Preliminary Assessment of Cumulative Impacts of Human Activities on Riparian/Riverine Habitat & Associated Wildlife

in the Greys River District, Bridger-Teton National Forest

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INTRODUCTION

The *Greys River Landscape Scale Assessment* noted that "Most riparian/wetland communities in the analysis area have been modified by human activity. Due to the presence of water, cool temperatures and accessible terrain, riparian areas throughout the Greys River drainage are intensively used for human activity. Impacts have resulted from the development of roads and trails, recreation uses such as fishing, camping, wildlife viewing, hunting and commodity uses such as trapping, timber harvest, ranching, gold mining and the collection of unique plants for food, fiber, and medicinal uses" (USFS 2003:89). In an assessment of the effects of land-use practices on riparian ecosystems, Krueper (1992:324) stated that "If riparian values are to be for future generations, management must exercise practices considered in terms of cumulative effects on biological and physical systems (Zube and Simcox 1987). Doppelt et al. (1993) also stressed the importance of assessing effects on riverine systems cumulatively, "slow death by a thousand wounds" as they put it.

Use of riparian areas in the Greys River Ranger District continues to increase and, correspondingly, impacts to riparian functioning, wildlife habitat, and wildlife will continue to increase. On the other hand, riparian areas on the district and other federal lands will play an increasingly important role in wildlife conservation in coming years as riparian habitat on private lands in Star Valley and surrounding basins are impacted by the high rate of urbanization and by other activities. Human use of riparian areas and development/modification of facilities on the district can no longer be analyzed separate and apart from the many other sources of impacts to these highly important and sensitive areas. While any given activity or facility may not have significant impacts on riparian functioning, habitat, and wildlife, the culmination of impacts from the full range of uses has the potential to significantly affect riparian ecology on the district. Because of the large number of potential sources of impacts and because only a small minority of these have been studied on the district and Bridger-Teton National Forest (BTNF), an analysis of cumulative effects must be informed by resource management principles and scientific/technical information. This report provides a start to a needed comprehensive analysis.

Purposes of this Report

This report is a preliminary assessment and is by no means meant to be the last word on cumulative effects of facilities and human activities on riparian/riverine habitat and associated wildlife in the Greys River Ranger District. In recognition that quality management decisions must be based on more than site-specific information and professional judgment, the purposes of this report are to:

- Highlight the many ways in which wildlife habitat and wildlife in riparian areas are being affected, or have the potential to be affected, by human activities and facilities.
- Provide enough documentation of potential consequences of seemingly benign[1] activities or effects to determine their potential for cumulatively affecting riparian/riverine habitat and wildlife.

[1] There are four aspects of "seemingly benign" or seemingly inconsequential effects needing explanation. First, not all plant and wildlife species are of interest to all people. Effects on some species may be seen as immaterial to some people, but the Forest Service is responsible for the conservation of all native species (particularly, the habitat necessary to sustain these species). Second, some changes that have happened over several decades, either to habitat or wildlife populations, may have gone unnoticed by many people, especially in regard to vegetation and wildlife not

- Make a preliminary assessment of the magnitude of the cumulative effects of human activities and facilities on riparian/riverine habitat and associated wildlife in the Greys River District.
- Identify hypotheses to be addressed through additional data collection and/or reviews of scientific/technical information.
- Provide documentation of known, probable, and potential sources of impacts for future planning efforts (e.g., travel planning) and associated National Environmental Policy Act (NEPA) analyses.

Overview of the Report

The forthcoming information (1) highlights the importance of riparian areas to wildlife and biological diversity, (2) shows that the effects on wildlife and habitat along the major and other riparian corridors of the Greys River District are pervasive, and (3) illustrates that there is reason to be concerned about the cumulative nature of the effects, particularly given the propensity for impacts to continue increasing.

The scope of this report is limited to an assessment of the impacts of human activities on wildlife and wildlife habitat. No attempt is made to identify the many benefits of allowing human activities or to portray the legal requirement to provide opportunities for multiple uses. For example, while the road system on the district is likely the source of the majority of cumulative impacts on wildlife and wildlife habitat, the road system supports recreation, livestock grazing, timber harvest, and harvest of other forest products, all of which are central to the mission of the Forest Service. While the report addresses both positive and negative effects of human activities and associated facilities (e.g., roads), there are few positive effects of human activity and facilities. An exception: indirect positive effect of providing opportunities for recreation, livestock grazing, and forest-product harvesting is continued support for the National Forest System which is highly important to sustaining wildlife habitat. However, because this positive effect does not take place on-the-ground, it is not addressed further in this report.

IMPORTANCE OF RIPARIAN AREAS TO WILDLIFE AND BIOLOGICAL DIVERSITY

Although riparian zones in the intermountain West typically comprise two percent or less of the landscape, riparian zones along with aspen stands typically encompass a majority of the biological diversity and they provide for many of the needs of wildlife in an area (Chaney et al. 1990, Bock et al. 1993, Federal Interagency Stream Restoration Working Group 1998). Kreuper (1992) estimated that riparian habitat is critical for up to 80% of terrestrial vertebrate species. Of all types of habitats in the southern Greater Yellowstone ecosystem, ecologically intact and healthy riparian areas and aspen stands sustain the most biologically diverse wildlife communities (Dobkin et al. 2002, Wyoming Partners in Flight 2003). Seventy-six species of birds are closely associated with cottonwood, willow, or aspen dominated woodlands in this area (Dobkin et al. 2002). Wyoming Partners in Flight (2003:52) highlighted the importance of riparian areas for birds, and captured

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of interest to these people. Third, some effects may in-and-of-themselves have little effect on habitat composition/structure or animal populations, but together with other effects could result in additive or synergistic effects. Fourth, resource professionals have not yet examined some of the effects that may be impacting wildlife and their habitat in riparian areas. In many cases, because we haven't looked we haven't seen. One of the purposes of this report, therefore, is to draw out some of the impacts found in other areas and to set the stage for assessing whether they apply on the Greys River Ranger District.

this importance in stating that "The best way to help the largest number of birds in Wyoming is to maintain or improve the condition of vegetation in riparian areas..." Dobkin et al. (2002) highlighted two characteristics important for sustaining riparian and aspen habitat for bird communities: light ungulate grazing (as opposed to heavy grazing pressure) and a moderate fire-return interval (e.g., 50-100 years).

PERVASIVENESS OF CUMULATIVE IMPACTS ALONG RIVERS AND STREAMS

While the Greys River District is nearly ½-million acres, the vast majority of human activity is concentrated in an estimated 1-2% of the district, and it is this area that accounts for almost all of the riparian/riverine habitat associated with rivers and major streams (probably greater than 75% of the riparian/riverine habitat in the district occurs within this concentration area). It is this zone where (1) where roads and major motorized trails were constructed or developed, (2) the vast majority of motorized vehicle activity occurs, (3) a large majority of camping occurs, (4) many of the cabins and other structures were built, (5) all boating and most of the fishing occurs, (6) cattle grazing is concentrated, (7) a substantial portion of noxious weed problems (and spraying) occur, and (8) reservoirs have disrupted riparian/riverine functioning. Thomas et al. (1979c) stated that "Recreational use of the riparian zone is many times that of other habitats (North Central Forest Experiment Station 1977)."

The Greys River Road parallels the Greys River its entire 50-mile length. DFC Class 3 on the Greys River District is bisected by the Greys River and the Greys River Road. The existing road density exceeds the road management standard in the Forest Plan (About 1.75 miles of road/square mile of habitat vs. the standard of 1 mile/1 square mile). And this does not include the many miles of authorized and illegal (user-created) motorized trails that exist in DFC Class 3, and which reduce habitat effectiveness to a similar degree as roads used by motorized vehicles. The distance from the Greys River Road to the nearest bank of the main channel ranges from 0 to 1/4 mile (less than 500 feet for most the length). Even in places where the river is further from the road, the elevated road is in most situations within eyesight of the river (i.e., minimal obstructions between the river and road). The distance between the road and riparian zone is typically far less than identified above. Furthermore, the Greys River Road, side roads, and bridges have markedly reduced the amount of riparian habitat along some stretches.

Roads parallel most of the major streams for most or all of their length (e.g., Little Greys River and Murphy, Deadman, Blind Bull, Sheep, Bear, Cabin, Three Forks, Strawberry, Willow, Swift, Dry, and Cottonwood Creeks. Through most of the length of these roads, they are within several hundred feet of the creeks, are totally within or encroach into riparian zones, and it is not uncommon for road banks to second as creek banks. In many situations, cross-sections would reveal that road beds occupy a substantial part of the riparian zone. There are few places where activity along the road does not have potential to disturb wildlife. There are several campgrounds and some creeks have numerous dispersed camping areas near their banks. Many other creeks are paralleled by trails, an increasing number of which are being used by ATVs and motorbikes, and most are within livestock grazing allotments. Activities along these roads and trails and at camping areas include vehicle travel on roads, off-highway vehicle travel, camping, fishing, and kayaking/boating/floating (in certain sections). Dogs occur in campgrounds; accompany people traveling by ATV, foot, and horseback; and likely periodically run loose in canyons and other areas along the Star Valley front.

All campgrounds along the Greys River are adjacent to the river and dozens of dispersed camp sites exist along the river. Many campers bring ATVs and motorbikes, which some campers use at the camp sites and along roads. Kayaking primarily occurs on the lower 10 miles of the river, but kayaking, canoeing, rafting, and floating occur throughout most of the river's length. Boating on the river is increasing in popularity. Fishing occurs throughout the length of the river and the density of anglers is increasing. Cattle grazing occurs from early June through mid October each summer along the Greys River in the Big Greys allotment. While impacts from livestock grazing in most areas are small, livestock grazing and the presence of livestock cumulatively impact wildlife and wildlife habitat along the river.

Nearly 60 years ago, Aldo Leopold spoke about problems he saw with more and more people going further and further into the backcountry. While his focus was on the effects of mechanized recreation on the outdoor experience, his characterization equally applies to the increasing pervasiveness of mechanization's effects on the health of native biotic communities:

> *...in the days of the elder Roosevelt... It began to be noticed that the greater the exodus* [of people to the countryside]*, the smaller the per-capita ration of peace, solitude, wildlife, and scenery, and the longer the migration to reach them. The automobile has spread this once mild and local predicament to the outermost limit of good roads—it has made scarce in the hinterlands something once abundant on the back forty... Like ions shot from the sun, the week-enders radiate from every town, generating heat and friction as they go... Advertisements on rock and rill confide to all and sundry the whereabouts of new retreats, landscapes, hunting-grounds, and fishing-lakes just beyond those recently overrun. Bureaus build roads into new hinterlands, then buy more hinterlands to absorb the exodus accelerated by the roads... recreation has become a self-destructive process of seeking but never quite finding..."* Leopold (1949:165)

I included this quote to exemplify the situation facing wildlife and wildlife habitat face on the Greys River Ranger District. As recent as about 30 years ago, access by vehicle was still fairly limited due to relatively few roads and poor road conditions (Gruell 1975). Motorized vehicles are no longer limited by "good" roads, as four-wheel drive trucks and SUVs have become standard family vehicles thereby greatly broadening what is meant by a good road. Furthermore, family trucks and trailers carry people and ATVs to the furthest reaches of "good" roads and ATVs then carry people up motorized trails and some go off-road, creating more trails. People on ATVs coming after them want to do their own exploring... and so the tentacles of motorized recreation reaches further and further into former hinterlands, never retracting but always expanding. ATVs and other motorized vehicles have thereby accelerated the rate at which this form of recreation is destructive to wildlife and wildlife habitat (e.g., part of the very experience some ATVers seek).

CUMULATIVE EFFECTS OF FACILITIES AND HUMAN ACTIVITIES ON WILDLIFE

While the riparian/riverine zones being affected by facilities and human activities in the Greys River District only account for an estimated 1-2% of the district, they encompass the most biologically diverse communities (aspen communities are a close second) and they are one of the most sensitive habitat types to disturbance and disruption. Despite the limited acreage of riparian areas, the majority of wildlife species depend on these areas for at least one stage of their natural history.

Narrow habitat zone
Highest zone of biodiversity on district
High sensitivity to disturbance
+ Concentrated (and increasing) human activity
= Major Concern

While the combined effects of facilities and human activities in riparian/riverine zones on the district cumulatively impact riparian/riverine habitats and associated wildlife, each of the major impacts are treated individually below. Knight and Cole (1995) recommended that recreational activities not be considered in isolation and that there could be unanticipated synergistic effects when more than one recreational activity occurs simultaneously — this reasoning can be extended to the effects of all human activities and the facilities that support them.

Human activities are obviously not the only factors that affect the biological diversity and functioning of riparian/riverine habitat. Elevation, surrounding topography, size of watershed, soils and history of soil development, plant communities, geomorphological processes, climate, annual variability in precipitation, erosion and deposition, wildlife herbivory, and beavers, among other factors, affect biological diversity and functioning of riparian/riverine systems (Federal Interagency Stream Restoration Working Group 1998, USFS 2004). Natural events and conditions known to affect riparian/riverine functioning in the Greys River drainage include landslides, channel movements, streambank vegetation, floods and periods of lower-than-average precipitation, avalanches, fire, and beaver dams (USFS 2004). A native wildlife community of a given area by definition is one that evolved to occupy the habitats — including variability in habitats over time — shaped by geo-physical, climatic, and biological processes of the area (Noss and Cooperrider 1994, Hunter 1996). Therefore, the very processes that naturally shaped and that still influence habitat conditions — including seasonal and annual variability in habitat conditions — cannot be said to negatively impact native wildlife communities as a whole, despite recognized periodic declines in habitat conditions for particular species and guilds. However, it is possible that the culmination of human activities has shifted the functioning of some riparian/riverine systems to the point that some natural processes (e.g., floods, lower-than-average precipitation) may further degrade the health and functioning of some parts of the systems. For example, a highly altered system (e.g., one with unstable banks and a lowered water table) may be prone to (1) further streambank and channel erosion during annual peak flows, and (2) infestation by nonnative invasive plant species, which could be made worse by lower-than-average precipitation.

Public Support

Providing opportunities for people to recreate, harvest resources, and graze livestock on the district contributes to the long term sustainability of wildlife and wildlife habitat on the district by fostering public support for National Forest System lands and their conservation. While the importance of this benefit cannot be overstated, it is difficult to assess cumulatively with the more direct effects addressed in more detail in this report. This report focuses on on-the-ground effects of activities and facilities.

Factors that have Reduced the Amount and Quality of Wildlife Habitat

Roads, Trails, Campsites, Off-Road Vehicle Use, and Other Recreation

The presence of roads, trails, culverts/bridges, parking sites, campgrounds, and dispersed camping areas in the Greys River corridor and along other streams has reduced the amount and quality of habitat available to wildlife that rely on riparian/riverine habitat and have contributed to the alteration of riparian/riverine functioning, which further reduces habitat quality. Future increases in user-created trails, the use of closed roads, and the number and extent of dispersed camp sites in riparian/riverine zones will continue to further reduce the amount of available habitat. Doppelt et al. (1993) identified roads as one of the largest causes of impacts to riparian/riverine ecosystems. The central factor for nearly all problems affecting riparian bird communities, identified by Wyoming Partners in Flight (2003:50), was increased road intrusion and the more focused use by all user groups due to the more extensive road systems. They highlighted adverse effects of access for people, recreation, outfitting/guiding, hikers, horseback riding, and off-road vehicles as culprits. Wyoming Partners in Flight (2003) referenced a study that found, of 106 nonconsumptive uses evaluated, 73% negatively affected wildlife. Krueper (1992) identified the pursuit of recreational activities in riparian areas as having a significant influence on riparian ecosystems and the birds that inhabit them. Hoover et al. (1985, as cited by Krueper 1992:324) "...found recreational visitors preferred environmental conditions which closely matched features which are found in healthy riparian ecoystems... As human populations increase in the West, riparian areas will continue to be affected..."

Direct Loss of Habitat

Loss of habitat acreage due to road construction results from placement of material on top of vegetation to build road surfaces; habitat loss due to creation of two-track and wider roads and trails results from the compaction and elimination of vegetation in the tracks (Cole and Landres 1995, Douglass et al. 1999, Maxell and Hokit 1999, Patla 2000, Forman et al. 2003). Where road bases have been built up, the width of habitat loss is greater. Small mammals and birds associated with dense herbaceous vegetation undoubtedly may be adversely impacted within and in the immediate vicinity of campgrounds and dispersed camping areas located within riparian zones since vegetation is smashed down, grazed (by horses), or nonexistent in heavily used areas (see also effects under Livestock Grazing). Thomas et al. (1979c) noted that camping areas in riparian zones reduces the amount of habitat due to loss of vegetation, trampling, and soil compaction.

Loss of Connectivity (Reduced Access to Habitat)

Forman et al. (2003:129-133, 226-230) described several ways that habitat connectivity is reduced or impacted by roads. For example, roads can be barriers to the movement of small mammals, amphibians, and other wildlife by restricting or preventing movement up and down riparian corridors, between riverine/wetland habitat and riparian habitat, between riparian/riverine habitat and upland habitat, and between wetland complexes within a riparian zone. Forman et al. (2003), Hickman et al. (1999), and Maxell and Hokit (1999) cited several studies showing that narrow roads and motorized trails (e.g. less than 10-feet wide) can restrict movements of some species of small mammals, amphibians, and insects. By acting as barriers to animal movements, roads reduce the amount of habitat available to some species, thereby shrinking available habitat more than the road base destroyed. There are numerous examples of primary roads and culverts on the district bisecting riparian habitat, creating divisions between riverine and riparian habitat and between riparian and upland habitat, and restricting movement of fish up and down stream channels. Culverts can restrict or prevent movement of fish up and down streams (Forman et al. 2003),

which in turn can affect the distribution and abundance of wildlife species that prey on fish or are eaten by them. Some of the culverts installed in the Greys River District have been found to restrict fish movements, which in turn affects breeding and other elements of fish ecology (USFS 2003, USFS 2004).

Reduced Habitat Quality (Terrestrial Habitat)

Forman et al. (2003:226-249) described a variety of ways in which roads can alter ecological interactions of riverine/wetland habitat with riparian habitat and ecological interactions of riparian/riverine systems with upland habitat, and they cited several supporting studies. Many of the changes stem from changes in surface and subsurface water flow patterns. Roads, especially those that have been elevated, can alter hydrologic processes to the point that wetlands and portions of riparian zones are lost. While losses may only constitute small acreages, but losses may constitute significant losses due to the already limited extent of riparian and wetland habitats on the district. Culverts and bridges can also alter floodplain dynamics. Dust and contaminants from vehicles can adversely affect vegetation along roads. The effects roads and trails have on the interactions of riverine habitat with riparian zones and on the interactions of riparian/riverine habitat with upland habitat has not been studied to any large extent.

Recreation activities along rivers and streams can trample streambank vegetation, which can destabilize streambanks and, along with livestock grazing, contribute to streambank erosion, downcut streambanks, and lowered water tables (Federal Interagency Stream Restoration Working Group 1998, Douglass et al. 1999). Waller et al. (1999) asserted that recreation activities that induce or accelerate bank erosion may impact beavers through changes in woody shoreline vegetation, which has the potential to limit recovery of beavers, thereby furthering some of the impacts originally caused by over-trapping of beavers.

Off-road and off-trail use of ATVs and other motor vehicles in riparian zones (which is illegal if not associated with camping or firewood collection) are contributing to reduced habitat quality; Douglass et al. (1999) provides extensive documentation of off-road vehicle impacts on vegetation and soils. Also, Meyer (2002) documented how two-track trails in wet areas become braided as riders incrementally pioneer new trails around muddy areas only to have the newly pioneered trails become muddy, prompting riders to create even more trails. Braiding of trails in wet areas occurs in many riparian areas and it contributes to further loss of vegetation in these limited and sensitive habitats.

While snowmobiling may seem innocuous to vegetation, a growing amount of research from other areas highly suggests that snowmobiling (off road) in riparian/riverine zones has the potential to be altering vegetation composition. Even low levels of snowmobiling can affect the survival of individual plants underneath snowmobile tracks and higher levels of snowmobile activity can have more serious effects on vegetation on woody-vegetation (e.g., willow, riparian scrub, mountain shrub), early seral forests, and southerly-facing slopes (Douglass et al. 1999, Stangl 1999; see also Boyle and Samson 1985, cited in Hickman et al. 1999). Impacts on forest vegetation have implications to riparian zones in the Greys River District because riparian zones provide the primary corridors of travel and because several forested and willow communities exist within riparian zones. Waller et al. (1999) cited a study that found significant changes to wetland vegetation composition. Furthermore, future vegetation treatments in and near riparian areas will result in removal of large trees and establishment of saplings which are particularly vulnerable to being damaged by snowmobile activity (Cole and Landres 1995, Douglass et al. 1999, Stangl

1999). It is hoped that acreage of treated habitat will increase over the years, but with increasing amount of snowmobile activity comes increased potential for conflicts. This issue in no way precludes snowmobile use; it only reinforces the need to appropriately manage snowmobile activity in areas where avoidance of damage is warranted.

Snowmobiling has also been shown to change the “subnivian environment” (microclimate provided by snowcover), which is important to the overwinter survival of many species (Hickman et al. 1999). Hickman et al. (1999) cited several studies demonstrating that snow compaction can inhibit small mammal movement under the snow, including creation of barriers, and can subject them to greater temperature stress, and that this can lead to higher levels of mortality. Riparian zones in the Greys River District provide travel corridors for snowmobilers and in some situations snow compaction across riparian corridors can be extensive, providing a large potential for impacts to occur. Any reductions in abundance of small mammals can potentially translate into effects during other times of the year (e.g., reduced diversity, reduced prey base for birds of prey).

Vehicles, horseback riders, hikers, and dogs also have the potential to contribute to the spread of noxious weeds, which can further impact habitat (see the Noxious Weed section, below).

Soil Erosion, Sedimentation, and Water Quality (Impacts to Aquatic Habitat)

Roads and trails also indirectly affect wildlife habitat in the watershed by increasing soil erosion, redirecting or blocking water flows, and gullying (Thomas et al. 1979c, Cole and Landres 1995, Douglass 1999, Meyer 2002, Forman et al. 2003). Satterlund and Adams (1992:325-326) contended that the potential impact of roads and trails "upon erosion and sediment often exceeds that of all other activities combined, especially in forests managed for timber," adding that "...the problems developed by off-road vehicle (ORV) users have grown explosively. In many wildland areas they have become a major source of watershed deterioration." Some of the user-created trails on the district run straight uphill near riverine and other wetland habitat, which likely contribute substantial amounts of sediment in localized areas during heavy rainstorms and during snowmelt. Road and trail design can offset some of the impacts, as compared to poorly designed roads and trails. Satterlund and Adams (1992:327) cited an example in which systematic planning of roads in a steep, forested basin in Oregon reduced road mileage by 11% and steep grades by 73%, as compared to when they were originally designed piecemeal to meet only current timber harvest needs.

Increased sedimentation in streams, rivers, and wetlands due to soil erosion from roads/trails and increased turbidity due to roads and trails crossing through springs, seeps, and other wet areas may adverse impact amphibians in limited areas of the watershed (Gomez 1994, Patla 2000). Sedimentation and turbidity can also affect fish and aquatic insects, which in turn can affect other wildlife species that feed on them (Forman et al. 2003). Management of soil in areas used by motor vehicles requires intensive on-site management to adequately mitigate impacts to soil (Douglass 1999, USFS 1990).

On slopes where snowmobiling exposes the soil, which is likely increasing with rising numbers of snowmobilers using the area and the increasing number of people "high-lining" on steep slopes, damage to vegetation and increased erosion may result, which in turn can impact riparian/riverine habitat (Cole and Landres 1995, Douglass et al. 1999, Stangl 1999). Noxious weeds and livestock grazing can also increase soil erosion by increasing the amount of bare ground (Miller et al. 1994, Westbrooks 1998, Snyder et al. 1999), thereby contributing to sedimentation.

Roads, motorized trails, and associated motor-vehicle use can also reduce water quality by introducing contaminants from vehicles, including organic compounds like gas, coolants, hydraulic fluids, oil, and other lubricants; heavy metals from vehicle wear, combustion products, abrasives in brakes, catalytic converters, and uncombusted fuel additives; and rubber from tire wear (Forman et al. 2003). Sources of these contaminants include not only standard vehicles, but also ATVs, motorbikes, and snowmobiles. Magnesium chloride is applied periodically to the Greys River Road. Dust, comprised both of naturally occurring and contaminants listed above, also makes it into aquatic systems. Herbicides sprayed on noxious weeds in and near riparian areas should not be ignored as a contaminant source. While seemingly non-significant compared to inputs along major highways and interstates, contaminants add to the cumulative impacts in riparian/riverine corridors. The types of contaminants addressed in this paragraph have been found to accumulate in food webs (Forman et al. 2003).

Thomas et al. (1979c) and Doppelt (1993) identified human waste as a contributing factor to reduced water quality. Given the large concentrations of people in some dispersed camp sites along the Greys River, Little Greys River, and numerous other streams on the district, this is likely a water quality issue but the extent of the contribution is unknown.

Conveyance System

Beyond impacts of roads and trails to habitat in the immediate vicinity of the roads and trails, roads and trails provide a conveyance system that effectively spreads impacts to areas further into the district. The extent to which this occurs is influenced primarily by the type/class of road and trail and the demand that exists for use of them. This element of 'road ecology' tends to get overlooked, but it is critical in designing roads/trails and evaluating them for possible alterations or elimination. Upgrades of the Greys River Road during the last several decades provides a prime example of this. When the road was narrow, winding, and rough, access into the middle and upper portions of the drainage was limited and the need for spur roads and trails and potential for off-road travel was much less than exists today with the extensive road improvements that occurred in the late 1990s. Upgrades to the road caused a substantial increase in public use in middle and upper portions of the Greys River drainage, which has further altered habitat in riparian areas.

Strictly from the standpoint of wildlife and wildlife habitat, the roads and trail system on the district acts as an arterial system that conveys vehicles, people, dogs, horses, livestock, noxious weed seeds, and diseases deeper-and-deeper into the recesses of wildlife habitat. As a general rule, the higher the quality and the more extensive the road and trail system, the greater the impacts will be on wildlife and wildlife habitat.

Public Access along Boundary

Public access is an issue related to those described above in this section ("Roads, Trails, Campsites, Off-Road Vehicle Use, and Other Recreation"). Additional public access is being sought along the Star Valley Front in order to better facilitate recreation on the Greys River District. While public access is limited on the front and increased access would benefit residents of Star Valley, increasing access along the front needs to be done in consideration of potential impacts on wildlife, wildlife habitat, and watershed functioning. Nearly all or all of the potential access points would likely be in valley bottoms (as opposed to side hills or ridge-tops). In other words, additional access points to the district would focus more use in riparian habitat which are already inundated with roads, trails, and other facilities. Access would likely result in the

establishment of trails or roads that would travel through or adjacent to riparian zones. The impacts of this are described extensively in the previous section and other sections on the following pages.

Use of Road System to Mitigate Impacts

The existing road system provides access that allows vegetation to be managed in ways that mitigate effects caused or facilitated by the road system, the long history of fire suppression, and livestock grazing. Restated, the road system that has fostered adverse impacts to wildlife and wildlife habitat is now important for supporting mitigation measures to offset these adverse impacts (e.g., prescribed burning, weed control, fuels management, timber harvest).

Forest plan revisions (including possible changes to designated roadless areas) and travel management planning present opportunities to revisit the balancing of (1) providing recreation and commercial-harvest opportunities and (2) providing healthy, functioning riparian habitat for wildlife. Depending on the outcome, including forthcoming management based on plan direction, ecological conditions in riparian/riverine habitat could improve or decline on the district in coming years.

Livestock and Livestock Herbivory

Livestock grazing has been a major contributing factor to significantly altered composition and structure of riparian areas throughout the intermountain West (Thomas et al. 1979a, Platts 1989, Elmore and Kauffman 1994, Kie et al. 1994, Dobkin et al. 1998, Federal Interagency Stream Restoration Working Group 1998). Elmore and Kauffman (1994) characterized livestock grazing as the second (chronologically after the severe overtrapping of beaver), and perhaps most influential, human perturbation of western riparian ecosystems. Records from the early 1900s indicate that an average of 1,500 cattle and 345,000 sheep either grazed in or were trailed through the Greys River watershed each summer, which resulted in excessive grazing in some locations (USFS 2004). The use of stock driveways that were used through the late 1960s and early 1970s likely altered vegetation composition and structure in some riparian zones. Recent trends in ecological condition in riparian corridors suggest that the existing cattle grazing program is being managed in a way that is allowing recovery of riparian/riverine systems (District files).

Cattle grazing in riparian zones can reduce the vigor of native vegetation along streambanks (Pond 1961, Knopf and Cannon 1982, Skovlin 1984, Kovalchik and Elmore 1991). When plant vigor of streambank vegetation is consistently reduced, it begins to be replaced by vegetation more resistant to grazing pressure (Pond 1961, Kovalchik and Elmore 1991) and by noxious weeds. This appears to have happened (historically) in some riparian zones in the Greys River District. As explained in the *Greys River Landscape Scale Assessment*, "Bulbous bluegrass is an exotic plant that is now found along much of the mid to lower stretches of the Greys River, principally in the flats and meadows that receive heavy use by cattle and recreationists. The natural vegetative diversity has [] been replaced by Kentucky bluegrass. This grass does not provide effective soil-holding capabilities nor does it supply much usable forage, compared to the sedges, grasses, forbs, and shrubs that were present historically. Its presence indicates a long history of overuse, whether by [livestock] grazing, recreation or other disturbance factors" (USFS 2004:91).

Reduced vigor and altered species composition of plant communities caused by cattle herbivory can result in further changes to vegetation communities in alluvial valleys due to increased streambank erosion resulting from reduced root-mass and binding ability of the new streambank

vegetation (Clary and Webster 1989, Gebhardt et al. 1989, Kleinfelder et al. 1992, Dunaway et al. 1994). Consequently, streambanks become less resistant to high water flows, banks erode, the channel-form changes, and water tables drop (Van Havereen and Jackson 1986, Gebhardt et al. 1989, Leonard et al. 1992). Lowered water tables contribute further to reduced cover of native riparian vegetation and increased cover of native upland plants (e.g., big sagebrush) that are tolerant of dry soils (Elmore and Beschta 1987) as well as non-native grasses and weeds that have limited soil-binding potential (e.g., timothy, spotted knapweed). Under these conditions, stream channels continue to erode until a new floodplain becomes established at a lower base level (Van Havereen and Jackson 1986, Gebhardt et al. 1989). Some stream channels on the district appear to be lower than they naturally would be, possibly as a result of historic livestock grazing pressure, but the extent of problems caused by historic cattle grazing in the Greys River District has not been examined to any large degree. Some streams are resistant to down-cutting and are naturally braided due to large compositions of cobble and other size rocks.

The nonnative bluegrasses have a shorter stature than the native sedges and grasses and, furthermore, cattle grazing reduces the height of herbaceous cover. This contrasts with the dense, lush, rank herbaceous vegetation cover that is a characteristic of many riparian communities when in healthy condition (Youngblood et al. 1985), which are conditions favored by several species of small mammals such as western jumping mice and meadow voles (Armstrong 1975, Wile 1996). Based on studies in other areas, shorter grass height caused by cattle grazing and domination of some riparian areas by nonnative grasses can adversely impact western jumping mice, meadow voles, and other species the prefer or depend on tall, dense herbaceous cover (see Fagerstone and Ramey 1996 and DeLong 2002a for literature reviews). Bird communities associated with meadow vegetation can also be impacted by livestock grazing (Knopf 1996, Dobkin et al. 1998). Given the major change in vegetation composition and structure in some riparian areas, potential effects on these and other species needs to be investigated further.

Given the behavior of cattle and response of willow to browsing and mechanical damage by cattle, it is likely that cattle have contributed to altered structure and reductions in the extent of willow communities in the Greys River District, but the extent of change is unknown. If there has been loss of willow habitat due to livestock herbivory, it does not appear to be extensive. However, even at moderate levels, livestock grazing can cause a shift in vegetation composition and structure and it is likely that current livestock grazing levels continue to influence plant species composition and structure in riparian areas. Some shifts may be subtle. Even when cattle are properly managed, heavy to severe herbivory by cattle can occur in localized areas within riparian zones. Changes in willow communities caused by cattle grazing can adversely impact bird and small mammal communities (Fagerstone and Ramey 1996, Knopf 1996, Dobkin et al. 2002), but this may not be a major issue on the Greys River District. One theory as to why moose numbers are declining is that browse production and quality in willow stands is declining, although this has not been substantiated.

Livestock, particularly cattle, can compete with wild ungulates and other herbivors for forage (Leege 1984, Christensen et al. 1993, Wisdom and Thomas 1996, Zeigenfuss et al. 2003), but this probably is no more than a minor issue in riparian areas of the Greys River District, except possibly in localized areas.

Livestock also have the potential to contribute to the spread of noxious weeds and reduced water quality, which can further impact habitat (see pertinent sections).

Noxious Weeds and Other Invasive Plants

The introduction and spread of noxious weeds and other nonnative invasive plant species has the potential to have major adverse impact on wildlife habitat, although they presently are having minor to moderate impacts in riparian/riverine zones as a consequence of annual control efforts. Nonetheless, the stage appears to be set for major increases in the spread and density of weeds in the district—if current noxious weed control program were relaxed—because (1) noxious weeds of several species have established on sites in numerous subwatersheds, (2) new weed seeds are likely brought into various parts of the district continually, and (3) soil disturbance and bare ground (e.g., associated with roads/trails, camping areas, ATV/motorbike 'play areas', and livestock grazing) throughout the length of many riparian/riverine zones provide optimal substrate for establishment and spread. Krueper (1992) identified exotic plant invasion in riparian areas as one of the major threats to migratory birds using these corridors. Several impacts described in the *Montana Weed Management Plan* (Montana Weed Management Task Force 2005) and *Invasive Plants: Changing the Landscape of America FACT BOOK* (Westbrooks 1998) illustrate the types of impacts that could be expected (i.e., existing potential) in the Greys River District if noxious weeds were not adequately regulated: (1) Surface runoff in western Montana was an average of 56% higher and sediment yield was 192% higher on spotted knapweed infested sites compared to sites dominated by native bunchgrasses (Lacey et al. 1989; (2) spotted knapweed reduced available winter forage for elk by 50-90% (Duncan 1997); (3) elk use was 266% higher on a winter range after knapweed was removed (Thompson 1996, Duncan 1997); (4) leafy spurge reduced habitat use by deer and elk in western North Dakota (Trammell and Butler 1995); and (5) noxious weeds reduced densities of passerine birds and small mammals (Scheiman et al. 2003). Rice et al. (1997) found that herbicide control of spotted knapweed allowed elk forage to increase by nearly 50% within three years, meaning that spotted knapweed had been suppressing forage production. On the Greys River District, Canada thistle infestations are dense enough in some areas so as to change the composition and structure of plant riparian communities, thereby impacting wildlife associated with the displaced communities. This is only a small list of possible impacts. Some authorities believe that the introduction and spread of nonnative species is the second most important threat to biological diversity; second only to habitat destruction (Westbrooks 1998). Invasive plants can damage soil and water resources, increase soil erosion, crowd out native plant species, and otherwise impact wildlife habitat (Westbrooks 1998). Subsequent use of herbicides to control noxious weeds can further impact biological diversity (USFS 1986, Snyder et al. 1999).

Roads and trails play an important role in dispersal of weed seeds by (1) providing access by motorized vehicles, horses, hikers, and dogs into areas that otherwise would not be accessed or used by these modes of transportation, and (2) providing an optimal substrate for seed germination for weed species (USFS 1986, Snyder et al. 1999). Motor vehicles, horses, hikers, and dogs can carry and distribute weed seeds (USFS 1986, Westbrooks 1998, Douglass 1999, Sime 1999). For example, a vehicle in one trip can spread 2,000 knapweed seeds over a span of 10 miles (Montana State University Extension Bulletin 1992, as cited by Snyder et al. 1999). By providing a conduit for transporting weed seeds into and throughout the watershed and by providing optimal sites for germination, the Greys River Road and other roads/trails probably contribute to the introduction and spread of noxious weeds to the largest degree of any other factor. As the number and mileage of user-created, motorized trails and the number and acreage of dispersed camping areas and ATV/motorbike play areas increase, it will become increasingly difficult to control the spread of noxious weeds.

While roads, trails, and associated transportation are the main conveyors of weed seeds, weeds are spread by other means. They are also likely introduced and spread by infected hay, livestock, and timber harvest practices (USFS 1986, Westbrooks 1998, Snyder et al. 1999). Wildlife and natural processes (aside from water flow) probably play a comparatively small role in the establishment and spread of noxious weeds (USFS 1986).

Not only does the introduction and spread of invasive plant species impact wildlife habitat, weed spraying in riparian and wetland areas has the potential to adversely affect native plant species (USFS 1986, Snyder et al. 1999) and wildlife that depend on native forb and shrub species impacted by herbicides (USFS 1986) and amphibians that can be directly affected by herbicides (Gomez 1994, Maxell and Hokit 1999).

The introduction and spread of non-native bluegrass species was discussed under livestock grazing. The introduction and spread of creeping wild rye also impacts plant species diversity and vegetative structure in meadows where it occurs. Efforts to compile literature documenting potential impacts to wildlife has not been undertaken as yet.

The control of noxious weeds, although necessary, can have detrimental impacts on vegetation since it is never possible to only spray target species. Unless herbicide spraying is conducted with great care, larger plants such as willow and aspen can be damaged and killed. Use of herbicides was also identified as a concern by Wyoming Partners in Flight (2003:66), and they suggested that biological control agents whenever possible.

Mitigating the effects of weeds brought in by livestock, vehicles, and other means is an ongoing effort in cooperation with the Lincoln County Weed and Pest District, and it includes herbicide spraying, biological control, and mechanical control methods. However, the control of noxious weeds, although necessary, can have detrimental impacts on vegetation since it is never possible to only spray target species. Unless herbicide spraying is conducted with great care, larger plants such as willow and aspen can be damaged and killed. Use of herbicides was also identified as a concern by Wyoming Partners in Flight (2003:66), and they suggested that biological control agents be used whenever possible.

Fire Suppression

Fire suppression is one of the major factors contributing to the unnatural and unhealthy condition of vegetation in the mid to lower elevation forests, shrublands, and riparian areas of the Greys River watershed (USFS 2004). Wyoming Partners in Flight (2003:50) highlighted adverse impacts from fire suppression as one of the main factors adversely affecting riparian bird communities in the montane zone. The changes that have occurred since fire suppression began were of such major consequences because fire historically was a dominant natural disturbance affecting the structure, composition, and pattern of forested and non-forested vegetation. "Active fire suppression began during the early 1900s and continues today with some modification The attempt to remove fire from the landscape has reduced an important disturbance process from the landscape. Until 2004, the entire analysis area [Greys River watershed] was considered an 'appropriate suppression area' where all unplanned ignitions must be suppressed using the 'least cost plus loss principle.' ...Up to now, fire suppression has been relatively successful at keeping some moderately-sized fires contained. Eight fires exceeding 500 acres have burned since 1910..." (USFS 2004:10). Consequences of fire suppression on riparian communities include encroachment of conifer trees into riparian zones (resulting in habitat conversion) and decadence of willow

communities. There are many examples of Englemann spruce encroaching upon cottonwood, willow, and other riparian communities. As the density, canopy cover, and height of Englemann spruce increases in a riparian plant community, it's value to native wildlife communities declines, particularly as this trend is duplicated in many different areas on the district.

Wyoming Partners in Flight (2003) summarized the negative impacts of increased cover of conifer trees in riparian areas due to fire suppression. They asserted that the highest density of nesting pairs of nesting birds is associated with good canopy cover of deciduous trees, a high diversity of tree species, lack of conifer dominance, and low relative grass cover.

Mitigation of the effects of many decades of fire suppression activities would largely include reapplying fire to the landscape. To the extent naturally-ignited wildland fires are allowed to burn and to the extent prescribed burning is used, riparian communities adversely affected by fire suppression will recover.

Over-Trapping of Beavers

Prior to Euro-American settlement, beavers played a major role in shaping many riparian/riverine habitats (Olson and Hubert 1994) and this was likely true of the Greys River watershed and other drainages in the Greys River District. Wyoming Partners in Flight (2003) highlighted the benefits of beavers to migratory birds and the adverse effects of reduced distribution and abundance of beavers. Extensive beaver trapping from 1818 through 1840 decimated the beaver population in the Greys River District (USFS 2004). Wyoming Partners in Flight listed the removal of beaver as one of the prevailing problems impacting riparian bird communities in the state. Reducing the beaver population may have changed fluvial processes by reducing channel movements during peak flows, preventing sediment storage, and reducing woody debris in stream channels. Although the number of beaver dams appears to have increased since the early 1900s, there continue to be many remnant beaver dams in places they have not occupied in many years and many previously occupied sites may not have any remaining signs of historic activity. Some previously occupied sites may currently be unsuitable for beavers due to lack of aspen trees (mainly due to fire suppression) and few or lack of willow communities (which may in part be due to no recent beaver activity). Gruell (1975) discussed the relationship between the decline of aspen and absence of beavers in small tributaries where they once occurred, as evidenced by remnant beaver dams. A limited amount of beaver trapping continues today, beaver dams may continue to be blasted in some drainages, and some dams are altered or destroyed to reduce impacts to roads. A working hypothesis is that there are far fewer active beaver pond complexes than existed prior to Euro-American settlement, which likely contributes to sub-optimal riparian/riverine habitat conditions in the Greys River Ranger District.

Citing several studies, Elmore and Kauffman (1994) characterized the extirpation of beavers as the first major human-caused factor that changed the composition, structure, and functioning of many western stream systems. They continued by explaining that:

> "...The elimination of beavers from streams altered site hydrology with subsequent changes in stream nutrient processes and riparian vegetation dynamics (Kovalchik and Elmore 1991, Naiman et al. 1986, Naiman et al. 1988). The beaver plays a functional role as a keystone species in many riparian ecosystems. Their activities influence stream hydrology including residence times of water in riparian zones, stream temperatures, and nutrient cycles; provide habitats for aquatic organisms; and vegetation dispersal, dynamics, and

structure of riparian zones. Their elimination can result in decreased surface water (i.e., loss of ponds), channel diversity, and conversion of wetland plant communities to xeric plant communities."

Unnaturally High Levels of Wildlife Herbivory

It has been surmised that annual concentrations of elk at the Forest Park feedground is detrimentally impacting vegetation on and in the vicinity of the feedground (USFS 2004), which is consistent with effects demonstrated for other elk feedgrounds (Dobkin et al. 2002, Smith et al. 2004). Of most concern are impacts to cottonwoods, willows, and aspen. It is also possible that elk, moose, and deer are contributing to vegetation impacts in other riparian areas.

Dams, Water Control Structures, and Other Water Developments

Dams exist on Cottonwood Creek, Swift Creek, and Strawberry Creek. By flooding riparian habitat and replacing this habitat with generally low production habitat and by altering hydrology below the dam, combined with major changes in riverine functioning, dams have major adverse impacts on riparian functioning, wildlife habitat, and wildlife (Satterlund and Adams 1992, Doppelt et al. 1993, Federal Interagency Stream Restoration Working Group 1998). However, 'reservoirs' on Swift Creek and Strawberry Creek have been filled in with extensive amounts of silt and currently appear to provide fairly productive riparian habitat.

Water diversion structures and spring developments exist in several stream systems on the district. In most cases, only a limited amount of water is removed and removal is generally near the boundary just before streams leave the district (i.e., impacts on National Forest System riparian/riverine habitat is limited in most cases). However, greater proportions of water are removed from higher up in some streams (e.g., Strawberry Creek). Nonetheless, Strawberry Creek continues to have year-round flow below the diversion point for the power plant. Dams typically block passage for native fish (Doppelt et al. 1993).

There has been more than one proposal to dam the Greys River. If the Greys River — the longest undammed river in Wyoming outside of Yellowstone National Park — were to be dammed, this would further erode riparian/riverine functioning and availability of wildlife habitat. The Campaign for the Snake Headwaters (2006) is proposing the Greys River and other rivers and streams for designation under the Wild and Scenic River Act. Such a designation would greatly reduce the chance of dams being constructed on the Greys River and Little Greys River, as well as on Crow Creek, Marten Creek, Corral Creek, Box Canyon, upper Salt River, and uppper Swift Creek.

Timber Harvest

Timber harvest increased to about 5 million board-feet/year in 1962. During 1963-1970, timber harvest on the Greys River District was approximately 15 million board-feet/year, most of this occurring in the Greys River watershed (USFS 2004). Most of this entailed clear-cutting practices. During 1971-1979, timber harvest declined to about 3-4 million board-feet/year. In total, nearly 10,000 acres were clear-cut and about 1,800 acres were selectively cut. While most timber harvesting occurred away from riparian areas, some riparian areas were directly affected (e.g., reduced overstory vegetation and change in species composition and structure) while others may have been indirectly affected through increased sedimentation and road construction. Given the minimal amount of logging that has occurred since the 1970s and early 1980s, timber harvest

currently is having limited impacts on riparian zones. To the extent timber harvest increases on the Greys River District, effects could potentially increase. Thomas et al. (1979c), Satterlund and Adams (1992), Doppelt et al. (1993) discussed the major negative effects that timber harvest can potentially have on riparian zones, including loss of vegetation, reduced large woody debris in rivers and streams, nutrient cycling, water temperatures, soil erosion, and disturbance to wildlife. Timber harvest activities can also contribute to the introduction and spread of noxious weeds (see Noxious Weed section, above).

Mining

Coal mining was a small-scale venture in the area, as recently as the 1980s (USFS 2004). Coal mining took place in upper Deadman and Blind Bull Creeks and the McDougal Pass area. Impacts to riparian habitat was localized, but within footprint of the disturbance, impacts were major and are still apparent today. Elevated levels of sedimentation below the sites may continue. Contaminant levels are not known. Seismic explorations for oil and gas took place during the late 1970s and early 1980s, but this likely had minimal impact on riparian/riverine habitat. Some riparian/riverine habitats were affected by gold mining. Recreational gold mining occurs on a limited basis and can have localized impacts due to substrate being disturbed during the process. Riparian vegetation may also be damaged.

Some of the gravel pits and potential sources of decorative rocks are near riparian areas and have the potential to contribute to sedimentation.

Structures and Agricultural Fields

The presence of houses/cabins, agricultural fields, and associated facilities in the Greys River and Dry Creek corridors (on private and federal lands) has further reduced the amount of habitat available to wildlife in these important riparian/riverine corridors. Not only is habitat lost where structures replace native habitat, the composition and structure of vegetation surrounding structures can be substantially altered. The Federal Interagency Stream Restoration Working Group (1998) describe impacts of agricultural production on stream and riparian functioning.

The Middle Greys River WSA (2005:53) identified residential development in in-holdings as one of the major threats to wildlife in this section of the river. The new owners of the Deadman Ranch are contemplating whether to develop or conserve their portion of the in-holding. The Deadman Ranch encompasses a portion of a crucial moose winter range.

Harvest of Firewood and Plant Materials

Given the location of roads and the propensity for people to collect firewood immediately adjacent to roads, the collection of firewood is concentrated in and near riparian areas. Wyoming Partners in Flight (2003) identified the collection of firewood as a concern regarding the conservation of migratory birds, presumably because firewood collection focuses on the harvest of snags which are important for cavity nesting birds. However, since there currently appears to be an unnaturally high density of snags in the district, this may not be an extensive problem. Furthermore, it is possible that high levels of human activity reduce the extent to which snags along roads are used.

The *Greys River Landscape Scale Assessment* identified the collection of unique plants for food, fiber, and medicinal uses" as a contributing factor impacting riparian areas (USFS 2003:89).

Water Quality

Factors that contribute to or have the potential to contribute to reduced water quality in riverine systems and other wetlands have been addressed in several subsections above. They include soil erosion from roads and trails; soil erosion caused by historic livestock grazing practices and timber harvest in adjoining upland areas; human waste at dispersed camp sites along riverine systems; feces from livestock and horses; use of herbicides along roads, trails, and in meadows; use of magnesium chloride on roads; and contaminants from vehicles, including various fluids (e.g., gas, coolants, oil), heavy metals from vehicle wear, and rubber from tire wear.

Reduced Habitat Effectiveness – Disturbance

A fundamental principle of wildlife management is that the presence and activities of people can reduce or eliminate the use of otherwise suitable habitat by particular species and groups of wildlife (Thomas et al. 1979b, Thomas et al. 1979c, Knight and Gutzwiller 1995, Canfield et al. 1999, DeLong 2002b, Skovlin et al. 2002). Citing an earlier review paper (Forman and Alexander 1998), Forman et al. (2003) stated that "Many native wildlife species are less common or absent near roads, which effectively results in a *road-avoidance zone*... the potential causes of an avoidance zone include visual disturbance, vehicular pollution, road-kills, and traffic noise." Thomas et al. (1979c) described and illustrated how habitat effectiveness in riparian zones is reduced by roads paralleling rivers and streams. This section addresses visual disturbance and traffic noise.

While the scope of this report is limited to riparian zones, it should be recognized that motorized vehicles traveling along roads and trails in valley bottoms and other human activities in valley bottoms can reduce habitat effectiveness far into adjoining upland habitats, especially on open slopes exposed to the road or trail.

Wheeled Motorized Vehicles

At the estimated road density of about 1.75 miles of road per square mile within DFC Class 3 along the Greys River, elk use would be expected to be roughly 60% of potential use for the area, which is more than the 50% reduction expected for the road management standard of 1 mile of road per square mile for this DFC Class (USFS 1990). Furthermore, 1.75 miles of roads per square mile does not account for the density of authorized and illegal (user-created) motorized trails that exist in DFC Class 3. Incorporation of motorized trails, which have similar effects on elk (Wisdom et al. 2004), as well as campgrounds and dispersed camp sites, would further reduce expected elk use below 60% within DFC Class 3. Estimates are based on Lyon (1983), as displayed in the 1990 Forest Plan (USFS 1990). It is well established through extensive research and analyses that, as the density of open roads increases in an area, elk use of the area declines (Thomas et al. 1979b, Leege 1984, Hillis et al. 1991, Hurley and Sargeant 1991, Canfield 1999; Wisdom and Cook 2000; Skovlin et al. 2002). Wisdom and Cook (2000:722) cited two studies showing that reductions in elk use of habitat have been measured as far away as 1.8 miles from roads. Leege (1984:7) state that "The most important factor usually regulating actual use of habitat by elk is disturbance caused by people. Most disturbance originate from roads..." Christensen et al. (1993:2) asserted that "Roads are undoubtedly the most significant consideration on elk summer range."

Studies conducted in a variety of locations indicate that motorized activity along roads and trails and near camping areas along rivers and streams in the Greys River District are likely displacing other wildlife species (aside from elk) from otherwise suitable riparian habitat, especially since

riparian/riverine habitat occurs in occur in narrow strips and roads/trails usually bisect these strips linearly. While mule deer and moose may not be affected to the same degree as elk (Wisdom et al. 2004), studies have demonstrated adverse impacts of ATVs and other motorized vehicles on mule deer and moose, including changes in feeding habits and distribution and decreases in reproduction (Knight and Cole 1995, Canfield et al. 1999, Forman et al. 2003). Forman et al. (2003) cited three papers in making the conclusion that "Deer tend to have lower densities near roads with traffic in the Rocky Mountain, suggesting an avoidance zone of 100-300 m (328-984 ft) from roads." Claar et al. (1999) cited several studies showing impacts of roads on the distribution and habitat use of black bears, grizzly bears, and other predators.

Thirty years ago, Gruell (1975:16) noted that "Human disturbance of nesting waterfowl has not been a management concern and is not expected to be in the foreseeable future." There have been many changes since he worked on the Forest, including a sharp increase in the amount of recreation, especially recreation supported by motorized vehicles. Impacts of human disturbance, including disturbance from motorized vehicles, has been extensively studied. Human disturbance can result in declining numbers of breeding pairs, increased desertion of nests, reduced hatching success, and decreased duckling survival (Knight and Cole 1995, Hamann et al. 1999, DeLong 2002b). Given the proximity of main roads, secondary roads, motorized trails, and camp sites in the District to riverine wetlands and associated meadow habitat, some level of human disturbance effects likely are occurring, but the extent is unknown.

Trumpeter swans currently do not inhabit the Greys River watershed, although suitable habitat appears to exist and they are present along the Salt River and other river systems in the area. Little relevant information was provided in Hamann et al. (1999), but they did cite one observation that "trumpeter swans nested within 200 m of a busy highway, but were alerted when vehicles stopped and passengers emerged."

Harlequin ducks, which have been observed in the Greys River drainage in the past (Gruell 1975), are very sensitive to disturbance (Hamann et al. 1999). Their apparent disappearance from the Greys River and apparent lack of nesting and brood-rearing on the Greys River proper may in part be due to the combined effects of vehicle activity along the entire course of the Greys River, activity at campgrounds and dispersed camp sites along the river, kayaking and other river recreation, and fishing. In Grand Teton National Park, 95% of harlequin observations were in backcountry areas accessible only by foot (Wallen 1987, as cited by Hamann et al. 1999). Similar results were found at Yellowstone National Park (McEneaney 1994, as cited by Hamann et al. 1999).

Hamann et al. (1999:3.23) described adverse impacts of non-motorized vehicle activity on passerine birds and stated that “Motorized activity along roads and trails may have an even greater disturbance and/or displacement effect on birds.” Forman et al. (2003) reviewed several studies showing very definitive effects of roads on habitat use by passerine birds. The cited three studies indicating the noise level at which densities of birds began to decline averaged 42 decibels (woodland birds) and 48 decibels (grassland birds), which is comparable to noise levels "in a typical reading room or during nighttime in one's home." Some studies cited by Forman et al. (2003) found that low levels of traffic can result in lower densities near roads. Given the magnitude of impacts to passerine birds, Hamann et al. (1999) recommended that no roads or trails should be established in riparian areas (at least 600 yards from streams). Bury et al. (1977, as cited by Hickman et al. 1999) demonstrated direct impacts of off-road vehicles on small mammal

species richness, abundance, and biomass and that these parameters are inversely related to off-road vehicle use in some areas.

Furthermore, several studies indicate that wildlife sightings decline as motorized use of roads increase (Knight and Cole 1995), indicating that it is not only wildlife that is being affected.

As in the discussion on impacts of roads, trails, and camping areas on the amount and quality of wildlife habitat, the type/class of roads and trails lower down in the Greys River drainage can greatly influence the extent of human disturbance higher in the drainage and tributaries.

Snowmobiles

Snowmobiling also has the potential to be affecting several species of wildlife that winter along the Greys River, Little Greys River, and smaller drainages. Wintering ungulates, especially moose, have the greatest potential to be impacted since the main snowmobile trails are on roads that run through the heart of narrow crucial moose winter range. Riparian habitat throughout the Greys River District comprises the core of the crucial moose winter range. Colescott and Gillingham (1998) found that snowmobile activity along the Greys River corridor during January and February of 1994 caused moose to move away from snowmobile activity that occurred along the main road. Effects were readily observable within about 160 yards of the road, but they did not assess the much more subtle energetic costs that can accrue even in the absence of movement away from a disturbance (Gabrielson and Smith 1995). Marked increases in heart rate and other physiological responses can substantially increase the amount of energy expended by animals, which can be significant during winter (Gabrielson and Smith 1995, Picton 1999). In their review of scientific literature, Canfield et al. (1999:6.8) stated that "In summary, it has been shown repeatedly, and for virtually every ungulate species, that even minor seemingly harmless sorts of disturbances [during winter/spring] cause increased heart rates – and increased energy expenditures." This is supported by Clark (1999). Adverse effects of human disturbance on wintering ungulates is the primary reason for maintaining closures on the elk winter range between Moose Creek and Deadman Creek and on the Forest Park elk feedground. These are the only two areas where snowmobiling is restricted within DFC Class 3 along the Greys River. It is possible that some wildlife species may become habituated to snowmobiling activity along groomed trails (Canfield 1999, Clark 1999).

Because snowmobiling in crucial winter range has the potential to affect physiological condition of animals and, in turn, survival of individuals and production rates and survival of calves, snowmobiling has the potential to affect distribution and abundance of moose at other times of the year.

Snowmobiling has the ability to affect the use of the Greys River, Little Greys River and other riverine habitats and associated palustrine wetlands by wintering waterfowl and waterbirds such as common goldeneyes, Barrows goldeneys, mallards, and common mergansers. The author has observed individuals of these species flushing as a consequence of snowmobile activity. Human disturbance of waterfowl from snowmobiling does not appear to have been well studied, but effects likely are similar to those of wheeled motorized vehicles and over-water motorized vehicles, which appear to disturb waterfowl through noise, movement, and speed (DeLong 2002b). Further investigation is needed.

Because the major thoroughfare for snowmobiling on the northern half of the Greys River District is adjacent to the Greys River, snowmobiles are loud, and because snowmobilers are infrequent along the Greys River, this activity has the potential to impact wintering bald eagles that winter along the river. Anthony et al. (1995) cited several studies demonstrating the adverse effects motorized vehicle use (and noise) can have on bald eagles and the disruption of bald eagle feeding activity caused by human disturbance during winter. They also cited several studies indicating the longer-term effects that winter recreation activities can have on bald eagle survival, given increased energy demands and reduced availability of food. Juvenile eagles are particularly prone to increased energy expenditures caused by winter recreation due to relatively higher energy demands and their lower efficiency in foraging.

Non-Motorized Recreation

Activity along non-motorized trails in the watershed is likely disturbing wildlife to lesser degrees than motor vehicles (e.g., it takes larger numbers of people on foot and on horseback to affect elk distribution to the same extent as motorized vehicle activity; Canfield et al. 1999, Wisdom et al. 2004), but habitat use and distribution may still be affected. In their review of scientific literature, Canfield (1999) assessed that impacts on the reproductive performance of ungulate populations may be expected where summer recreational activities approach high levels (which likely characterizes portions of the riparian corridor along the Greys River and other streams in the Greys River District). Knight and Cole (1995) summarized the results of studies demonstrating that wildlife can be negatively affected by hiking, backpacking, horseback riding, and cross-country skiing.

Numerous studies have shown the displacement effects of human activities, including river rafting and hiking, on bald eagle habitat use along rivers (Anthony et al. 1995). Although ospreys oftentimes nest near human activity, Hamann et al. (1999) cited situations in which recreational activity resulted in lower osprey nest success, including an example from Yellowstone National Park. Wallen (1987, as cited by Hamann et al. 1999:3.5) "reported that fishing seemed more disruptive to harlequins than hiking..." and Hamman et al. (1999) cited two studies indicating that whitewater rafting can affect the use of streams by harlequin ducks. For example, Hunt (1993, as cited by Hamann et al. 1999) found that the rise in commercial white-water rafting trips significantly correlated with declines in harlequin duck numbers from 1986 through 1992. Other waterbird species have been shown to be negatively affected by non-motorized boating (Knight and Cole 1995, DeLong 2002b).

Hamann et al. (1999) cited several studies (from Wyoming and Colorado) demonstrating adverse effects of hikers on breeding activity of passerine birds, with some of the effects potentially resulting in important problems for some species. Similarly, Hickman et al. (1999) cited several studies that showed increased energy expenditure and displacement of small mammals due to hiking and backpacking.

To the extent that mountain bike riding increases on the Greys River District, and more specifically within riparian zones, disturbance of wildlife could increase beyond existing levels along non-motorized trails. Studies addressing this issue need to be located.

Campgrounds and Dispersed Camping Areas

Several studies cited by Hamann et al. (1999) demonstrated that campgrounds in riparian areas can reduce the density and diversity of passerine birds. Furthermore, they stated “Species that may be

most severely impacted by these riparian campgrounds may, in turn, be those that can least tolerate impacts, such as the veery, a species that is experiencing significant population declines throughout the North American continent. In Idaho cottonwood forests, Saab (1996) found that the veery required larger patches of cottonwood forest in areas of disturbed campgrounds. Loss of shrub understories in and around campgrounds reduced key habitat for many riparian species as well (Luckenbach 1979)." Hamann et al. (1999) also cited a study that found belted kingfishers to be impacted by campgrounds in riparian areas, especially when they were located near potential nesting sites (banks) and potential feeding sites (riffles). Given the magnitude of impacts to passerine birds, Hamann et al. (1999) recommended that no new campgrounds be established in riparian areas (at least 600 yards from streams).

Dogs

An extension of human disturbance related to recreational pursuits and activities such as wood cutting is the disturbance effects of dogs, which often accompany campers, hikers, bikers, and others. Dogs have the potential to increase the level of displacement of wildlife along trails during spring, summer, and fall, especially when dogs chase wildlife (Knight and Cole 1995, Olliff 1999, Sime 1999). Wildlife in riparian zones along the Star Valley front also have the potential to be affected by dogs running loose, given the proximity to towns, subdivisions, and single houses near the national forest boundary. Depending on breed, displacement of wildlife caused by dogs can take the form of their mere presence, harassing, and chasing. Dogs running loose in campgrounds and dispersed camping areas can particularly reduce wildlife use of surrounding areas since they may be in the area for several days. Along the Star Valley front, roads and trails near towns and residential areas provide easy access for free-ranging and stray dogs.

Hunting & Target Practice

Hunting is well known to alter behavior, population structure, and distribution patterns of wildlife (Knight and Cole 1995, DeLong 2002b), but hunting is carefully managed by the Wyoming Game and Fish Department to ensure that target populations are sustained over the long term. While some species may be actively hunted in riparian zones (e.g., moose, ruffed grouse), most impacts of hunting on wildlife in riparian zones are likely due to camping and travel to and from hunting areas, especially motorized travel, which effectively can displace target species from many riparian areas (discussed elsewhere). Furthermore, hunters contribute to the creation of user-created ATV trails which draws additional hunters during the hunting season and other ATV riders at other times of the year. Target practice during all times of the year, but mainly summer months, likely has effects on wildlife use of areas used for target practice.

Livestock

Some wildlife species show an aversion to the presence of cattle to the extent it can affect habitat use by these wildlife species. For example, it is well established that the presence of cattle tends to displace elk from areas when cattle are using them (Leege 1984, Christensen et al. 1993, Wisdom and Thomas 1996, Zeigenfuss et al. 2003). Although cattle do not appear to affect elk distribution on summer range to the extent previously though, there continues to be strong indication that elk avoid areas where cattle are present if other options exist for elk (Christensen et al. 1993). In their north-central Utah study on elk-domestic sheep interactions, Beck et al. (1996:64) concluded that "In general, elk distanced themselves from sheep but stayed in the same general area to use salt placed for sheep." However, sheep tend not to use riparian areas nearly to the extent that cattle do; therefore, sheep grazing likely has more limited effects on wildlife use of riparian areas. While

mule deer have been observed to shift habitat in response to the presence of large concentrations of cattle, such shifts generally are not of much significance (Peek and Krausman 1996). Furthermore, activities of herders and their dogs can impact wildlife through disturbance, as discussed elsewhere. Livestock and associated activities, therefore, have the potential to reduce elk use near roads beyond reductions in use caused by motorized vehicles and people along roads, motorized trails, and camping areas.

Increased Wildlife Mortality

Motor Vehicles

Wildlife mortality resulting from vehicle collisions or vehicles running over animals has the potential to affect the USFS's ability to prevent sensitive species from becoming federally listed; preventing sensitive species from becoming federally listed is BTNF Goal 3.3. A variety of wildlife species are periodically killed by vehicles along the Greys River Road and to a lesser degree along other roads and trails on the Greys River District. For most wildlife species, mortality along roads and trails likely has little effect on populations in the district. However, roadkill can have substantial effects on some wildlife species, depending on locations of roads and trails (and off-road/trail use), movement patterns of the species, timing of the movements relative to timing and extent of vehicle traffic, and population status.

A review of scientific information revealed that amphibians are particularly susceptible to being impacted by vehicle traffic along roads and trails, especially when roads/trails bisect or parallel key habitats (Maxell and Hokit 1999), which is exactly the situation with most roads/trails on the district (they parallel and bisect key amphibian habitat). For example, mortality from vehicle traffic along roads and trails near wet areas and that bisect wetlands may be a mortality factor of spotted frogs (Gomez 1994) and other sensitive amphibians occurring on the district. The potential for amphibian mortality caused by individuals being run-over by vehicles is particularly pertinent to the Greys River District since the Greys River Road and other roads and motorized trails closely follow stream courses and are located within riparian zones that encompass an abundance of oxbows, pools, marshes, and other wetlands.

Waller et al. (1999) cited several studies indicating that roadkill can be a factor affecting river otter populations. Several of the river/stream systems occupied by otters have roads paralleling the river or stream.

Monitoring wildlife mortality along roads/trails would need to be conducted to determine if roadkill was having measurable effects on particular wildlife populations. Some of the wildlife species that have been observed to be killed by motor vehicles include red squirrel, cottontail rabbits, ruffed grouse, and garter snakes.

Dogs

In addition to disturbance effects of dogs on wildlife, which has the potential to contribute to higher mortality rates through reduced physiological condition, dogs can chase down and kill wildlife or wound them sufficiently to result in death. For example, Waller et al. (1999) reported that dogs may pose a threat to species such as otters in areas where recreational use is increasing. Claar et al. (1999) stated that dogs may be a source of mortality of carnivorous species of wildlife, particularly dependent young.

See also the “Disease” subsection under “Reduced Wildlife-Population Health,” below for additional mortality threats).

Fishing

Waller et al. (1999) discussed increased mortality of river otters, mink, muskrats, and beaver that could result from fishing tackle, as well as the trapping of otter due to the inaccurate perception that they deplete game fish populations. Hamann et al. (1999) cited instances of harlequin ducks, pelicans, herons, and other water birds being found entangled in fishing line and embedded with fishing hooks and lures.

Recreational Shooting

Another form of mortality that relates to road access is 'varmint' shooting from roads and trails. Roads and motorized trails provide ready access, which can facilitate these activities, and people have been seen shooting ground squirrels in meadows along the Greys River Road. Hickman et al. (1999) cited several papers that discussed the adverse impacts of recreational shooting.

Disease

Disease can be a major mortality factor at times for some wildlife species, and potential exists for additional non-endemic, infectious diseases to become established in wildlife. Effects of diseases on wildlife are summarized in the Disease subsection under the heading Potential for Reduced Wildlife-Population Health, below.

Predation and Nest Depredation

There is no information to show that human activity or developments have caused mammalian predator populations in the Greys River District to increase beyond the natural range of variability or that they average higher than naturally occurred. However, it may be possible for cumulative human factors to affect some prey populations to the point that natural predation levels affect them more than would occur if the prey populations were healthy, as with other naturally occurring processes in the face of changed ecosystems. This is probably not true of hunted species since, if this were occurring, hunting would need to be discontinued. (This is not to say that predation does not affect hunting opportunities, but this is not a topic of this report.)

It is possible that raven and magpie populations have increased in the district, although this has not been specifically addressed. Raven populations are substantially higher west-wide than they were prior to Euro-American settlement and are having significant effects on a variety of wildlife species (Boarman and Berry 1995). Given West-wide trends and, in consideration of incidental observations of high numbers of ravens (and magpies) in Star Valley and conditions conducive to corvids (e.g., road-killed wildlife, presence of a landfill, agricultural production), it is reasonable to suggest that raven and magpie populations are higher than pre-Euro-American populations. Ravens and magpies, particularly at unnaturally high densities, can be important contributors to elevated nest depredation of a variety of bird species.

Potential for Reduced Wildlife-Population Health

A wildlife population is healthy when it performs its vital functions normally, is resilient to stress and disturbances, is sustainable over the long term, and when it requires no or minimal outside care [adapted from definitions of ecosystem health (Costanza 1992:248, Haskell et al. 1992:9), rangeland health (National Research Council 1994:34), and organism and environmental health

(Karr 2001)]. The concept of health is integrally related to that of ecological integrity (Haskell et al. 1992, Karr 2000). A healthy wildlife population does not necessarily equate to a population of healthy individuals, as endemic diseases are a natural part of animal ecology (Peterson 2003).

The integrity and sustainability of wildlife populations are affected by a variety of factors, including amount, quality, and connectivity of habitat; availability of forage/prey; predation rates; recruitment rates; disease prevalence and spread; among others. Many of these factors are addressed elsewhere. Disease is addressed below.

Diseases

Recognition is increasingly being given to the effects disease introduction and spread can have on wildlife populations and to ecosystem health. As pointed out by Cleaveland et al. (2002:139), the threats posed by disease may appear to represent a minor problem for conservation when compared to habitat loss, over-harvesting, and pollution, but disease risks for wildlife are likely to increase "as contact with human and domestic animal populations become more frequent," for which they said increased mobility of humans and domestic animals is playing an important role. The potential for people, pets, livestock, and vehicles/equipment to transmit disease-causing organisms into wildlife habitat and to wildlife is increasing in riparian corridors of the Greys River District. A growing list of non-endemic diseases are being spread by wildlife and other means after their introduction elsewhere. Compounded with these factors, Cleaveland et al. (2002) asserted that the effects of disease in wildlife populations already adversely affected by other factors (e.g., habitat loss and fragmentation) may be more pronounced. This includes endemic diseases since the dynamics between endemic diseases and their hosts may change as a consequence of environmental degradation.

Disease is often overlooked as a conservation problem until a major problem occurs (Cleaveland 2002). Even if a disease is having an effect on a wildlife population or biotic community, either by itself or cumulative with other factors, this may not be detected. Just because there are no documentations of disease effects in the Greys River District, except for the results of a few isolated and limited investigations and the ongoing brucellosis surveillance program in elk, this does not mean disease is not affecting wildlife in the district. We are not looking.

While brucellosis in elk is likely not having a significant affect on the elk population (Thorne et al. 2002), the high prevalence of brucellosis in elk is a sign that conditions are ripe for the rapid spread of more serious non-endemic, infectious diseases that could potentially become established in the future (Smith 2001).

Livestock

While importation, quarantine, and brand-inspection laws and regulations for livestock management have markedly slowed the spread of disease-causing organismis between countries and locations within the United States, it has not eliminated the potential for diseases and parasites to be transmitted from livestock to wildlife (Jessup and Boyce 1996). Other than the diseases that have already been transmitted from livestock to wildlife populations and that are known to affect certain wildlife populations in the Greys River District (e.g. brucellosis in elk), the extent to which diseases have been transmitted from livestock to wildlife in the recent past is unknown and the potential for additional non-endemic infectious diseases to be transmitted from livestock to wildlife is also unknown. Nonetheless, livestock likely provide an ongoing vector for disease transmission to wildlife in the Greys River District, recognizing that most of these diseases have

already been introduced to wildlife or originally came from wildlife populations, and recognizing the annual livestock grazing program on the district also carries with it an inherent risk of introducing additional non-endemic diseases into wildlife populations. With respect to riparian areas, cattle are the main class of livestock of concern, although diseases transmitted from sheep to wildlife can affect wildlife in riparian areas. The list of diseases that can potentially be transmitted from livestock to wildlife is long and the following is only a partial list. Most of the information was obtained from Jessup and Boyce (1996).

The adverse effects of *Pasteurella* transmission from domestic sheep to bighorn sheep populations (e.g., population declines, local extinctions) are especially well known (Jessup and Boyce 1996, Miller 2001). However, most diseases transmitted from livestock to wildlife do not cause such serious impacts. Nonetheless, several diseases (e.g., Pneumonias, septicemias, Leptospirosis, malignant catarrhal fever, hemorrhagic disease, respiratory synctial virus) and a variety of parasites (e.g., several species of gastrointestinal nematodes, lungworms, liver flukes, ticks, and mites) can be transmitted from livestock into wildlife habitat or directly to wildlife (Jessupe and Boyce 1996, Williams and Barker 2001). Most impacts are relatively minor, but under some situations impacts on wildlife populations can be more severe.

While chances are low, the possibility exists for future introductions of a non-endemic, highly-infectious disease (e.g., bovine tuberculosis, paratuberculosis) to be introduced by livestock into western Wyoming. Such an introduction could have major adverse impacts to wild ungulates.

Livestock can also transmit other disease-causing organisms on their body. For example, Patla (2000) asserted that livestock have the potential to spread diseases of amphibians (see "Vehicles, Equipment, and Clothing," below, for more detail).

Domestic Dogs

Beyond disturbance effects and direct mortality, dogs associated with people using the Greys River District and dogs running loose along the Star Valley front can potentially transmit various diseases and parasites to wildlife directly and through introduction of disease organisms and parasites into wildlife habitats. While diseases and parasites transmitted by dogs may themselves alone not cause major adverse impacts to wildlife, potential effects may be cumulative with other factors impacting wildlife in riparian zones. Effects of diseases (e.g., canine distember, rabies, canine parvovirus, plague, giardia, muscle cysts, leptospirosis) and parasites (ticks, tapeworms, keds, fleas) that can be transmitted from dogs to wild canids, felids, mustelids, ungulates, and other wildlife range from minor, immeasurable effects to extensive die-offs (Sime 1999, Williams and Barker 2001). As with livestock, dogs can also transmit other disease-causing organisms on their body. For example, Patla (2000) asserted that dogs have the potential to spread diseases of amphibians (see "Vehicles, Equipment, and Clothing," below, for more detail). Sime (1999) described each of several diseases that can be transmitted from dogs to wildlife. Claar et al. (1999) cited several examples of canine distemper in martens and fishers, and stated that dogs have the potential to introduce diseases to carnivorous species of wildlife.

Vehicles, Equipment, and Clothing

Patla (2000) stated that disease might be the most insidious threat to amphibians in the Bridger-Teton National Forest, including the Greys River District. She surmised that the threat is elevated because equipment (e.g., vehicles, waders), livestock, and pets that carry disease organisms can be transported throughout large areas given extensive road and trail system.

Whirling disease in trout can be transported by waders, boats, and other clothing and equipment, and it can have major adverse impacts on some trout populations. Reductions in trout numbers could adversely impact wildlife species that forage on them, including otters, osprey, great blue herons, and bald eagles.

Nonnative Invasive Species

Nonnative invasive species can also affect native populations and communities. The extent of nonnative fish has been addressed elsewhere by the zone fisheries biologist. Potential effects of nonnative aquatic species, including fish, should be assessed further.

Regional Context

Degradation and loss of riparian habitat in the Greys River District is all the more important when considering the degradation and loss of riparian habitat on private lands where the largest expanses of riparian habitat exist in western Wyoming and eastern Idaho, and throughout the intermountain West. Degradation and loss of riparian habitat is a major issue in the Intermountain West, and federal lands play an important role in sustaining this habitat. Doppelt et al. (1993) cited reports demonstrating that 70-90% of natural riparian vegetation has been lost to human activities nationwide; flow alteration has degraded 70% of the nation's rivers and streams; and one-third of America's fish are endangered, threatened, or of special concern. He added that there is not one river system in the U.S. that has been spared the effects of human activities.

WRAP-UP

Conclusions and Hypotheses

1. There is sufficient information to show that past and present human activities and facilities in and near riparian zones on the Greys River Range District are cumulatively having a significant effect on riparian/riverine habitat and associated wildlife.

2. To the extent public use of the Greys River Ranger District continues to increase, cumulative effects on riparian/riverine habitat and wildlife will continue to increase unless effects are somehow mitigated.

3. Motorized vehicle facilities (e.g., roads, trails, camping areas) and motor vehicle use appears to be the most pervasive impact in riparian zones.

4. Other uses and facilities incrementally add to the effects of motorized vehicle facilities and use.

Recommendations

1. Expand the discussion of positive effects on wildlife and wildlife habitat stemming from the provision of recreation and resource harvest opportunities (e.g., in terms of fostering public support). This would need to address the issue of balancing recreation and harvest opportunities with habitat conservation and the issue of balancing different types of recreation opportunities, some of which have lesser impacts on wildlife and habitat.

2. Further investigate the relationship between beaver and aspen in small, high-gradient streams and assess the potential for restoring aspen and, ultimately, beaver in these drainages.

3. Quantify the extent to which roads, trails, and associated facilities have reduced the amount, quality, and effectiveness of riparian/riverine habitat on the district (e.g., see diagrams in Thomas et al. 1979c). This would include working with the recreation program to determine road/trail locations and densities, and to evaluate this information with respect to specific habitat types and wildlife-use areas.

4. Identify other information needs for which field data-collection or observations may be needed, and formulate a plan of action to obtain the information.

5. Complete an in-depth review of the pertinent scientific and technical information (see "Need for a Detailed, Comprehensive Analysis," below).

6. Using this report as a starting point, identify any missing effects and additional scientific and other information, and complete a detailed cumulative effects analysis of factors affecting wildlife and wildlife habitat in riparian/riverine areas. Distribute draft reports for peer review.

7. Work with field and experiment stations, Wyoming Game and Fish Department, and other entities to gather additional needed information, both in the field and through literature reviews.

8. Apply for grants to support the implementation of the recommendations and, to the extent possible and where necessary, contract out to other institutions to complete specific components.

Need for a Detailed, Comprehensive Analysis

Given the tremendous importance of riparian/riverine habitat to sustaining wildlife in the Greys River District combined with a high and growing concentration of human activity within these narrow corridors, a more detailed assessment is warranted than is provided in this report. A detailed assessment is particularly relevant at this time given the upcoming travel management planning process that will be initiated on the district within the next two years. This report lays the foundation for a detailed assessment by:

- Identifying a preliminary range of impact sources.
- Identifying preliminary sources of scientific and other information.
- Identifies information gaps and recommendations to fill these gaps.
- Providing opportunity for others to critically evaluate the framework and contents (this report) from which a more detailed assessment should be built.

Several papers in Joslin and Youmans (1999) stressed that individual recreational activities and other activities affecting wildlife should not be considered in isolation because they could have cumulative and possibly synergistic effects. This is particularly relevant to the many interconnecting factors that affect wildlife in riparian/riverine habitats of the Greys River Ranger District.

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