland capability at the Forest Plan level was addressed as part of forest plan revision. Current Region 2 protocols for modeling rangeland capability for were used for cattle and sheep. The process used is documented in Appendix B of the FEIS.

Table 1 displays the MIS Species and the associated habitat element each species represents identified in the Shoshone Forest Plan.

Table 1. Management indicator species for the Shoshone National Forest

Common name	Global/state ranking	Habitat
Fish species		
Stream trout (Yellowstone cutthroat, Snake River cutthroat, rainbow-cutthroat hybrids, brook trout, and brown trout)	Yellowstone cutthroat trout G4/T2/S2	Streams Riparian habitat
Bird species		
Ruffed grouse	G5/S5	Aspen communities
Brewer's sparrow	G5/S5	Sagebrush communities
Red-breasted nuthatch	G5/S5	Mature conifer forest with snags

Ruffed grouse

Distribution, status and trend

Ruffed grouse range across the northern half of North America. They occur from central Alaska, through most of Canada, south to Utah, Wisconsin, and the Appalachian Mountains (Rusch et al. 2000). Ruffed grouse are a permanent resident in mountainous regions of the northwestern, north-central, and northeastern parts of the State.

No trend data are available that are specific to the Shoshone or Wyoming. WGFD does not track populations of this species, but they do periodically collect hunter harvest information. Based on recent WGFD harvest data (2010), ruffed grouse are consistently harvested in upland game management areas that encompass the Shoshone.

Species habitat condition and trend

In Wyoming, ruffed grouse are found in aspen and aspen/conifer mixed stands. On the Shoshone, aspen is found in scattered stands across the Forest.

Aspen occurs on a variety of sites within the Shoshone, becoming increasingly prevalent on the south end. Aspen is most common on relatively moist sites characterized by fine-textured soils (Reed 1971). Its successional role varies from a purely seral species to persistently seral. These stands frequently occupy concave slopes of low hills and even occur in big sagebrush zones on volcanic talus and boulder fields. When growing within or adjacent to conifer, aspen stands tend to be seral. Here, aspen occupies sites where disturbances have removed the conifers. Conifers will commonly reclaim these sites over time.

Aspen reproduction typically is asexual, with new shoots being produced from root sprouts (suckering) (Barnes 1966, USDA Forest Service 1991). This, combined with the persistence of aspen in the understory of some mature forests, explains why aspen tends to develop where it occurred previously. Sexual reproduction is quite rare, though seedlings do occur when severe disturbances such as fire are followed by extended moist conditions required for seedling establishment (USDA Forest Service 1985). For example, aspen seedlings were abundant in some areas after the 1988 fires in nearby Yellowstone National Park (Romme et al. 1995). Because of reproductive requirements, sexual reproduction of aspen is thought to be episodic (Romme et al. 1997). There is considerable genetic diversity between clones, with some clones better adapted for higher elevations and some responding differently to weather conditions than others (Meyer et al. 2006).

There are about 23,300 acres of aspen on the Shoshone. Field observations indicate that most aspen is mature (USDA Forest Service 2009). Aspen occurs as a seral species and a climax species on the Shoshone (USDA Forest Service 2009). Climax stands occur below the lower limits of conifers, while seral stands grow among conifers. These seral stands are replaced by conifers over time without disturbance. Aspen is thought to be at the lower end or just below the historic range of variability (USDA Forest Service 2009).

Management Activity effects

The primary risk factors from forest management are fire suppression and livestock grazing. A natural risk factor is wild ungulate grazing, primarily by elk. Maintaining and increasing the acreage of aspen on the Shoshone would be the most important forest management consideration. Increasing aspen age class diversity would also be an important aspect of aspen management. Protecting recently treated aspen stands from livestock grazing and wild ungulate browsing would be important to successfully regenerate aspen.

Vegetation treatment in aspen can improve stand conditions. These treatments primarily involve prescribed fire to reduce conifer encroachment in aspen stands and to improve stand health. Because vegetation treatment on aspen stands on the planning area is limited, potential impacts to ruffed grouse from these activities on the Shoshone are expected to have a positive impact to the species.

Wildland fire use is not a planned activity. However, it would be utilized as a tool to allow natural disturbances to occur, as opportunities arise. Aspen is a target species for wildland fire use on the planning area, and potential impacts to ruffed grouse from this activity on the Shoshone is expected to be beneficial.

Fire generally has a positive effect on aspen cover type, by renewing stand conditions, killing encroaching pine, and setting stands back to an earlier seral stage where aspen can colonize a site. Wildfire usually has a greater impact than prescribed fire because the fire intensity required to regenerate aspen is more difficult to achieve in a prescribed fire. Alternatives with more fire, particularly wildfire, will result in a greater increase in aspen cover type.

Livestock grazing on the Shoshone is likely to overlap potential habitat for the ruffed grouse. These activities are, therefore, predicted to have potential negative influences on individual breeding pairs of ruffed grouse where activities and habitat overlap. On NFS land, however, these activities are expected to be minor because of the small amount of acreage involved and the conservation measures developed to minimize potential impacts.

Brewer’s sparrow

Distribution, status and trend

Brewer’s sparrows winter in the southwestern United States and north-central Mexico. They do not appear to have elevation limits in their breeding range.

Brewer’s sparrows are well distributed within the Great Basin and other sagebrush habitats in northwestern North America. They breed throughout Wyoming (Rotenberry et al. 1999). They likely occur Forest-wide within suitable habitat based on recent surveys by the Rocky Mountain Bird Observatory from 2002 to 2008 (Hanni et al. 2009). From 2002 to 2009, the Rocky Mountain Bird Observatory detected 640 Brewer’s sparrows (Hanni et al. 2009, Rehm-Lorber et al. 2010). There are currently no known population estimates or trends for the species on the Shoshone. At the State level, breeding bird surveys indicate a slight declining trend (- 0.7), but the trend is not significant ($p = 0.37$) (WGFD 2010b).

With fluctuations in natural ranges of habitat, it is difficult to determine whether populations of this species on the Shoshone are similar to historic levels. Regional declines reported in breeding bird survey results for most of the West indicate they are not (Paige and Ritter 1999), and significant acreages of sagebrush habitat have been lost throughout the West due to European settlement influences, such as conversion to agriculture, urban development, or losses due to cheatgrass invasion. These changes are likely having an effect on Brewer's sparrow populations, though these effects currently are not occurring to a significant extent on the Shoshone, as compared to surrounding lands.

Species habitat, condition and trend

Nests for this species are typically constructed in the bottom portion of live sagebrush plants, typically in the taller shrubs.

Brewer's sparrows are dependent on sagebrush habitats, tending toward mature stands and larger stand sizes, which make them sensitive to habitat fragmentation (Paige and Ritter 1999). Food sources are primarily insects in the summer, with seeds of grasses and shrubs a secondary source. Across the Shoshone, there are approximately 38,800 acres of sagebrush, representing 2.0 percent of the Forest (USDA Forest Service 2012b). Diverse soils, geology, and climatic conditions cause varying distributions of sagebrush habitat types across the Shoshone.

Mountain big sagebrush dominates the montane shrublands throughout the Absaroka Mountains. These communities are scattered on alluvial deposits [1] or deeper soils on south- and west-facing slopes throughout the Absaroka Mountains. A high-elevation phase of this habitat type occurs on the south- and west-facing slopes just below the high plateau surfaces of Carter Mountain, Phelps Mountain, and the upper Greybull River. On the Clarks Fork Ranger District, mountain sagebrush forms part of an extensive forest/shrubland/grassland habitat type mosaic occurring on granite substrates on the lower portions of the Beartooth Plateau.

Arid low-elevation sagebrush occurs on the eastern margin of the north half of the Shoshone. The most extensive of these shrublands is found in the valleys of the North Fork and South Fork of the Shoshone River. Calcareous soils [2] generally support dwarf sagebrush types dominated by black sagebrush, while non-calcareous alluvial soils support big sagebrush.

On the Wind River Ranger District outside the Absaroka Mountains, younger sediments and non-volcanic substrates support two shrublands with limited ranges. Shallow rocky soils on exposed sites in the East Fork – Button Draw areas support low sagebrush habitat types. These provide important big game winter range because they remain snow-free much of the winter. A contrasting set of conditions supports low sagebrush on shale substrates of the lower Horse Creek and Long Creek areas. Soils under these have a fine-textured layer that interrupts drainage, causing saturation for part of the growing

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[1] Alluvial deposits are clay, silt, sand, and gravel left by flowing streams, typically producing fertile soil.
[2] Calcareous soils contain calcium carbonate.

season. These soils are subject to degradation from trampling when they are wet. This habitat type occurs as small patches within a mosaic of shrubland and scattered forest habitat types.

Sagebrush and related types on the Washakie Ranger District are quite different from the remainder of the Shoshone because of the occurrence of shrub species more common to Utah and the Great Basin area. These species form mixed shrub communities occupying basins and lower slopes on sedimentary formations flanking the southern Wind River Mountains. These communities are dominated by mountain big sagebrush and one or more other shrubs including bitterbrush and mountain snowberry. Mid and upper slope portions, and steep south and west exposures, support dwarf sagebrush habitat dominated by threetip sagebrush. The southwestern corner of the Washakie Ranger District contains xeric[3] shrublands dominated by big sagebrush subspecies, which are similar to the less productive shrublands of the Absaroka Mountains.

In general, most of the sagebrush stands on the Shoshone are likely in a mature condition. This is largely due to fire suppression, especially at the lower elevations on the Shoshone. Fire suppression can cause increases in shrub cover and tree encroachment, but on the Shoshone the change is not large enough to be outside of the historic range of variability at the stand or landscape level (low confidence) (Meyers et al. 2006). There appears to be adequate habitat to support viable populations of this species on the Shoshone.

Analysis of the data, reports, and photographs indicates that the overwhelming majority of rangeland conditions are generally meeting condition objectives or improving (see Figure 1). Where plant composition was determined, the data displayed a static or positive trend toward the desired condition (see Figure 2). Rangeland that was currently in desired condition showed the least change and those changes were attributed to natural succession. Across the Shoshone, with a few exceptions, range vegetation conditions are either at or moving toward the desired conditions as outlined in the forest plan and/or the associated allotment management plan.

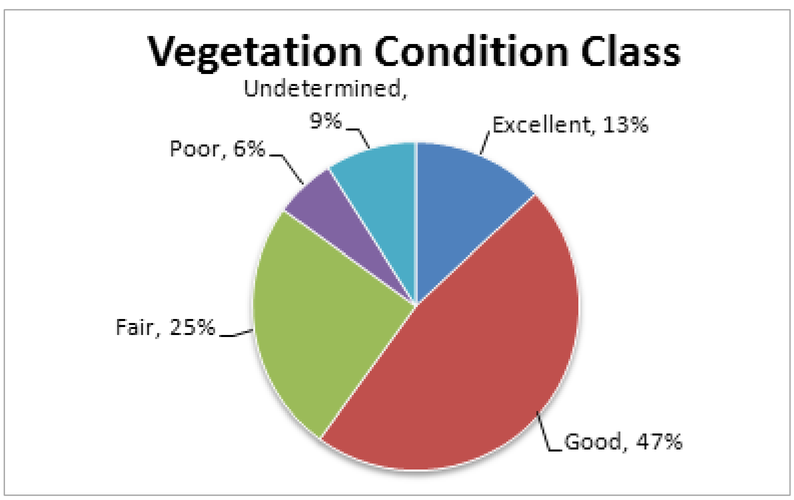

Figure 1. Rangeland vegetation condition class on the Shoshone National Forest

[3] Xeric sites or habitats are characterized by dry conditions.

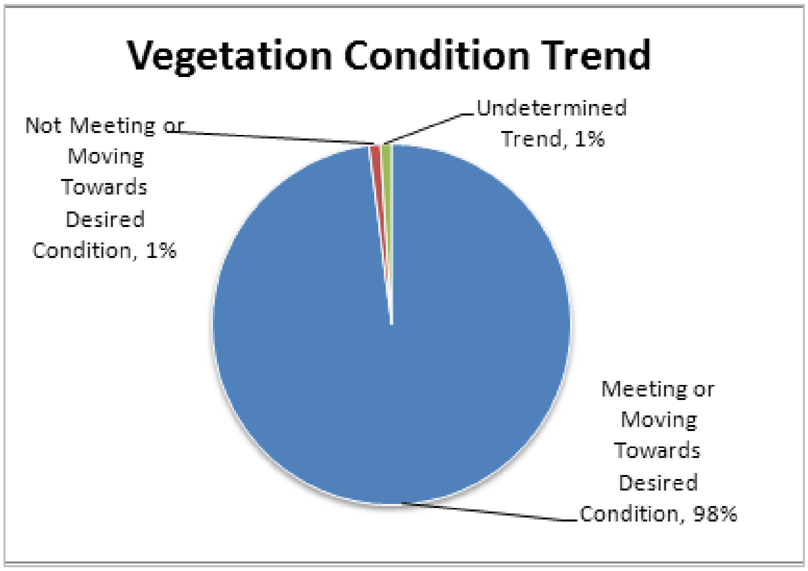

Figure 2. Rangeland vegetation condition trend on the Shoshone National Forest

Management Activity effects

Primary risk factors from forest management include: habitat fragmentation, prescribed fire, livestock grazing, and invasive plants.

Livestock grazing can influence sagebrush ecosystems. High stocking rates typically result in an increase of mature sagebrush due to the removal of understory herbaceous vegetation. Trampling of nests is not thought to be of concern, as this sparrow nests in the canopy of sagebrush. Nest parasitism from cowbirds may have an impact, as cowbirds tend to follow livestock herds (Paige and Ritter 1999). However, both rotational grazing systems and the later turn-out date of most livestock operations likely provide adequate areas of little influence from this effect (Bock et al. 1993). Livestock may also increase the risk for the introduction of invasive plants.

Invasive plants are currently limited to localized concentrations and are primarily located along major travel corridors (roads and trails). Similarly, cheatgrass has yet to invade large or broad portions of the Shoshone. However, the threat of habitat loss remains high. Cheatgrass alters the fire regime and increases the probability for more frequent fires. This reduces the chance for sagebrush and native bunchgrasses to get re-established following a fire.

Retention of stands of mature sagebrush habitat at a watershed scale would provide for ensured habitat for populations of this species. Although to what level is unknown, it is assumed that within a range of what likely historically occurred is reasonable. This would also facilitate management toward ensuring sustainable and diverse habitat conditions. If sagebrush was managed only for mature high canopy cover stands, the habitat is more at risk for losses due to wildfire, and would not provide the needed diversity of grasses/forbs for other species. Mosaics created by prescribed burning may be most beneficial, though this could also be accomplished through other methods.

Roads can have negative effects on these species. Roads can reduce patch size, increase the potential for displacement by other species more adapted to roads and edge (horned larks), and increase the risk for introduction of invasive plants.

Fire can affect sagebrush both positively and negatively. Positive effects include diversifying sagebrush stand structure, killing conifer encroachment, and renewing growth. Widespread fire, particularly of high intensity, can set sagebrush habitat back to grassland, and in some cases, can lead to the proliferation of invasive species such as cheatgrass that can permanently covert the stand from sagebrush to grassland. All alternatives have direction to minimize, where possible, fire that could lead to cheatgrass expansion. This negative impact would be greatest in those alternatives with the greatest amount of wildfire. Prescribed fire can be conducted in areas to avoid the negative impacts and emphasize the positive impacts.

Red-breasted nuthatch

Distribution, status and trend

Red-breasted nuthatches (*Sitta canadensis*) are a non-migratory, native avian species on the Shoshone. They are widespread in distribution in coniferous forests on the Shoshone and throughout Wyoming.

Since 2002, the Shoshone has undertaken avian point count monitoring to improve its information available on population trends for several species. The nuthatch is adequately detected through this survey protocol, and baseline trends indicate a stable population with estimated densities of approximately 206,500 (72 percent coefficient of variation) (Rehm-Lorber et al. 2010). However, populations are known to fluctuate in response to cone crops.

Species habitat condition and trend

They are associated with mature structural stages, primarily due to their association with soft snags for nesting cavities, and from both insects in bark and cone crops as forage. Hart and Hart (2001) found that old live aspen with heart rot was a significant component in cavity construction and indirectly benefits the nuthatch since it nests in constructed cavities. Norris and Martin (2008) suggest that nuthatches selected sites that maximized nesting and foraging opportunities, and during food pulses (mountain pine beetle outbreaks), nuthatches may select more foraging opportunities over higher densities of suitable nest trees.

Conifer Cover Types

Douglas-fir types are the major low-elevation forested type that occurs on the Shoshone, ranging from 6,500 to 9,500 feet in elevation. With the climate regimes found on the Shoshone, Douglas-fir thrives on soils derived from limestone or basic extrusive volcanics (andesites, basalt) and is less common on soils derived from granitic rocks (USDA Forest Service 1983a). Consequently, in the Wind River and Absaroka Mountains, Douglas-fir is absent in some areas where it might be expected based on climate alone. Since 2000, almost all the Douglas-fir cover type has been affected by Douglas-fir beetle to some degree.

Engelmann spruce and subalpine fir habitat types on the Shoshone are complex with a large number of understory and substrate variations. Engelmann spruce occurs as a climax codominant or dominant on the wettest habitat types where it is more successful than subalpine fir. It is also more prevalent on the eastern flanks of the Shoshone's mountain ranges than it is on the western flanks farther west in the Greater Yellowstone Ecosystem. Types reflect this where Engelmann spruce, rather than subalpine fir, is associated with whitebark pine at cold, dry, high-elevation sites. Engelmann spruce types have a slightly wider elevation range, from 6,200 to 10,300 feet, while subalpine fir types range from 6,500 to 9,800 feet. Soil substrates strongly influence the occurrence of Engelmann spruce and the seral species with which it is associated. Succession to Engelmann spruce and subalpine fir occurs on any soil type at higher elevations or on steep slopes. In some areas with more calcareous soils, the spruce is especially abundant. Spruce beetle activity is widespread on the Shoshone.

Lodgepole pine occurs on a broad range of ecological conditions from the colder Douglas-fir sites to all but the wettest spruce/fir sites. Lodgepole pine is a major seral species that is often the first tree to reforest a severely disturbed site. In these situations, other conifers often replace lodgepole pine within one generation. Lodgepole pine is most persistent on gentle terrain. On lower slopes, benches, and broad valleys with large fluctuations in temperature, lodgepole pine can remain dominant. It can also remain dominant on gentle slopes and benches near treeline. In these situations, the stand may contain small amounts of whitebark or limber pine. Lodgepole pine is more widespread and is common on the acidic, coarse soils derived from granitic rocks and some sandstones.

Lodgepole pine is well adapted to disturbances because it often bears cones that remain closed for many years, thereby storing thousands of seeds. Known as serotinous cones, they open primarily when exposed to higher than normal temperatures, such as during fire or when the cones are near the soil surface. Notably, not all lodgepole pine produce serotinous cones and the proportion of closed and open cone trees is highly variable. Serotinous lodgepole pine are not common on the Shoshone, but observations suggest that serotinous cones are more common in the northern part of the Shoshone than in the southern (about 60 to 70 percent and 10 percent, respectively) (USDA Forest Service 1983a). Since 2000, there has been a continual upward trend in the number of acres affected by mountain pine beetle.

This species would be most strongly associated with mature to older forest habitat structural stages (4A, 4B, 4C), and have been known to occur in the younger stages if snags are present. Currently, approximately 49 percent of the forested habitats are in structural stage 4, of which approximately 14 percent (174,000 acres) is in the 4C category. Nuthatches are not known to be sensitive to edge or fragmentation issues, including effects of roads or timber harvest. Keller and Anderson (1992) found similar results when comparing cut stands of trees (fragmented habitat) to unfragmented stands. While it was not clear from their 1992 data that red-breasted nuthatches were influenced by fragmentation, in previous study years they were more abundant in the uncut stands. Continued availability of their habitat (4C, snags, etc.) would be the issue of concern.

Meyer et al. (2006) quantitatively evaluated the proportion of the forested lands at high elevations in different age classes on the Shoshone and compared the age class distribution to Yellowstone. Using FIA data, most successional stages fell within or close to variables in Yellowstone. Overall, the Shoshone appears to have low numbers of stands with trees averaging more than 300 years old. Given the low levels of timber harvest, this cannot be attributed to timber harvesting. When the oldest stage (age class) was defined as greater than 200 years old, all stages were within the historic ranges of variability at the scale of the entire Shoshone.

On low-elevation forests, an effect of timber harvesting and fire suppression has been to reduce the natural variability in stand structure and age distribution caused by historic disturbances. The increased tree and sapling density resulting from fire suppression prevents most trees from reaching large sizes and reduces the stand average. The average age structure of unharvested low-elevation stands is probably outside the historic range of variability due to fire suppression. The result is an older age class distribution.

A very small percentage (1 percent) of Douglas-fir has been harvested; timber harvest has probably not yet reduced the percentage of the low-elevation lands in older age class outside the historic range of variability. Old-growth forests certainly could be lost in the future if suitable lands are harvested.

Most of these differences are minor compared to the large shift in age class distribution that is occurring because of the widespread insect epidemics affecting all conifer species on the Shoshone. Over 70 percent of the conifer stands on the Shoshone have been impacted to date. Though impacts are variable, the overall trend is a shift from older forests to younger forests.

Table 2. Current Forest-wide age class diversity for conifer cover types for the Shoshone (Menlove 2008) (percentage of cover type acres*)

	Age class distribution (percentage of age class)		
Forest cover type	**Younger**	**Middle**	**Older**
Douglas-fir	6	78	16
Spruce/fir	6	64	30
Lodgepole pine	15	63	22

* Percentages reflect Forest-wide numbers and may vary across the Forest.

Snags

Snags are created through insect and disease outbreaks, fire, wind events, and natural mortality. Data for snag size and density on unharvested stands were gathered by Harris (1999) in southern Montana. Harris's work includes most of the cover types on the Shoshone. Table 3 shows these numbers for cover types that occur on the Shoshone. In the absence of other data, these data for unharvested stands provide a baseline for natural snag levels.

Table 3. Diameter of snags per acre in untreated stands (Harris 1999)

Cover type	Number of sample sites	9 to 14.9 inches	15 to 20.9 inches	21 to 26.9 inches	Greater than 27 inches	Total snags per acre
Spruce/fir	280	16.06	3.79	0.92	0.32	21.09
Douglas-fir	420	6.78	1.62	0.46	0.10	8.96

Cover type	Number of sample sites	9 to 14.9 inches	15 to 20.9 inches	21 to 26.9 inches	Greater than 27 inches	Total snags per acre
Lodgepole pine	230	11.13	0.85	0.17	0.03	12.18
Dry subalpine*	30	27.62	2.78	0.98	0.06	31.44
Hardwood**	16	5.33	0.00	0.00	0.05	5.38

* Dry subalpine consists of whitebark pine and limber pine types.

**Hardwood types consist of aspen, cottonwood, and birch.

Table 4 displays snag densities for the Shoshone in 1998. For all species except whitebark and limber pine, total snag numbers on the Shoshone are comparable to those found by Harris. Given the small percentage of the Shoshone impacted by timber harvesting, it is reasonable to assume these snag levels are comparable to natural levels. The densities for whitebark pine and limber pine are lower than those found by Harris. Given the similarity for all other cover types to Harris's findings and the lack of any activities that would reduce snag levels only for whitebark pine and limber pine, we assume the data represent comparably natural snag numbers for these species on the Shoshone that are lower than those found by Harris in southern Montana. Another difference between the Harris numbers and the Shoshone data is that there are generally fewer snags over 15 inches. Again, given the general lack of activities on the Shoshone that could cause the loss of larger snags only, it is reasonable to assume that, given climate and moisture regimes, tree sizes are generally smaller on the Shoshone than in the Harris study.

Table 4. Diameter of snags per acre on the Shoshone (USDA Forest Service 1998 (FIA data))

Cover type	9 to 14.9 inches	15 to 20.9 inches	Greater than 21 inches	Total snags per acre
Spruce/fir	24.43	4.21	0.43	29.07
Douglas-fir	8.07	1.08	0.23	9.38
Lodgepole pine	15.02	0.50	0.27	15.79
Whitebark pine	9.77	0.68	0.83	11.28
Limber pine	6.83	2.27	0	9.10
Aspen	5.70	1.96	0	7.66

As discussed in Meyer et al. (2006), snag density is often highest in recently burned forests and in old-growth forests (Tinker 1999, Mehl 1992). Fire suppression and timber harvest are the two activities most likely to affect these conditions. Given the general inaccessibility of the Shoshone, fire suppression has had less of an effect than in other areas in the West. In the higher-elevation forests, only 5 to 10 percent has been impacted by fire suppression (Meyer et al. 2006). At lower elevations, most of the Shoshone has been impacted, given the easier accessibility. Fire regime condition class assessments indicate that 24 percent of the Forest has missed at least one fire event.

Studies show that areas subjected to timber harvest (less than 4 percent of the forested land on the Shoshone) have fewer snags than unharvested areas (Harris 1999, Meyer et al. 2006).

In the high-elevation forest, limited harvesting and fire suppression have not shifted snag densities outside the historic range of variability at the broad scale (Meyer et al. 2006).

Considering that most low-elevation forests on the Shoshone have not been harvested, but have been influenced by fire suppression, the larger effect of management on snags and coarse woody debris at lower elevations may be less frequent fire occurrence. Fire tends to create snags, but insect and disease epidemics can do the same. In the absence of fire (or harvesting), pathogens may become more abundant. Meyer et al. (2006) determined that the number of dead trees (snags) due to fire suppression is not yet unusually high or low, so low-elevation snag size and density is within the historic range of variability. At a smaller scale, the effects of timber harvest (including firewood gathering) may have reduced snag densities outside the range of historic variability in the portion of some watersheds. Very little aspen has been harvested—less than 1 percent—on the Shoshone. Snag density and size are thought to be within the historic ranges of variability for aspen forests.

The current insect outbreak has greatly increased snag density across the Shoshone. This increase is not reflected in the FIA data gathered in 1998. Recent reports confirm the level of bark beetle-caused mortality is increasing across the Rocky Mountains, including the Shoshone. Over the past 10 years, widespread bark beetle epidemics have occurred on the Shoshone. All major bark beetles have been in epidemic status on at least parts of the Shoshone during this time. Under current conditions, snag levels at the broad scale are within or above the range of historic variability.

Management Activity effects

Anticipated activities (prescribed fire, commercial harvest, wildland fire use, and fuelwood cutting) that have the potential for removing mature coniferous habitat may have an impact on this species.

The natural processes of insects and disease and fire would continue to be the largest source of influence on the availability of 4C and old forest stages and snags. Recent and past harvest activities have occurred on approximately 3 percent of the forested acres.

Snag removal occurs with firewood harvest. This effect typically only occurs within a few hundred feet along open roads. Where additional roads are constructed in support of harvest activities, there would be more of this type of habitat removed. However, it is also likely that due to the large expanses of habitat away from roads remaining, more than adequate snag abundance would be provided, and desirable snag abundance levels would still be ensured in project areas, even following harvest. Timber modeling indicates that regardless of alternative, the forested acres would continue to mature with an abundance of mature structural stages. Wildfires and prescribed burns would create snags by killing live trees, and mosaic patterns typically leave green recruitment trees for future snags.

With regard to effects to Forest-wide populations, it could be assumed that populations would follow the trend of the habitat as discussed above, which would largely be driven by natural disturbance processes. However, as with any wildlife species, elements of climate would have a strong influence, affecting forage and prey available, and thereby, reproduction success. Red-breasted nuthatches are relatively unaffected by human disturbance. As with other passerines, active nests could be occasionally removed through timber and firewood harvesting. However, as only a few hundred acres of commercial harvest or firewood harvest are typically active in any given breeding season, this effect is thought to be minimal and undetectable to populations, particularly at the Forest-wide scale. The Plan will implement the measures required by the Migratory Bird Executive Order 13186 by providing appropriate management direction, monitoring, and consideration of rare species.

Anticipated activities (prescribed fire, commercial harvest, and wildland fire use) in all alternatives that may change habitat are all viewed as maintaining the habitat through time as desired by the Forest-wide strategy in the Plan. Diversity in age class structure may help prevent more widespread loss of habitat, and/or create resiliency to disturbance, even though habitat may actually be reduced in the short term through disturbance activities.

The bark beetle epidemics are having substantial effects on conifer species on the Shoshone. In most cases, the insect impacts to conifer cover types are generally not changing cover types. In areas most severely hit, where most of the standing trees are killed, there is some shifting of cover types. Some spruce stands may revert to an earlier seral stage of lodgepole pine. Loss of complete stands of whitebark pine or limber pine could result in an increase of grassland cover types. In some stands, substantial reductions of conifer canopy could allow for earlier seral stages of aspen to expand. These effects are generally the same across all alternatives. Due to the small amount of suitable timberlands, there is not enough active management on the forest to change the overall trend. Alternative F does have a large amount of managed land that could influence the trend, but it is unlikely that budget levels would be adequate to allow enough treatment to reverse any ongoing trends.

Trout

Distribution, status and trend

Stream game trout were selected as the management indicator species for aquatic habitat because they are well distributed throughout the Shoshone. In addition, good stream trout population information is available throughout the Shoshone for trend indices from working cooperatively collecting population information with the WGFD. Aquatic management indicator species include Yellowstone cutthroat trout, rainbow, their hybrids, brook and brown trout.

Yellowstone cutthroat trout is a historic native trout species on the Shoshone. Subsequently, numerous game trout have been introduced into occupied and previously unoccupied stream habitats. They include Yellowstone and Snake River cutthroat, rainbow, rainbow-cutthroat hybrids, brook, and brown.

At the time of white settlement, the distribution of Yellowstone cutthroat trout included large areas of Montana, Idaho, and Wyoming. Rangewide, historical habitat for Yellowstone cutthroat trout was estimated to include about 17,720 miles of streams and 61 lakes (May et al. 2007, Gresswell 2009). In Wyoming, Yellowstone cutthroat trout historically occupied an estimated 6,710 stream miles.

Current distribution is estimated at about 7,530stream miles rangewide. As of 2006, Yellowstone cutthroat trout conservation populations occupied 7,200 miles of streams and 205 lakes (May et al. 2007). This represents 41 percent of the historical stream habitat. In Wyoming, Yellowstone cutthroat trout conservation populations (greater than75 percent pure) currently occupy 4,050 stream miles or 53 percent of the Yellowstone cutthroat trout's current range.

Historically, Yellowstone cutthroat trout had an estimated 670 miles of stream habitat on the Shoshone. Many streams were blocked from historical upstream migration due to natural barrier falls. Subsequent stocking of streams and downstream drift from upstream stocked lakes significantly increased stream fish distribution. This resulted in about 1,420 stream miles with fish currently on the Shoshone (WGFD Stream and Lake database 2011) and essentially doubled the historical miles of stream with fish on the Shoshone. From hybridization and competition with non-native fish species, Yellowstone cutthroat trout populations were significantly reduced to about 390 miles of stream for Yellowstone cutthroat trout conservation populations (greater than75 percent genetic purity) or about 59 percent of the historic, native stream miles on the Shoshone (May et al. 2007).

Species habitat condition and trend

Streams and Lakes

The Shoshone currently has about 4,150 miles of perennial streams. About 1,420 miles of stream contain fish.

Diverse stream and riparian habitats are found throughout the Forest because of different geologic, soil and vegetative types, elevation, precipitation, and climatic changes. The central two-thirds of the Shoshone (from about the Clarks Fork River to the Wind River) are located in the Absaroka volcanics. The volcanics are generally characterized as young in geologic time, have poor water absorption characteristics and unconsolidated soils, and are highly erodible. As a result, tributary streams typically have high gradients, steep slopes, and large substrate with pocket pools providing the majority of the fish-holding habitat. Riparian zones are narrow and limited. The main stem valley streams are typically braided, unstable, and often migrate laterally due to significant bed load deposition. The floodplain and riparian zones are wide and dynamic. As a result, these main stem volcanic streams naturally carry substantial amounts of heavy fine sediments, bed load material, and woody debris during major runoff events. The main stem streams tend to be shallow and wide with low pool to riffle ratios, little in stream cover and streambank vegetation at base flows. This situation results in lower fish densities per linear mile of stream compared to other geologic-driven stream habitats on the Shoshone. Where suitable pool holding habitat does exist, fish densities are higher.

The northern and southern parts of the Shoshone are generally pre-Cambrian granitics. They are much less erodible than the volcanics. As a result, streams in these areas generally have more stable and well-defined channels with wide riparian and floodplain habitats, low gradients, more deep pools, well-established bank vegetation, and lower sediment loads than the volcanic streams. Additionally, these streams are narrower and deeper with higher pool to riffle ratios and have more suitable fish-holding habitat. The northern part of the Shoshone (generally north of the Clarks Fork River) is composed of hard granitics that are highly resistant to erosion, which results in very little instream fine sediment compared to the volcanics. Biological productivity is generally low since the hard granitics are erosion-resistant and nutrient-poor. The southern part of the Shoshone (generally south of the Wind River) is primarily composed of decomposed granitics that result in higher fine sediment in the form of sand with higher nutrient loading and biological productivity than the hard granitics.

Overall, stream habitat conditions on the Shoshone are improving or remaining stable, and most are currently meeting desired conditions. Improving livestock grazing practices, improving road drainage, removing and replacing stream crossing barriers to fish passage, and implementing various stream habitat enhancement projects have all helped improve stream conditions, both on and adjacent to the Shoshone.

There are numerous lakes on the Shoshone with the majority located on the Beartooth Plateau, the Fitzpatrick Wilderness, the Popo Agie Wilderness, and adjacent areas. Currently, 311 lakes comprising about 9,074 acres support some type of fishery. Most of these lakes are found in the granitic geologic types. Granitics are not as erosive as the volcanics, tend to form rolling bench lands, and are less steep. The soil type is more porous and stores more surface water. The Absaroka volcanics have very few lakes and ponds because of steep slopes and high erosiveness, and the soil types do not absorb much surface water.

Historically, all of the high mountain lakes on the Shoshone were barren of fish because they were formed by uplifting and glacial activity. This process generally separated high mountain lakes and ponds from lowland streams, preventing upstream fish access and colonization. Many of the lakes that have suitable fish habitat have been subsequently stocked. Introduced lake game fish species include Yellowstone and Snake River cutthroat, rainbow, rainbow-cutthroat hybrids, brook trout, golden trout, lake trout, splake, and arctic grayling.

Of the 311 high mountain lakes with fish on the Shoshone, about 11 lakes are currently known to contain naturally reproducing conservation populations of Yellowstone cutthroat trout. Yellowstone cutthroat trout were originally planted since all the high mountain lakes on the Forest were presumed to be barren at the time of white settlement.

Forest-wide, some lakes are still barren with a portion of them having the potential to support a viable fishery. The WGFD staff believes all lakes within the Shoshone on the north zone with current fisheries potential have been stocked. On the south zone, the WGFD noted numerous lakes on the Shoshone with fisheries potential that have not been stocked, primarily within wilderness.

Watersheds

The condition of a watershed is defined by the biophysical characteristics and processes that affect both the soil and hydrologic functions in a watershed. The condition can range from pristine to severely impaired. The term healthy watershed is often synonymous with functioning properly, and indicates that the watershed is able to capture, store, and release water, sediment, wood, and nutrients within a range of natural variability. They create and sustain habitats that support diverse populations (USDA Forest Service 2011).

The Forest Service Manual (FSM) uses three classes to describe watershed condition and they are relative to the potential natural condition (USDA Forest Service 2004a, FSM 2521.1): Class 1 watersheds exhibit high geomorphic, hydrologic, and biotic integrity. Class 2 watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity. Class 3 watersheds exhibit low geomorphic, hydrologic, and biotic integrity. Geomorphic integrity can be defined in terms of slope stability, soil erosion, channel morphology, and other upslope, riparian, and aquatic habitat characteristics. Hydrologic integrity relates primarily to flow, sediment, and water-quality attributes. Biotic integrity is defined by the characteristics that influence the diversity and abundance of aquatic species, terrestrial vegetation, and soil productivity. In each case, integrity is evaluated in the context of the natural disturbance regime, geo-climatic setting, and other important factors within the context of a watershed (USDA Forest Service 2011).

There are 147 6th-level hydrologic unit code watersheds that are all or partially on the Shoshone, and based on the above classification. Most of these (89 percent) are considered Class 1 or functioning properly. Of those watersheds functioning properly, typically those in wilderness provide the best reference conditions or attributes of healthy watersheds. Eleven percent are considered functioning at risk, and concerns relate mostly to historic uses such as heavy grazing or roads associated with timber harvest and motorized recreation. Additional background on the watersheds classified as functioning at risk is included in appendix G of the FEIS. These watersheds are generally on an improving trend due to ongoing management actions. There are no impaired watersheds on the Shoshone. There are about 4,150 miles of perennial streams on the Shoshone. Overall, stream conditions on the Shoshone are improving or remaining stable and meeting or moving toward desired conditions.

Riparian areas

Riparian areas are places where water-dependent vegetation lives and grows on the banks of stream, lakes, and rivers and includes the water courses themselves. Wetlands, such as swamps, bogs, marshes, and wet meadows, are areas that are frequently saturated or inundated by surface water or groundwater, which is sufficient to support a variety of characteristic plant or animal communities. Wetland plant and animal communities typically require saturated or seasonally saturated soils to survive. Most riparian areas are obvious because of their unique vegetation. In drier parts of the Shoshone, ribbons of dense vegetation flank streams and rivers, in distinct contrast to the surrounding uplands and valley bottoms. For the purposes of this discussion, riparian ecosystems, wetlands, lakeside zones, springs, and floodplains will be referred to collectively as riparian ecosystems or areas.

Although riparian areas occupy only a small part of the Shoshone, they are a critical source of diversity within ecosystems. Healthy riparian areas, with an abundance of trees, shrubs and other native vegetation, slow flood waters and reduce the likelihood of downstream flooding. Riparian areas help improve water quality by filtering runoff, sediment, and nutrients from flood flows and adjacent upland slopes. Healthy riparian areas act like sponges; they absorb water readily during periods of excess precipitation. Water slowed by riparian areas enters the groundwater where it is released at a later time. Riparian areas produce stream cover and shade, which helps keep water temperatures at desired levels for fish and water-dependent animals adapted to these environments. Fish also depend on healthy riparian and stream for stable channels and habitat, sustained water supplies, clean water, food, and cover.

The conditions of riparian areas along with other attributes can be used as an indicator of ecosystem quality. To determine riparian condition, we used an integrated approach including a cross section of Forest and District resource specialists that were familiar with on the ground riparian conditions in 1999. This included fish and wildlife biologists, range conservationists, hydrologists, engineers, and recreation specialists. Available information included detailed surveys, monitoring information and/or most recent ocular observations. Using a mapping exercise, specialists used this information to determine riparian condition for individual riparian polygons that were greater than about 160 feet wide and intercepted perennial streams on NFS lands. The Proper Functioning Condition (PFC) methodology guidelines (USDI BLM 1998) were used to determine riparian condition. At that time, most riparian habitat was in proper functioning condition with a few localized areas functioning at risk or not functioning. The functioning at risk and non-functioning condition ratings were primarily due to past commercial livestock management and inadequate road design or location. Since 1999, riparian and stream habitat conditions on the Shoshone have further improved or remained stable. This was primarily due to improved commercial livestock grazing practices, better dispersal of recreational livestock at dispersed campsites, improved road drainage, correcting fish passage barriers at road crossings, and implementing various stream habitat enhancement projects. Since 1999, the range allotments addressed in those environmental assessments were reevaluated for riparian condition and updated. As a result, the most current riparian condition ratings from 2010 are included in Table 5 (USDA Forest Service 2010b). About 89 percent of the riparian acres were in proper functioning condition, about 9 percent were functioning at risk, and less than 1 percent was non-functioning.

Table 5. Shoshone National Forest riparian condition (2010)

Riparian condition	Acres	Percentage of total acres
Proper functioning condition (Good)	61,127	89
Functioning at risk (Fair)	6,221	9
Non-functioning (Poor)	192	<1
Unknown (Not sampled recently)	1,145	2
TOTAL	68,685	100

Management Activity effects

The primary risk factors from forest land management activities include improper timber harvest, livestock grazing, roads, and trails. Improper land management can increase stream sediment beyond natural levels. Streams can become wide and shallow with little instream cover. Undersized stream crossings can completely or partially block upstream fish passage. Catastrophic fires can significantly affect stream trout populations from increased sediment, removal of vegetative cover and greatly increase the potential for significant runoff events. Other natural risks include severe climatic events such as drought and floods outside the natural range of variability. Climate change has the potential to reduce summer flows in streams, increase spring runoff events, and increase summer water temperature in the long term (Rice et al. 2012). Increases in water temperature may also shift fish communities to favor non-native stream trout. Aquatic invasive species are also potential risk factors to stream trout and other fish populations.

Generally, land management actions have the most impacts immediately after the activity, with disturbance effects decreasing over time. Activities that alter the quantity, timing, and quality of water resources, permanently alter stream channel dynamics, or increase stream sediment significantly above natural levels over the long term have the greatest potential for adverse effects. Generally, the risk of adverse effects from land management activities increases the closer the disturbance is to riparian areas, streams, or wetlands. It also generally increases cumulatively the more activities there are in a drainage within a shorter timeframe. This aquatic and riparian resource analysis focuses on effects from anticipated management activities by alternative.

Factors that can lead to a decrease in riparian area and function are: improper commercial and or recreational livestock grazing, timber harvest, road development, under-sized stream crossings, water diversions, and disturbances associated with excessive recreational use. Improper past livestock grazing has been a primary factor leading to some of the degraded riparian areas on the Shoshone. Improper livestock grazing can lead to bank damage from trampling; wide, shallow stream channels; riparian plant community conversions; and excessive sedimentation beyond natural levels. On forested landscapes, some past silviculture practices, road building, and fire suppression practices have contributed to altered riparian conditions by changing flow regimes and altering channel morphology. When disturbances to the riparian area are significant, they may modify the interaction between the floodplain, water table, and the stream channel. Adverse long-term impacts to the riparian area can lead to a decrease in the function and associated habitats provided by a healthy riparian area. Long-term benefits to riparian habitat and the biota that use them occur when land management activities help create a diversity of habitats, a mix of vegetative seral stages and prevent large-scale, catastrophic fires outside the natural range of variability.

Timber Harvesting

Harvest in riparian zones can reduce streamside vegetation and overhead cover, which can increase annual and daily stream temperature fluctuations somewhat and decrease the supply of large woody material available for recruitment to streams. Timber harvest can also increase stream sediment levels over the short term. Increased stream sediment also carries increased nutrients, which can increase biological productivity over the short term. Associated timber harvest equipment can damage or compact streambanks and riparian areas. With proper implementation, administration, and compliance, timber harvest can help simulate natural processes, set back succession, and provide a diversity of vegetative habitat types over the long term alone or in conjunction with prescribed fire, where appropriate.

Roads and Trails Management

The Shoshone contains a variety of roads and trails with various levels of condition and maintenance. Roads and trails that are not disconnected from stream systems can be a chronic source of increased sediment (Winters et al. 2004). Some streams have adjacent roads or trails where significant erosion can deliver sediment directly into the stream. Excessive sediment can fill pools and change channel morphology, reducing habitat for fish, and plug the interstitial spaces of the streambed, suffocating fry and invertebrates and/or reducing habitat for invertebrates and spawning and rearing fish. Unlike many other disturbances that increase erosion, sedimentation from travelways tends to be chronic and to last as long as the travelways exist, which can create long-term impacts to aquatic habitat unless corrected. Roads, trails, and associated human travel also can cause reduction, disturbance, and interruption of riparian habitat. Accordingly, numerous fish and wildlife species associated with riparian areas can be adversely affected by excessive road-related sediment.

Undersized stream crossings, especially culverts can restrict the channel, create downstream drops at the outlet, and flush out existing substrate within the culvert, resulting in complete or partial barriers to upstream aquatic and terrestrial organism passage. Undersized culverts also increase the chances of flood damage, maintenance or replacement costs.

Fires and Fuels management

Wildfire within the natural range of variability generally creates a mosaic of habitat types, sets back vegetative succession, and creates vegetative diversity in and around riparian areas. These processes also release sediments and nutrients into streams, which also increases biological productivity.

Wildfires significantly outside the natural range of variability can burn large landscapes very hot in some areas damaging soils and releasing significant amounts of sediment into streams, well above natural conditions. This can result in significant adverse effects to aquatic resources from erosion, excessive stream sedimentation, and extensive vegetative removal that can take a long period of time for recovery.

Fire suppression efforts can considerably increase erosion potential and delivery of sediment to streams from fire lines constructed by heavy equipment or by hand, if installed improperly. Fire suppression activities are typically conducted to minimize impacts to riparian areas by restricting the use of dozer lines and retardant in riparian areas. When retardant is allowed to reach water sources, aquatic biota may be impacted as a result from diminished water chemistry and quality. Potentially undesirable aquatic invasive species may also be transferred from one water source to another, from the use of the various types of fire suppression equipment that transport water and fine sediments where most aquatic invasive species are found.

Livestock Grazing and Big Game

Excessive ungulate grazing can have detrimental effects on aquatic resources, particularly in areas where livestock tend to concentrate, such as riparian areas for watering, feeding, and loafing. With proper grazing, management impacts to riparian areas can be compatible with maintaining desired conditions.

Improper livestock management and wild ungulate grazing can reduce streambank stability through vegetation removal, streambank trampling, and shearing. Livestock and other ungulates can compact soil or destabilize streambanks by direct hoof action, causing increased sediment, stream widening or down-cutting of stream channels, and often change riparian vegetation types, resulting in insufficient habitat for fish. Stream widening and sedimentation can reduce instream cover and habitat quality for fish though mechanisms similar to those described for vegetation removal through timber harvest or fire, but grazing impacts can be compounded by repeated annual livestock use of the same areas. Stream down-cutting often causes the water table to drop, which results in less riparian habitat and a vegetative type change. Down-cutting also leads to channel straightening and reduced stream sinuosity, which also reduces habitat for aquatic biota.

Recreation

Most summer developed and dispersed recreation sites are located near streams, lakes, or valley bottoms. The potential influence of developed and dispersed recreation sites on aquatic resources varies across the Shoshone. Some sites are located in riparian habitats, and so corresponding influences would be anticipated there. Recreation impacts to water resources on the Shoshone are generally related to streamside recreation use including roads and trails, camping, water-based recreation, and indirect potential effects from upland recreation activities. Motorized off-road non-winter recreation travel can cause riparian area degradation and adverse water quality impacts. Horse, bike, and foot traffic generally have less impact, but can cause localized effects, especially where trails parallel or cross streams. Lakes and streams, especially those with fish that attract anglers or provide good hunting opportunities in the area, can receive significant impacts from recreational livestock and foot traffic if not managed properly. Streamside areas are often chosen for dispersed campsites and recreational livestock use. Summer dispersed campsite use can damage riparian vegetation, cause soil compaction in riparian zones, erode streambanks, and cause increased nutrient loading and pathogen levels due to human waste contaminating streams and lakes. Recreational and commercial livestock can reduce water quality through bacterial input, nitrate pollution, and fine sediment from erosion if not managed properly.

Fishing is an activity that occurs on the Shoshone. Access to streams, lakes, and reservoirs provides a variety of angling opportunities in locales that range from easily accessible developed sites to remote subalpine wilderness areas. Fishing and associated equipment can contribute to the propagation and distribution of aquatic invasive species, which can damage aquatic biota and disrupt aquatic ecosystems. Recreational fishing may adversely affect existing populations of Yellowstone cutthroat trout, and aquatic management indicator species on the Shoshone, because increased recreational fishing pressure generally results in increased harvest and incidental fishing mortality, although this can be addressed through fishing regulation changes and stocking strategies.

Generally, over-the-snow winter motorized recreational uses do not significantly impact aquatic resources because the streams and lakes and adjacent habitats are snow and/or ice covered. Damage to vegetation and soil erosion can occur if snowpack is not adequate to protect these resources. Winter motorized activities can also compact the snow, forming barriers that may alter spring runoff patterns, which can result in soil erosion and gullies in certain situations.

Water contamination from human waste and petroleum products, such as motor oil and gasoline, can degrade water quality in waters adjacent to areas of concentrated use such as parking lots and snowmobile staging areas. The likelihood and magnitude of impacts from these activities depend on site-specific factors such as average slope, aspect, elevation, vegetation, weather conditions, available facilities, and amount of use. In very high-use, concentrated winter motorized use areas such as Yellowstone Park others have found adverse effects to water quality and aquatic biota. Because the Shoshone generally has much less use, site conditions vary, and these sites are relatively small in area and widely dispersed, it is reasonable to assume that cumulative impacts will be minimal at the Forest scale.

Developed winter recreation sites may adversely affect aquatic and riparian resources. Downhill ski areas include Sleeping Giant near Pahaska and the Red Lodge Race Camp on the Beartooth Plateau. Cross-country ski trails include the Park County Nordic Ski Association Trails at Pahaska, and Beaver and Willow Creek cross-country ski trails near Lander. They are permitted to operate on the Shoshone. Downhill ski area development can lead to increased runoff and erosion through timber clearing for lifts, runs, trails, and other facilities. Snowmelt runoff is increased, especially when cleared areas are compacted through grooming or where snow making has artificially increased the snow depth. Sleeping Giant uses water from the North Fork Shoshone River for making snow early in the ski season. The amount of water used is minimal and the intake is screened to prevent fish entrainment. As a result, this operation has no measurable effect on sensitive fish and aquatic management indicator species. Downhill ski areas and snow resorts also typically disturb soils throughout cleared areas. Erosion and sediment can result, especially from soils that are near streams, unstable, or highly erodible. In addition, these uses can also degrade wetlands and riparian areas by draining or filling them, or by altering their vegetation.

The Red Lodge Race Camp is located in high alpine above tree line. The operation is run in the late spring and early summer using existing snowpack. As a result, impacts to aquatic resources are minimal.

Existing downhill and cross-country ski areas on the Shoshone will continue to be permitted. These are small enough that there are minimal impacts to aquatic resources from their use. Any future expansions would be designed to mitigate effects to aquatic resources with appropriate project design features.

Mineral and Energy Development:

The largest current activity associated with mining on the Shoshone, is limited to exploitation of mineral materials for road construction purposes or individual permits for landscaping use off-Forest. Gravel pits are generally located in areas with minimal impacts to aquatic resources. Existing mining operations, for locatable minerals, in the Shoshone are typically small and limited in number. Increases in mining activity are not anticipated for the future. Mining effects could include land disturbances and processing activities that may affect surface and groundwater quality, water quantity, and timing of release.

The possibility of oil and gas development in the planning period is predicted to be low or very low. Potential adverse effects would be from improper roading, land disturbance, effects to ground water and potential for spills.

Monitoring

The following are items in the Forest Plan Monitoring Strategy that are tied to Management indicator species (see Forest Plan Chap 3)

Monitoring driver	Monitoring questions	Monitoring priority	Monitoring indicators	Frequency of reporting
Maintain or improve habitat capable of supporting the viability of	■What are the habitat conditions and trends for management indicator species?	High	■Habitat condition and trends	5 years

wildlife and fish management indicator species	■What are the estimates of population trends for management indicator species?	High	■Population trend estimates	5 years