Fisheries Specialist Report

Santa Fe National Forest Travel Management

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INTRODUCTION

This report addresses the environmental consequences on the fisheries resource as a result of implementing the Travel Management Rule. It includes the potential effects of various modes of travel (i.e., motorized roads and trails, motorized dispersed camping corridors, motorized big game retrieval areas, and areas designated specifically to provide motorized cross-country travel) on the Santa Fe National Forest.

Issues

The public expressed the following concern regarding the effects of motorized routes on fish and wildlife species.

1. Continued public motorized use of routes and areas described in the proposed action will adversely affect forest resources. These effects include:
   - Erosion, soil compaction, and degradation of water quality;
   - Degradation of fish and wildlife habitat;
   - Damage to heritage resources;
   - Damage to rare plants; and
   - Compromising the character of wilderness and inventoried roadless areas.

This is one of the key issues that will receive detailed analysis and discussion in the environmental impact statement. These issues define the scope and extent of impacts that may be caused by the proposed action, or alternatives to the proposed action. The fisheries portion of this issue ("Degradation of fish and wildlife habitat") will be discussed in more detail in this Specialist Report.

Alternatives Considered and Evaluated

Alternative 1 (No Action). The No Action alternative provides a baseline for comparing the other alternatives. No Action is a snapshot of the motorized use currently believed to be occurring on the Forest. The Travel Management Rule would not be implemented, no changes would be made to the transportation system, no permanent prohibition on motorized cross-country travel would exist, and no designated route system would be established. Public motor vehicle use of unauthorized routes would continue, and these routes would not have status as system routes.

Alternative 2 (Corrected Proposed Action). The Corrected Proposed Action incorporates minor changes to the Proposed Action based on public comment and the forest's field verification. For example, it removes proposed designations from roads that do not exist, or proposes to designate the more traveled

route as identified on the ground. It corrects alignments of routes and makes minor adjustments in the dispersed camping corridors.

Alternative 2 also adds motorized big game retrieval corridors in the same locations as the dispersed camping corridors to illustrate the effects of having *some* motorized big game retrieval as opposed to none (Alternative 3) or having it on all designated roads (Alternative 4). Though the Proposed Action did not originally proposed motorized big game retrieval, it lent itself best to showing the middle range of motorized big game retrieval.

Alternative 2 reduces the number of roads available for public motor vehicle use, increases the number of motorized forest system trails, and prohibits cross-country travel by motor vehicles. The fixed distance corridors are in two widths, 150- and 300 feet on either side of the road.

Alternative 3. Alternative 3 responds to concerns about negative impacts to natural resources from motorized use. This alternative would designate the fewest miles of motorized routes, have no motorized dispersed camping or motorized big game retrieval, and no areas. Alternative 3 also expanded some larger blocks of non-motorized areas by proposing no or a bare minimum of roads and motorized trails in them.

Alternative 4. Alternative 4 responds to the concerns about a lack of motorized access and recreational opportunities. Of the action alternatives, it proposes the most routes and areas desired by the public. It increases the amount of motorized dispersed camping available by including those places suitable for it but not currently being used as such and expanding the corridors to 300 feet on either side of the route. Alternative 4 also proposes to allow motorized big game retrieval up to 1 mile off of either side of any designated route during hunting season. Alternative 4 would provide more general access to the forest by designating more routes. It also increases the mileage of motorized trails and number of loops.

Alternative 5. Alternative 5 responds to the issue of conflict between motorized and non-motorized users. Alternative 5 would designate more motorized use in some parts of the forest, and less in others to enhance everyone's recreational experience. This alternative does not place any limits on non-motorized use; hikers, mountain bikers, and equestrians would still be able to use those routes designated for motorized use. Alternative 5 proposes some motorized dispersed camping, and some motorized big game retrieval within 1 mile of either side along major forest roads only.

REGULATORY FRAMEWORK

National Forest Management Act (NFMA) of 1976 as amended

"*Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area.*" (36 CFR 219.19)

Endangered Species Act (ESA) of 1973, as amended

Requires Federal agency, *"to insure that any action it authorizes, funds or carries out,... is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat."*

Forest Plan Direction

The 1987 Santa Fe National Forest Land and Resource Management Plan (as amended 1996 and 2004) outlines goals that describe "a desired condition" and which are "the end results" of implementing the Forest Plan (pg. 17). Specific goals for fisheries include:

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Goals and Objectives:

- Manage habitat to maintain viable populations of wildlife and fish species and improve habitat for selected species. Coordinate habitat management with other resource activities.
- Identify, protect and enhance habitat that contains threatened, endangered, and sensitive species of plants and animals to contribute toward the goal of species recovery.

In order to achieve these goals, standards and guidelines were developed to serve as "mitigation measures and coordinating requirements needed to protect resources and the environment (pg. 48)." Specific standards and guidelines associated with Santa Fe National Forest's fishery program include:

Forestwide Standards and Guidelines

- Inventory, evaluate, and improve areas of streams, lakes, and wetlands for cold water fisheries, especially the Rio Grande Cutthroat trout, water fowl and other water-related habitats (pg. 62).
- Monitor management practices within occupied and potential threatened or endangered species habitat and evaluate impacts (pg. 63).
- Continue activities to improve Rio Grande Cutthroat habitat with the objective of securing the species. Develop Rio Grande Cutthroat trout fisheries within selected areas identified in conjunction with the New Mexico Department of Game and Fish (pg. 64).
- "Cooperate with New Mexico Game and Fish in monitoring indicator species populations. Establish baseline data for indicator species habitat and monitor trend at ten year intervals (pg. 64)."
- Manage threatened and endangered animal, fish and plant habitats to achieve delisting in a manner consistent with goals established with the US Fish and Wildlife Service and the New Mexico Department of Game and Fish in compliance with approved recovery plans (pg. 64).
- Habitat requirements for TES species will take precedence over requirements for other species, and habitat requirements for sensitive species will take precedence over non sensitive species (pg. 64).
- Manage sensitive species to sustain viability and prevent the need for listing as threatened or endangered (pg. 65).
- "Protect the productivity and diversity of soil, water, vegetation, wildlife and fish resources prior to implementing projects (pg. 79)."
- Give preferential consideration to resources dependent on riparian areas over other resources when conflicts among uses arise (pg. 79)."
- Consider fisheries management objectives in the design of stream crossings (pg. 90).
- Minimize the area of impact of new and existing roads and trails on riparian zones and wet meadows (pg. 90).

Santa Fe National Forest Management Area Standards and Guidelines:

Management Area	Standards and Guidelines	Page #
C	▪ Wildlife emphasis is to enhance threatened or endangered species habitat, riparian habitat, and fisheries. ▪ Coordinate with recreation development and viewshed corridor planning to reduce impacts on T&E and sensitive species. ▪ Threatened or endangered species habitat management will emphasize reducing human disturbance and enhancement of riparian communities.	109
E	▪ Wildlife emphasis is to enhance game and non-game habitat and fisheries in a manner, which contributes to the recreation experience.	119
L	▪ The riparian zone will be evaluated for enhancement opportunities with specific considerations of possible contribution to threatened or endangered species	147

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Management Area	Standards and Guidelines	Page #
	recovery. ▪ In the east Fork of the Jemez River, wildlife management should emphasize late forest seral stage habitat, threatened or endangered species, and fisheries.	
Q	▪ Wildlife management is to emphasize game and non-game habitat in a manner which contributes to the recreation experience.	163
R	▪ Wildlife management will emphasize threatened or endangered species habitat enhancement, access management, riparian enhancement and even distribution of seral habitats.	167

METHODOLOGY

Analysis Area

Direct and Indirect Effects – The spatial bounds for the direct and indirect effects is the National Forest System lands (having species and habitats) within the proclaimed boundary of the Santa Fe National Forest because this is where the Forest has jurisdiction to designate motorized routes. The temporal bounds is from the publication of the motor vehicle use map, anticipated around 2010, to approximately 2025. The effects of this project will start with the publication of the motor vehicle use map, and 2025 is the next most likely time the Forest would reassess its method of managing motorized travel. Further, some routes would have revegetated or been repaired by that time.

Cumulative Effects: The spatial bounds for the cumulative effects analysis is the National Forest System lands within the proclaimed boundary of the Santa Fe National Forest because this is where the Forest has jurisdiction to designate motorized routes. The temporal bounds for the cumulative effects analysis is from 1987 through 2025 (refer to "Temporal Bounds and List of Projects for Cumulative Effects Analysis" in the project record).

Direct effects to animals and their habitat are based on the likelihood of the species or habitat being present. Species presence/absence determinations were based on habitat presence, fishery population surveys, recorded fish sightings and observations made during habitat inventory (snorkeling observations), and from existing databases such as BISON-M and others. Geographic Information System analysis was used extensively in the analysis of habitat amount, quality, and species distribution.

The following resource areas are discussed: management indicator species (MIS); threatened and endangered species, Regional Forester's Sensitive species, general fish populations. Only those specific threatened, endangered, and sensitive fish species that could be affected by the actions and occur in the project area are addressed in this document.

Assumptions

A number of assumptions regarding roads and trails have been developed by the Santa Fe National Forest Travel Management Team to facilitate the analysis of environmental impacts. The following assumptions were used in the development of this fisheries specialist report:

- With a restriction on public use, motorized use of administrative roads will be less than the existing use.

  Discussion: Pursuant to 36 CFR 212.5, the Forest estimated needing 1,428 miles of roads for adminstrative use (Travel Analysis Process report). These "administrative" roads fall under the exemptions listed in the Travel Management Rule (36 CFR 212.51 (a)(1) through (8)). Most of these roads are currently open to the public as well as the Forest Service and its permittees. After the

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designation process, use on the administrative roads would be limited to **only** the Forest Service and its permittees for things like repairing stock tanks or going to telecommunications sites. The Forest does not have data on the frequency with which the administrative roads are presently used, but it is reasonable to assume that use will decrease when public access is restricted.

- Temporary roads, trails and areas built to support emergency operations or temporarily authorized in association with contracts, permits, administrative use, or leases are not intended for public use. Any proposal to add these temporary roads, trails, and areas to the system will require a NEPA decision.

- Any routes not included in the decision are not precluded from consideration for addition to or obliteration from the Forest's transportation system in future travel management actions.

- The effects of motorized trails are the same as the effects of roads.
  Discussion: Though the tread width of a trail is less than a road, the incremental difference in effects at the forest scale is assumed to be negligible. The effects of roads and trails may vary greatly at specific locations; however, across the forest, it would not be possible to separate these effects.

- All motorized vehicles, such as motorcycles, ATVs, trucks, and cars, cause similar resource impacts. There may be some exceptions for some resources (e.g. noise).
  Discussion: No clear scientific agreement on the differences between vehicles exists for the forest to quantify differences in impacts between vehicle types.

- If a road is closed to all motorized use it will not receive any maintenance.

- The condition of roads and trails designated for motorized use will stay the same, or slightly improve, over current conditions and over time.
  Discussion: Roads and trails will continue to be maintained as needed and as the Forest's budget allows. Fewer miles of roads will be designated at the higher maintenance level, so funding can be used on more miles of road. For trails, the forest anticipates working with the many volunteers who wrote to comment to help with trail maintenance. Having seasonal closures in place will prevent motorized use and subsequent rutting during wetter seasons, thereby keeping roads in better condition.

- If a road is closed to all motorized use it will not receive any maintenance.

- The amount of administrative use of forest system roads is not expected to change between alternatives.
  Discussion: The access and maintenance needed to administer the forest is expected to remain constant. Permits for firewood collection, which will be modified to include motorized cross-country travel, will continue until specific collection areas are designated (expected over the next 2 to 5 years). Because the administrative and permitted uses are exempt, they are not included in the analysis.

- The amount of motorized dispersed camping will decrease along routes, but not disappear, in Alternative 3. Where motorized dispersed camping along routes continues, it is assumed to occur in the same "corridors" as Alternative 1 since these sites are already established.
  Discussion: Alternative 3 would not designate fixed distance corridors for motorized dispersed camping. People will be allowed, however, to park next to the road and camp, either next to their vehicles or by carrying gear in further by non-motorized means. The interdisciplinary team believes that, because of the restriction of not being able to drive directly to their campsite, some people will

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choose to go elsewhere or not camp, resulting in a decrease of use along routes. Some people will choose to park and camp anyways, and it is likely that they would go or return to established sites. The exact amount of the predicted decrease cannot be determined.

- Not every acre of corridors designated for motorized dispersed camping and motorized big game retrieval will be driven on.

  Discussion: Slope and vegetation limit motorized access in many places within the corridors. The Forest designated corridors in such a manner as to improve peoples' ability to read the map. For instance, the scale of the map would not facilitate designating corridors less than ½ mile in length.

- The estimated number of motorized trips to retrieve a downed big game animal would not change between alternatives, except for Alternative 3, which does not allow it.

  Discussion: The Forest has estimated the average number of downed big game animals at 438 per year (No Action Description, project record). This is likely to be a low estimate. Because the Forest does not have data on the locations of where big game is retrieved, we assumed that it occurred in the same places identified as having motorized cross-country travel, approximately 443,000 acres.

- For the purposes of this analysis, the amount of motorized dispersed camping is assumed to be constant between alternatives.

  Discussion: Assuming a constant use will display the potential effects of concentration, a concern of the public's. Though it is reasonable to assume that publication of fixed distance corridors on a map will draw more visitors to them, the exact amount of the increase cannot be accurately determined.

- The capability to enforce and the public's compliance with the motor vehicle use map would increase over the existing situation for all action alternatives.
  Discussion: Experience on the Forest shows that after an initial educational period, compliance with new rules and regulations increases over time.

- The Santa Fe National Forest does not have an accurate assessment of road/stream crossings. Therefore, the number of stream crossings presented in this document was estimated using Geographic Information System (GIS) data layers. There are some limitations with the data – for example, if a road segment comes close enough to the stream, GIS will mark it as a crossing, even though it may not actually cross the stream. An assumption is made that while the route may not actually cross the stream, its close proximity likely represents an area of acute road impacts (compaction, run-off). So while the absolute counts presented here may not be accurate, the data is considered sufficient to display effects because the same data sets were used for each alternative.

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ISSUE 1: MANAGEMENT INDICATOR SPECIES

The Santa Fe National Forest Plan (Forest Plan 1987) identifies eight Management Indicator Species (MIS) to represent a larger group of wildlife species presumed to share the same habitat requirements. The wildlife species include Bighorn sheep, Rocky Mountain elk, Mexican spotted owl, Merriam's turkey, hairy woodpecker, Piñon jay, mourning dove, and Rio Grande cutthroat trout. These species were selected for their association with plant communities or habitat which management activities are expected to affect. Other factors considered in the selection of these species were monitoring feasibility, migratory habitat, and habitat versatility (Forest Plan, p96). This report discusses the fish (Rio Grande cutthroat trout) only; refer to the Wildlife Report for a discussion of the other species.

Native Rio Grande cutthroat trout are afforded protections and legal obligations as a State Sensitive Species and Species of Greatest Conservation Need (New Mexico Department of Game and Fish 2006), a USDA-Forest Service Regional Forester's Sensitive Species, and a Santa Fe National Forest management indicator species (MIS). In May of 2008, the U.S. Fish and Wildlife Service completed a status review for Rio Grande cutthroat trout under the Endangered Species Act of 1973, and found that listing the species was warranted but precluded by higher priority actions. As a result of that review, Rio Grande cutthroat trout was included on the candidate species list "with a listing priority of 9, because the threats affecting it have a moderate magnitude and are imminent" (Federal Register May 14, 2008). In addition, due to its current risk of being formally listed under the protection of the Endangered Species Act, management agencies in Colorado and New Mexico have signed on to range-wide and state-wide conservation agreements specific to the species. The state-wide conservation agreement (USFS 2002) was signed and agreed upon by the Southwest Region of the Forest Service, New Mexico Department of Game and Fish, and the U.S. Fish and Wildlife Service. The agreement states that the Santa Fe National Forest shall "protect, maintain, and improve existing and potential Rio Grande cutthroat trout habitat and manage these watersheds and stream-riparian habitats to ensure long-term conservation and persistence of the subspecies." In order to achieve this, the Santa Fe National Forest shall "(p)revent or alleviate management related impacts that could degrade occupied or potential Rio Grande cutthroat trout habitat and/or impair current populations."

This is further complemented by the Conservation Agreement for Rio Grande Cutthroat Trout in the states of Colorado and New Mexico (RGCT Conservation Team 2009) which was signed and agreed upon by the Southwestern and Rocky Mountain Regions of the Forest Service, New Mexico Department of Game and Fish, Colorado Division of Wildlife, U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, New Mexico and Colorado Councils of Trout Unlimited, and Mescalero and Jicarilla Apache Nations. The overall goal of the agreement is to assure the long-term viability of Rio Grande cutthroat trout throughout their historic range. This is done by maintaining areas that currently support RGCT, managing other areas for increased abundance, establishing new populations where feasible, and the preserving the species genetic diversity. The agreement further states agencies agree to: "Secure and enhance watershed conditions" for RGCT.

The Forest and Rangeland Renewable Resources Planning Act of 1974 as amended by the National Forest Management Act (NFMA; 1976) states that Forests must develop Forest Plans that "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives (§1604(g)(3)(B). " Also, sensitive species "must receive special management emphasis to ensure their viability and to preclude trends towards endangerment that would result in Federal listing (FSM 2672.1)."

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AFFECTED ENVIRONMENT - Rio Grande Cutthroat Trout (*Oncorhynchus clarki virginalis*)

Rio Grande cutthroat trout (RGCT) is one of 14 subspecies of cutthroat trout native to the western United States (Behnke 2002). RGCT are found primarily in clear, cold mountain lakes and streams in Colorado and New Mexico within the Rio Grande Basin (Sublette et al. 1990). Isolated populations persist in southern New Mexico on the Gila National Forest in the Black Range (Sublette et al. 1990) and on the Mescalero Apache Indian Reservation in the Tularosa Basin. One disjunct population is found in the Canadian Drainage (part of the Arkansas Basin). On the Santa Fe National Forest (SFNF), RGCT exist in mountain streams in the Sangre de Cristo and Jemez Mountain ranges in tributaries to the Pecos, Chama, and Jemez rivers.

Rio Grande cutthroat trout spawn on the descending limb of the snowmelt hydrograph, which is typically from the middle of May to the middle of June in New Mexico (New Mexico Game & Fish 2002). An average water temperature of about 10°C (50°F) appears to be a key factor initiating spawning of RGCT (Stumpff 1998). Male cutthroat trout typically mature sexually at two years of age; whereas, females usually mature at three years (Irving 1954, Drummond and McKinney 1965). Depending on size, an individual female may deposit 2000-4500 eggs into a gravel nest, or redd. Sediment-free depositional gravel beds that have a continuous flow of well-oxygenated water are required for successful development of the embryos. Suitable gravels range from 6-40 mm in diameter (Magee et al. 1996, Harig and Fausch 1999). Hatching of RGCT is temperature dependent, occurring in 21 days at about 11°C (52°F). Juveniles need shallow calm water that is protected by the elements. Side channels, undercut banks and overhanging vegetation or exposed roots along margins provide this type of habitat. Adult RGCT need pools with residual depth greater than 1foot in order to survive harsh winter conditions (Harig and Fausch 2000). RGCT feed opportunistically on aquatic and terrestrial invertebrates that are found mainly in stream drift.

SFNF manages 1,072 miles of perennial stream length. Approximately 965 miles were thought to be historically occupied with RGCT prior to stocking of non-native trout (the first stocking record noted in New Mexico was in 1896 (Sublette et al. 1990)). As of May 2007, data collected by New Mexico Department of Game and Fish (NMDGF) and SFNF identifies 39 streams as occupied with RGCT, totaling 138.3 miles of occupied stream . Of these occupied stream miles, 47.0 miles are currently considered secure (no invasion of non-native fish).

The overall decline in RGCT numbers in New Mexico is attributed to many factors which include but are not limited to: 1) introduction of non-native trout species who either prey upon or hybridize with RGCT; 2) dewatering of streams for irrigation; and 3) altered stream habitat. Non-native trout introductions are the major culprit for decline of RGCT. German brown trout (*Salmo trutta*) were introduced in the early 1900's. They currently occupy most perennial streams on SFNF, but are no longer stocked. They are piscivorous and prey upon RGCT. This aggressive behavior limits productivity of RGCT and eventually leads to extirpation of the native fish in a given stream segment. Rainbow trout (*Oncorhynchus mykiss*) have been stocked in New Mexico since 1896 and are distributed throughout the state (Sublette et al. 1990) in cold-water streams and lakes. New Mexico Game and Fish (NMDGF) continually supplement populations with stocking. Rainbow trout hybridize with cutthroat trout and compete for food. Genetic introgression debilitates the gene pool, again limiting the productivity of RGCT. Rio Grande cutthroat trout cannot genetically survive when mixed with rainbow trout.

While the introduction of non-native fish and dewatering of streams have had direct effects on the range of RGCT, alteration of stream habitat rarely excludes populations of RGCT from persisting but can limit the size of a population. In stream sections where there are no non-native fish, defined as "secure" populations, RGCT population size is directly affected by availability and quality of habitat. In stream sections where non-native fish persist with RGCT, defined as "non-secure" populations, altered stream

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habitat in combination with competition, predation and hybridization from non-native fish can quickly reduce a RGCT population segment and result in a high likelihood of extirpation. In high quality habitat locations with introduced trout, RGCT populations have a lower probability of extirpation or can hold on for a longer period of time.

Altered stream habitat is attributed but not limited to: 1) fire suppression altering riparian habitats, delivery of large wood and nutrient cycling; 2) catastrophic wildfire altering run-off patterns which leads to channel-altering streamflows; 3) timber harvest and fuelwood consumption, removing current and potential large woody debris, as well as delivering non-point source pollutants; 4) grazing practices which alter floodplain dynamics and riparian habitats, destabilize streambanks, widen streams, introduce sediments, and increase nutrient loading; 5) road construction which encroaches on stream structure and floodplain dynamics, straightens channels, introduces non-point source pollutants, and hardens stream banks; and 6) dispersed and developed recreational practices (motorized and non-motorized trails, camping, etc.) which alter riparian habitats, harden floodplains, widen streams, increase non-point source pollutants, and remove stream structure.

Across the SFNF, fish habitat quality varies from poor to high (qualitative ranking is based on a matrix of variables outlined in the USFS Region 3 Stream Inventory protocol (USDA Forest Service 2005)). In high elevation locations where recreation and grazing access is limited by topography and wilderness regulations, stream habitat quality is moderate to excellent. In the lower elevations, poor habitat conditions and water quality are limiting factors to the size of RGCT populations. Poor habitat conditions can be attributed but not limited to a lack of in-stream large woody debris, sediment-filled pools, loss of undercut banks, depletion of beaver populations, lack of side channel development and poor riparian health. Decreased water quality can be attributed but not limited to soil compaction, road and trail run-off, unstable banks, and delivery of pollutants from non-point sources.

Roads and trails may affect stream channel form and function, including sediment delivery to streams with subsequent effects on aquatic habitat and biota. Much research exists that shows evidence of increased erosion and sediment delivery to streams from roads and trails (Gucinski et al. 2001). Roads disturb soils and increase the potential for erosion and sediment transport and deposition in streams (Furniss et al. 1991). Summer motorized and non-motorized uses on trails (motorcycles, ATVs, horses, mountain bikes, hikers) can also disturb soils and increase potential for erosion and sediment delivery. Sediment concerns are generally highest when roads and trails are not sufficiently drained, as water and sediment can concentrate on roads and trails during spring snowmelt runoff or periods of intense rain and be delivered to streams. However, with sufficient drainage, water and sediment can be diverted off of upland road and trail segments and filtered through forest vegetation, instead of being routed to streams (Furniss et al. 1991). As such, upland segments of roads and trails can generally be designed to mitigate sediment delivery to streams and wetlands.

Potential sediment effects to trout vary according to life-stage specific habitat requirements, habitat conditions (quality) and habitat availability (quantity) because different life-stages use different habitats. Adults typically prefer pool habitats and juveniles utilize pools, runs and some riffle habitats. Sediment effects on adult and juvenile trout can occur when sediment concentrations exceed the capacity of the channel and pools fill or riffles become more embedded, thus increasing the width/depth ratios of the stream. Young-of-the-year fish require low-gradient rearing areas like side channels and channel margins. Incubating eggs require clean spawning gravels. Adverse effects to young trout (egg through fry life stages) can occur when fine sediment concentrations increase in spawning gravels (Bjornn and Reiser 1991, Hicks et al. 1991). Increased fine-sediment in stream gravel has been linked to a decrease in fry emergence and juvenile fish densities, loss of winter carrying capacity, and increased predation of fishes. Increased fine sediment can reduce benthic organism populations and algal production (Gucinski et al. 2001). However, the effects of roads are not limited to those associated with increases in fine-sediment

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delivery to streams; they can include barriers to migration, water temperature changes (through loss of stream cover and slowing of water), and alterations to streamflow regimes. Improper culvert placement at road-stream crossings can reduce or eliminate fish passage (Belford and Gould 1989), and road crossings are a common migration barrier to fish (Furniss et al. 1991). Eaglin and Hubert (1993) detected a positive correlation with numbers of culverts and stream crossings and amount of fine sediment in stream channels, and a negative correlation with fish density and numbers of culverts in the Medicine Bow National Forest.

Issue 1: Effects to Forest Plan management indicator species (MIS) – Rio Grande cutthroat trout.

Measures:

- The miles of open, motorized roads and trails within 300 feet of streams occupied by Rio Grande cutthroat trout.
- The acres of land available for motorized dispersed camping and motorized cross-country travel ("areas") within 300 feet of streams occupied by Rio Grande cutthroat trout.
- The number of stream crossings for open, motorized roads and trails on fish-bearing streams.

Rational:

Studies have shown that roads are considered to have the highest potential for being a major long-term source of sediment in forested watersheds (Megahan and Kidd, 1972, Rice, Rothacher and Megahan, 1972). Additional studies have shown that road-related sediment can move as far as 300 feet via overland flow (Burroughs and King, 1989, Belt, O'Laughlin and Merrill, 1992). Based on this information, a buffer distance of 300 feet was selected for examining road and motorized cross-country trails adjacent to streams occupied by Rio Grande cutthroat trout, as sediment is one of the key threats to habitat quality.

ENVIRONMENTAL CONSEQUENCES FOR MIS – Rio Grande Cutthroat Trout

Table 1. Summary of miles of open, motorized road within 300 feet of streams occupied by Rio Grande cutthroat trout and the number of stream crossings.

Alternative	Alt 1	Alt2	Alt 3	Alt 4	Alt 5
Motorized routes (roads & trails)- miles	33.56	1.77	1.33	5.79	3.59
Motorized corridors* - miles	0.26 mi	0.26 Camp & MBGR	0	0.26 Camp & 5.59 MBGR	0.24 Camp
Motorized areas	998	0	0	0	0
Number of stream crossings on RGCT occupied streams	98	4	4	12	10

* Motorized corridors include those designated for camping (camp) and those designated for motorized big game retrieval (MBGR).

Direct effects are those effects which result in the direct mortality of Rio Grande cutthroat trout, or the destruction/ elimination of their habitat. Indirect effects are those effects which result in changes to fish habitat as a result of changes in the aquatic environment over time. These include alterations of stream channel sediment or woody debris delivery rates and amounts; modification of stream

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temperature regimes by reducing riparian shading, or changes in stream bank stability due to near-bank activities.

Effects Common to All Alternatives, including No Action

There are approximately 138 miles of occupied RGCT streams on the Santa Fe.
All action alternatives improve upon the current condition by reducing the miles of roads and trails open to vehicular traffic. In addition, many uninventoried motorized routes will be closed to vehicular use. These are user-developed or unauthorized routes that are not part of the Forest Service infrastructure and do not receive routine maintenance; as such, they are often not constructed in a manner that minimizes sediment delivery to streams.

Closing routes to vehicular traffic will have two effects on water resources:

1. Some of the closed roads will revegetate naturally, i.e. heal themselves,
2. Some of the closed roads will continue to create resource damage, because unpaved roads and compacted areas generate overland flow. Road cuts intercept surface and subsurface flow and the road network becomes an extension of the drainage network, routing run-off & sediment into the stream more rapidly (MacDonald and Stednick 2003).

The degree to which closed roads will recover on their own or continue to create resource issues is unknown. Those roads continuing to cause resource damage will be prioritized for future decisions regarding decommissioning or restoration to restore contours and native vegetation as appropriate to reduce erosion and compaction issues.

Potential impacts from motorized big game retrieval include cross-country vehicular travel through wetlands, riparian zones, and across streams inhabited by fish, which would increase the risk of sedimentation of key instream habitats. The potential impact is limited to the number of big game permits issued for units within the Forest, which average 438 per year (see Social and Economic Analysis Specialist Report). Motorized big game retrieval consists of a single or multiple cross-country trips to retrieve a downed animal. Not all permits issued result in a cross-country trip to retrieve an animal, because not all permits result in successful hunts (no animal to retrieve), and because some animals can be retrieved without a vehicle. There is insufficient information to identify where cross country trips will take place, so even distribution across the Forest is assumed. It is also assumed that motorized big game retrieval identified in Alternatives 2, 4, and 5 will result in 438 cross country two-way trips per hunting season on the Forest. Additionally, it is assumed that these trips will not create new motorized routes because in between hunting seasons, routes will have a year to naturally reclaim, and it is unlikely that game will be retrieved from the same area each year or multiple times within the year on the same track.

Alternative 1 – No Action

Direct/Indirect Effects – Alternative 1:

Alternative 1, Existing Condition, retains the existing motorized travel routes, along with their direct and indirect effects. Direct effects include continued vehicular traffic on motorized routes which either ford streams or which lie within the stream itself. Unfortunately, the Santa Fe National Forest does not have a current inventory of the number of low-water crossings (or fords) or an assessment of their condition. A few of these trails are well known, for example, including one off of Forest Road 422 which crosses Polvadera Creek several times and actually includes trail segments which run up the stream bed itself. Polvadera Creek is a 4th order stream originating from springs on the north side of the Jemez Mountains and is home to one of the Forest's "Core Conservation" populations of Rio Grande cutthroat trout,

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meaning this population has high (>99%) genetic purity and is deemed the "the highest priority for long range conservation management" (New Mexico Department of Game and Fish 2002). Unfortunately, a number of stressors, including the trail, have combined to create a stream in which riffle sediment content, pool development, and pool quality are "not properly functioning" (USDA Forest Service 2005). In addition, heightened stream temperatures led to Polvadera Creek being listed as impaired because it is not meeting the designated use set by New Mexico Environment Department as a high quality coldwater fishery. This is one example of the kind of direct effects that currently exist on several of the 33.56 miles of motorized roads and trails that run within 300 feet of occupied Rio Grande cutthroat (RGCT) trout habitat. These motorized routes cross RGCT occupied streams 98 times.

In addition to the 33.56 miles of motorized routes under Alternative 1, there are 0.26 miles of motorized camping corridors and 998 acres open to cross-country travel located within 300 feet of RGCT occupied streams. Indirect effects of these motorized routes, corridors, and areas include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. Alternative 1 is not likely to result in a loss of species viability although it has the greatest length of open motorized routes within 300 feet of occupied RGCT streams.

Alternative 2 – Modified Proposed Action

Direct/Indirect Effects – Alternative 2:

Alternative 2 closes 31.8 miles of motorized routes within 300 feet of occupied RGCT streams. In addition, the number of stream crossings on these occupied streams is reduced to 4 total (a reduction of 94 stream crossings from existing condition). Direct effects described for Polvadera Creek under Alternative 1 are eliminated, as that trail off of Forest Road 422 is proposed to be closed. In fact, there are no known low-water crossings, or fords, on any of the RGCT occupied streams under this Alternative.

In addition to the 1.77miles of motorized routes under Alternative 2, there are 0.26 miles of motorized camping corridors and 0 miles of motorized cross-country areas located within 300 feet of RGCT occupied streams. Indirect effects of these motorized routes proposed in Alternative 2 include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. However, the effects of this Alternative are greatly reduced from the Existing Condition. RGCT habitat should be greatly improved once the 31.8 miles of closed motorized routes begin to revegetate.

Alternative 3 –

Direct/Indirect Effects – Alternative 3:

Alternative 3 closes 32.2 miles of motorized routes within 300 feet of occupied RGCT streams. In addition, the number of stream crossings on these occupied streams is reduced to 4 total (a reduction of 94 stream crossings from existing condition). Direct effects described for Polvadera Creek under Alternative 1 are eliminated, as that trail off of Forest Road 422 is proposed to be closed. In fact, there are no known low-water crossings, or fords, on any of the RGCT occupied streams under this Alternative.

In addition to the 1.33 miles of motorized routes under Alternative 3, there are no motorized camping corridors or cross-country areas located within 300 feet of RGCT occupied streams. It is assumed that amount of motorized dispersed camping will decrease along routes, but not disappear under this Alternative. Campers may still park alongside the road and camp within the existing corridors at established dispersed campsites, but use is expected to decrease and vehicles will be prohibited from the riparian area. Indirect effects of these motorized routes proposed in Alternative 3 include

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alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. However, this Alternative has the least impact and provides the greatest improvement with regard to motorized routes along RGCT occupied habitat. RGCT habitat should be greatly improved once the 32.2 miles of closed motorized routes begin to revegetate.

Alternative 4 –

Direct/Indirect Effects – Alternative 4:

Alternative 4 closes 27.8 miles of motorized routes within 300 feet of occupied RGCT streams. In addition, the number of stream crossings on these occupied streams is reduced to 10 total (a reduction of 34 stream crossings from existing condition). Direct effects described for Polvadera Creek under Alternative 1 are retained, however, that trail off of Forest Road 422 is proposed to be open only seasonally for motorcycles. These are the only known low-water crossings, or fords, on any of the RGCT occupied streams under this Alternative. While the direct effects of operating motorized vehicles across and in a RGCT occupied stream are reduced from the existing condition through the seasonal restriction and through the restriction of motorcycles only, the impacts would still be evident. Wheels through the stream disturb soils and increase the potential for erosion and sediment transport and deposition in streams. In addition, the motorized use would be allowed during spawning season, so potential impacts include an increase in fine sediment spawning gravels, which is linked to a decrease in fry emergence and juvenile fish densities.

In addition to the 5.79 miles of motorized routes under Alternative 4, there are 0.26 miles of motorized camping corridors and 5.59 miles of motorized big game retrieval corridors located within 300 feet of RGCT occupied streams. Motorized big game retrieval (MBGR) will only be allowed during the appropriate hunting seasons and only for the retrieval of game. Impacts to RGCT occupied habitat from MBGR is expected to be minimal. Indirect effects of these motorized routes proposed in Alternative 4 include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. However, the effects of this Alternative, while greater than either Alternative 2 or 3, are reduced from the Existing Condition.

Alternative 5 –

Direct/Indirect Effects – Alternative 5:

Alternative 5 closes 29.97 miles of motorized routes within 300 feet of occupied RGCT streams. In addition, the number of stream crossings on these occupied streams is reduced to 10 total (a reduction of 88 stream crossings from existing condition). Direct effects described for Polvadera Creek under Alternative 1 are retained, however, that trail off of Forest Road 422 is proposed to be open only seasonally for motorcycles (same effect as under Alternative 4). These are the only known low-water crossings, or fords, on any of the RGCT occupied streams under this Alternative. While the direct effects of operating motorized vehicles across and in a RGCT occupied stream are reduced from the existing condition through the seasonal restriction and through the restriction of motorcycles only, the impacts will still be evident. Wheels through the stream disturb soils and increase the potential for erosion and sediment transport and deposition in streams. In addition, the motorized use will be allowed during spawning season, so potential impacts include an increase in fine sediment spawning gravels, which is linked to a decrease in fry emergence and juvenile fish densities.

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In addition to the 3.59 miles of motorized routes under Alternative 5, there are 0.24 miles of motorized camping corridors and 0 miles of motorized big game retrieval corridors located within 300 feet of RGCT occupied streams. Indirect effects of these motorized routes proposed in Alternative 5 include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. However, the effects of this Alternative, while greater than either Alternative 2 or 3, are reduced from the Existing Condition.

Determination:
Each alternative, including the No Action alternative, adds to the Forest's system of motorized routes. These routes were either constructed by the Forest during past activities and not identified in the current system or are user created and will be adopted into the Forest's system of motorized routes depending on the alternative selected. Alternative 1 is not likely to result in a loss of species viability even though it has the greatest length of open motorized routes within 300 feet of occupied RGCT streams. In general, a reduction in motorized use within 300 feet of occupied and potential Rio Grande cutthroat trout streams will decrease the potential for sedimentation of aquatic habitats. Alternative 3 results in the greatest reduction of miles of motorized routes within 300 feet of occupied habitat (32.2 miles), and the proposed alternative would result in a reduction of 31.8 miles. Selection of any of the action alternatives would not physically remove any motorized roads or trails; however, the reduction of vehicular traffic would reduce the potential for direct mortality and sedimentation. In addition, motorized cross country use would be reduced in all of the alternatives resulting in a reduction of potential impacts. Selection of any of the action alternatives are not likely to cause a loss of species viability because they improve on the current condition, even though individual Rio Grande cutthroat trout may be negatively impacted.

ISSUE 2. THREATENED, ENDANGERED SPECIES

Fish and Wildlife Service Listed Species and Critical Habitat– Santa Fe National Forest

Common Name	Taxon	FWS Status	Forest Status [1]
Rio Grande Silvery Minnow	*Hybognathus amarus*	Endangered	[1] N

[1] N = Does not occur within a Forest boundary; however, there are Forests that may need to consider indirect effects to the species which may occur off Forest.

NOTE: Rio Grande cutthroat trout, a candidate species, is also a Management Indicator Species (MIS) for the Santa Fe National Forest, and effects are addressed in the MIS section of the document.

AFFECTED ENVIRONMENT – Rio Grande Silvery Minnow *(Hybognathus amarus)*

The Rio Grande silvery minnow is listed as an endangered species under the protection of the Endangered Species Act (ESA). In addition to being federally listed under the ESA in 1994, the Rio Grande silvery minnow was listed as endangered by New Mexico (19 NMAC 33.1), Texas (sections 65.171 - 65.184 of Title 31 T.A.C.), and the Republic of Mexico (USFWS 2007).

Rio Grande silvery minnow was historically one of the most widespread and abundant fishes in New Mexico. In the Rio Grande, it ranged from the confluence of the Rio Chama near Española to the Gulf of Mexico, and in the Pecos River from near Santa Rosa to its confluence with the Rio Grande. Its current habitat is limited to about 7 percent of its former range and is fragmented by dams (Cochiti, Angostura,

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Isleta, and San Acacia) into four discrete reaches , Cochiti Reach (22.3 mi), Angostura Reach (40.4 mi), Isleta Reach (53.1 mi), and San Acacia Reach (58.2 mi). The species has been documented in the three lower reaches (Angostura, Isleta, and San Acacia), but due to access restrictions, it has not been sampled in the Cochiti Reach since 1995 (Platania and Dudley 2003), and the species appears to be extirpated from the reach upstream of Cochiti Reservoir. The last collection of Rio Grande silvery minnow from the Rio Chama was 1949, and the last collection of the minnow above Cochiti Lake was in the late 1970's, less than five years after the closure of that reservoir in 1975 (U.S. Fish and Wildlife Service 1999). The species appears to be limited to a 262-km (163-mi) reach of the Rio Grande from around Cochiti Dam downstream to Elephant Butte Reservoir in New Mexico, and a 2.8 mile stretch of the Lower Jemez River, between the Jemez Canyon Dam and its confluence with the Rio Grande (U.S. Fish and Wildlife Service 2007).

Rio Grande silvery minnow is a small, relatively heavy-bodied fish that is round to ovate in cross-section and rarely exceeds 100 mm (4 in) total length (U. S. Fish and Wildlife Service 1999). Live specimens are light greenish-yellow dorsally and light cream to white ventrally (U.S. Fish and Wildlife Service 2007). Until fairly recently, little was known of the life history and ecology of the Rio Grande silvery minnow (Sublette et al. 1990). The Rio Grande silvery minnow is a pelagic spawner that produces thousands of semibuoyant, non-adhesive eggs that passively drift downstream while developing (Platania and Altenbach 1998). This reproductive behavior and egg physiology is relatively common among fish species inhabiting the Rio Grande and the Pecos River (Platania and Altenbach 1998). Spawning by Rio Grande silvery minnow is associated with high-flow events such as spring runoff or summer rainstorms, and typically occurs over a relatively brief period (1 month) in May or June, although spawning can occur later in the season. Spawning takes place in the water column when water temperature is 20-24° C (68-75° F).

Rio Grande silvery minnow habitat includes silt substrates in areas of low or moderate water velocity (e.g., eddies formed by debris piles, pools, and backwaters). Rio Grande silvery minnow is rarely found in habitats with high water velocities, such as main channel runs, which are often deep and swift. The species is most commonly found in depths of less than 20 centimeters (7.9 inches) in the summer and 31-40 centimeters (12.2-15.75 inches) in the winter. Few use areas with depths greater than 50 centimeters (19.7 inches). Throughout much of its historic range, the decline of the Rio Grande silvery minnow may be attributed in part to destruction and modification of its habitat due to dewatering and diversion of water, water impoundment (incl. fragmentation of habitat and alterations of the natural hydrograph), and modification of the river (channelization). Competition and predation by introduced non-native species, water quality degradation, and other factors may also have contributed to its decline. While some of these threats have been reduced since the Rio Grande silvery minnow was listed as endangered, none have been eliminated (USFWS 2007).

Critical Habitat

The recovery plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 1999) and revised in 2007 (USFWS 2007). Critical habitat was designated for the silvery minnow on June 6, 2002 (USFWS 2002) and revised on February 19, 2003 (USFWS 2003). The critical habitat encompasses 252 km (157 miles) of the middle Rio Grande, from the Cochiti Dam downstream to the utility line at River Mile 62.1, just north of Elephant Butte Reservoir. The width of the critical habitat is defined as the area bound by existing levees, or, where no levees are present, as 91.4 meters (300 feet) of riparian zone adjacent to each side of the bankfull stage of the middle Rio Grande. The Pueblo lands of Santo Domingo, Santa Ana (including lands within the Jemez watershed), Sandia, and Isleta are excluded from this designation because specific management plans for the minnow were developed for these Pueblos prior to critical habitat designation (USFWS 2003).

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Activities associated with recovery of the Rio Grande silvery minnow have not been identified with NFS lands. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. It does, however, manage lands within watersheds that are source to the middle Rio Grande, and as a result, protective language found in the Forest-wide Standards & Guidelines relating to protection and management of Threatened and Endangered Species, riparian areas, watershed protection, roads and vegetation management apply to this species. The combined protection of key watershed components along with specific measures that seek to mitigate or minimize the effects of forest management projects will reduce or eliminate the potential for adverse indirect effects to Rio Grande silvery minnow (USFS 2004).

Issue 2: Effects to Fish and Wildlife Service threatened and endangered species – Rio Grande silvery minnow.

Measures:

- Combined open road and motorized route densities in watersheds (10-digit Hydrologic Unit Code) that are source to the Middle Rio Grande designated critical habitat for Rio Grande silvery minnow.

Rationale: Route density is used by the U.S. Fish and Wildlife Service (FWS) and National Oceanic and Atmospheric Administration's National Marine Fisheries (NOAA Fisheries) as one way to measure watershed condition as it relates to resident and andaromous fish in the Pacific Northwest. The joint agencies' general recommendation is that a given watershed should have less than 1.55 km/km² (2.5 mi/mi²) of road system; if in excess, that factor is considered to be not properly functioning. While the FWS and NOAA Fisheries recommendation is not a Regional standard, it was used to display effects on aquatic species in the Biological Assessment (BA) for the 11 Land & Resource Management Plans (LRMPs) of the National Forests and National Grasslands in the USDA Forest Service Southwestern Region (USDA Forest Service 2004a). That BA was prepared in response to a need for reinitiation of formal §7 consultation on the 11 LRMPs, and in that analysis, the route density of each watershed (10-digit Hydrologic Unit Code (HUC)) on each National Forest was compared to this recommendation.

In keeping with that analysis and the resulting §7 consultation, the route density threshold of 2.5 mi/square mile will be used to display the potential effects of each of the Travel Management alternatives on the Rio Grande silvery minnow "Route density" as calculated here includes only those roads and trails currently open or proposed to be open for public motorized use in one or more Alternatives. Although administrative use may occur on those roads not open to the public, use is assumed to be minimal (see Assumptions on page 3 of this analysis). The analysis area for this issue indicator is the portion of three 10-digit HUC watersheds within the Forest boundary that flow into the Middle Rio Grande silvery minnow critical habitat.

ENVIRONMENTAL CONSEQUENCES FOR T&E SPECIES – Rio Grande Silvery Minnow

Table 2. Combined open road and motorized route densities in watersheds (10-digit Hydrologic Unit Code) that are source to the Middle Rio Grande designated critical habitat for Rio Grande silvery minnow. Watershed area and road miles are tabulated for the portion of the watershed within the Forest boundary only.

Alternative	Area w/in SFNF (sq mi)	Existing road miles / density	Alternative 2 road miles/density	Alternative 3 road miles/density	Alternative 4 road miles/density	Alternative 5 road miles/density
HUC 1302020102 –	155.26	305.65 mi./ 1.97 mi/mi^2	155.82 mi/ 1.00 mi/mi^2	111.39 mi/ 0.72 mi/mi^2	203.38 mi/ 1.31 mi/mi^2	136.66 mi/ 0.88 mi/mi^2

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Alternative	Area w/in SFNF (sq mi)	Existing road miles / density	Alternative 2 road miles/density	Alternative 3 road miles/density	Alternative 4 road miles/density	Alternative 5 road miles/density
Canada Ancha – Rio Grande						
HUC 1302020103 – Headwaters Galisteo Creek	68.77	209.27 mi./ 3.04 mi/mi^2	69.49 mi/ 1.01 mi/mi^2	51.92 mi/ 0.75 mi/mi^2	92.85 mi/ 1.35 mi/mi^2	72.67 mi/ 1.06 mi/mi^2
HUC 1302020106 – Arroyo Tonque – Rio Grande	54.03	104.68 mi./ 1.94 mi/mi^2	47.08 mi/ 0.87 mi/mi^2	12.24 mi./ 0.23 mi/mi^2	56.51 mi./ 1.05 mi/mi^2	59.76 mi./ 1.11 mi/mi^2

Effects Common to All Alternatives, including No Action

All action alternatives improve upon the current condition by reducing the miles of roads and trails open to vehicular traffic. In addition, many of the un-inventoried motorized routes will be closed. These are routes that are not part of the Forest Service infrastructure and do not receive routine maintenance. As such, these user-developed or unauthorized routes are often not constructed in a manner that minimizes sediment delivery to streams. Closing them will allow the road or trail prism to revegetate naturally, i.e. heal itself. For other closed roads which continue to create resource damage, decisions may be made in the future to actively decommission the route or to manually restore contours and vegetation as appropriate to reduce erosion and compaction issues.

There are no Direct Effects to Rio Grande silvery minnow under any Alternative because the species is extirpated from the Forest. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. However, the Forest does manage lands within 5th- level watersheds (10-digit HUC) that drain into the Middle Rio Grande critical habitat for Rio Grande silvery minnow. These include:

- Canada Ancha – Rio Grande, HUC 1302020102
- Headwaters Galisteo Creek, HUC 1302020103
- Arroyo Tonque – Rio Grande, HUC 1302020106

Alternative 1 – No Action

Direct/Indirect Effects – Alternative 1:

There are no Direct Effects to Rio Grande silvery minnow because the species is extirpated from the Forest. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. It does, however, manage lands within watersheds that are source to the middle Rio Grande, and as a result, protective language found in the Forest-wide Standards & Guidelines relating to protection and management of Threatened and Endangered Species, riparian areas, watershed protection, roads and vegetation management apply to this species.

Under Alternative 1 (Existing Condition), road densities in the portions of two watersheds within the Forest boundary are well below the threshold of 2.5 miles/square mile (mi/mi^2; Table 2). In Canada

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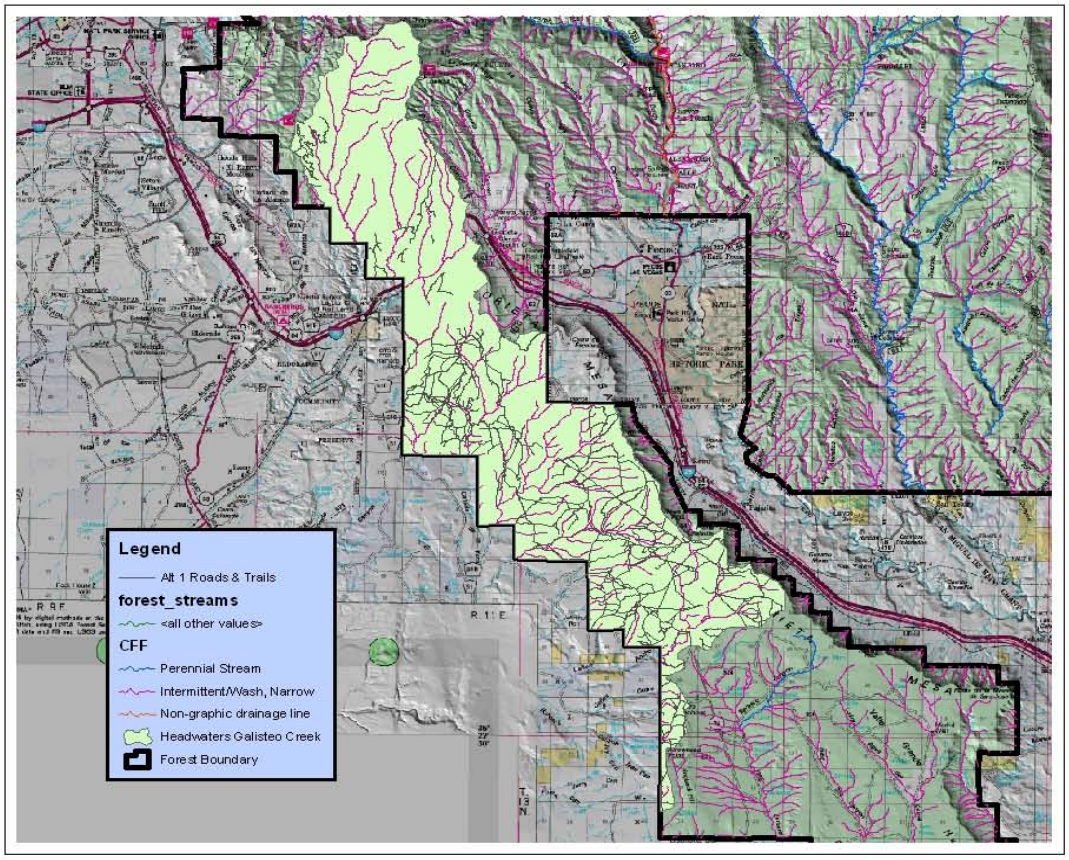

Figure 1. Alternative 1 roads, trails, and stream channels in Headwaters Galisteo Creek watershed (10-digit HUC) – aka Glorieta Mesa. Watershed is clipped to the National Forest boundary for

Ancha – Rio Grande, the existing route density is 1.97 mi/mi^2, and in Arroyo Tonque, route currently at 1.94 mi/mi^2. In Headwaters Galisteo Creek the existing route density is 3.04 mi/mi^2, which is above the FWS and NOAA Fisheries threshold for properly functioning watersheds. This watershed is in an area known as Glorieta Mesa, south and west of Pecos (Figure 1).

Although there are 104.7 miles of stream drainages on the portion of Glorieta Mesa within Headwaters Galisteo Creek watershed (Figure 1), the majority of those drainages are intermittent/wash (Cartographic Feature File (CFF) code 405). There is only ¼ mile of perennial water (CFF 402), and 1 ¼ mile of non-graphic drainage line (CFF 470). In addition, these intermittent drainages are many miles upstream of any perennial water, and more than 40 river miles from the Middle Rio Grande critical habitat. Any sediment that might be created by road erosion or compaction on the Mesa and is washed into an intermittent channel will likely settle out before it reaches perennial water.

While there could be adverse effects to the watershed from localized road or trail erosion, the route density of two Forest Service watersheds feeding into critical habitat for the Rio Grande silvery minnow is well below agency recommendation, and in one watershed (Headwaters Galisteo Creek) the route density is slightly over agency recommendations (3.04 mi/mi^2). However, this motor vehicle use on Forest Service roads and trails occurs many miles from Rio Grande silvery minnow occupied habitat, and is connected only by intermittent flows. Conchas, and other reservoirs, serve as a sink for water constituents that may impart some influence on silvery minnow populations. Effects should be absent or very minor. Therefore, Alternative 1 will result in an effects determination of **May Affect, Not Likely to Adversely Affect** for the Rio Grande silvery minnow.

Alternative 2 – Modified Proposed Action

Direct/Indirect Effects – Alternative 2:

There are no Direct Effects to Rio Grande silvery minnow because the species is extirpated from the Forest. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. It does, however, manage lands within watersheds that are source to the middle Rio Grande, and as a result, protective language found in the Forest-wide Standards & Guidelines relating to protection and management of Threatened and Endangered Species, riparian areas, watershed protection, roads and vegetation management apply to this species.

Under Alternative 2, road densities in the portions of all three watersheds within the Forest boundary that feed into Rio Grande silvery minnow critical habitat are well below the threshold of 2.5 miles/square mile (mi/mi^2; Table 2). In Canada Ancha – Rio Grande, the proposed route density for Alternative 2 is 1.00 mi/mi^2, and in Arroyo Tonque, route density would be at 0.87 mi/mi^2. In Headwaters Galisteo Creek, route density would drop to 1.01 mi/mi^2. Using this threshold of 2.5 mi/mi^2, these watersheds would be considered "properly functioning". Although there could be adverse effects to the watershed from localized road or trail erosion, the route density of these Forest Service watersheds feeding into critical habitat for the Rio Grande silvery minnow is well below agency recommendation, and effects should be absent or very minor. Therefore, Alternative 2 will result in an effects determination of **May Affect, Not Likely to Adversely Affect** for the Rio Grande silvery minnow.

Alternative 3 –

Direct/Indirect Effects – Alternative 3:

There are no Direct Effects to Rio Grande silvery minnow because the species is extirpated from the Forest. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. It does, however, manage lands within watersheds that are source to the middle Rio Grande, and as a result, protective language found in the Forest-wide Standards & Guidelines relating to protection and management of Threatened and Endangered Species, riparian areas, watershed protection, roads and vegetation management apply to this species.

Under Alternative 3, road densities in the portions of all three watersheds within the Forest boundary that feed into Rio Grande silvery minnow critical habitat drop significantly as many roads are proposed to be closed to motorized use. Route density is well below the threshold of 2.5 miles/square mile (mi/mi^2; Table 2) in all watersheds. In Canada Ancha – Rio Grande, the proposed route density for Alternative 3 is 0.72 mi/mi^2, and in Arroyo Tonque, route density would be at 0.23 mi/mi^2. In Headwaters Galisteo Creek, route density would drop to 0.75 mi/mi^2. Using this threshold of 2.5 mi/mi^2, these watersheds would be considered "properly functioning". Although there could be adverse effects to the watershed from localized road or trail erosion, the route density of these Forest Service watersheds feeding into critical habitat for the Rio Grande silvery minnow is well below agency recommendation, and effects should be absent or very minor. Therefore, Alternative 3 will result in an effects determination of **May Affect, Not Likely to Adversely Affect** for the Rio Grande silvery minnow.

Alternative 4 –

Direct/Indirect Effects – Alternative 4:

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There are no Direct Effects to Rio Grande silvery minnow because the species is extirpated from the Forest. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. It does, however, manage lands within watersheds that are source to the middle Rio Grande, and as a result, protective language found in the Forest-wide Standards & Guidelines relating to protection and management of Threatened and Endangered Species, riparian areas, watershed protection, roads and vegetation management apply to this species.

Under Alternative 4, road densities in the portions of all three watersheds within the Forest boundary that feed into Rio Grande silvery minnow critical habitat are still lower than those under Alternative 1 (Existing Condition), but increase slightly over the other Alternatives, as more roads are proposed to remain open to motorized use. Route density is still well below the threshold of 2.5 miles/square mile (mi/mi^2; Table 2) in all watersheds. In Canada Ancha – Rio Grande, the proposed route density for Alternative 4 is 1.31 mi/mi^2, and in Arroyo Tonque, route density would be at 1.05 mi/mi^2. In Headwaters Galisteo Creek, route density would increase to 1.35 mi/mi^2. Using this threshold of 2.5 mi/mi^2, these watersheds would all be considered "properly functioning". Although there could be adverse effects to the watershed from localized road or trail erosion, the route density of these Forest Service watersheds feeding into critical habitat for the Rio Grande silvery minnow is well below agency recommendation, and effects should be absent or very minor. Therefore, Alternative 4 will result in an effects determination of **May Affect, Not Likely to Adversely Affect** for the Rio Grande silvery minnow.

Alternative 5 –

Direct/Indirect Effects – Alternative 5:

There are no Direct Effects to Rio Grande silvery minnow because the species is extirpated from the Forest. Additionally, the Santa Fe National Forest does not manage lands within the area designated as critical habitat. It does, however, manage lands within watersheds that are source to the middle Rio Grande, and as a result, protective language found in the Forest-wide Standards & Guidelines relating to protection and management of Threatened and Endangered Species, riparian areas, watershed protection, roads and vegetation management apply to this species.

Under Alternative 5, road densities in the portions of three watersheds within the Forest boundary that feed into Rio Grande silvery minnow critical habitat are well below the threshold of 2.5 miles/square mile (mi/mi^2; Table 2) in all watersheds. In Canada Ancha – Rio Grande, the proposed route density for Alternative 5 is 0.88 mi/mi^2, and in Arroyo Tonque, route density would be at 1.11 mi/mi^2. In Headwaters Galisteo Creek, route density would decrease to 1.06 mi/mi^2. Using this threshold of 2.5 mi/mi^2, these watersheds would all be considered "properly functioning". Although there could be adverse effects to the watershed from localized road or trail erosion, the route density of these Forest Service watersheds feeding into critical habitat for the Rio Grande silvery minnow is well below agency recommendation, and effects should be absent or very minor. Therefore, Alternative 5 will result in an effects determination of May Affect, Not Likely to Adversely Affect for the Rio Grande silvery minnow.

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ISSUE 3: REGIONAL FORESTER'S SENSITIVE SPECIES

Regional Forester's Sensitive Species – Santa Fe National Forest		
Common Name	**Taxon**	**Forest Status [1]**
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	D
Rio Grande chub	*Gila Pandora*	D
Rio Grande sucker	*Catostomus plebeius*	D

[1] D = Documented, reliable, recorded observation, in appropriate habitat within the Santa Fe National Forest boundary.

Rio Grande chub (*Gila pandora*), Rio Grande sucker (*Catostomus plebeius*), and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) are all on the Regional Forester's sensitive species list. In the National Forest System, a sensitive species is a species for which population viability is a concern due to a current or predicted downward trend in population numbers or in habitat capability. The Rio Grande cutthroat trout is also a candidate species for the Endangered Species Act and a management indicator species.

AFFECTED ENVIRONMENT – Rio Grande Cutthroat Trout

On the Santa Fe National Forest, habitat for Rio Grande cutthroat trout occurs in several streams of the Pecos, Jemez, Rio Chama, Rio Grande, and Rio Puerco watersheds. Approximately 138 miles of 39 streams within the Forest are currently known to be occupied by the species. The habitat requirements and quantitative effects analysis for Rio Grande cutthroat trout is described in the Management Indicator Species section of this report (Issue 1: Management Indicator Species on page 7). However, the effects determinations for the Sensitive Species Environmental Consequences are inclusive of the Rio Grande cutthroat trout.

AFFECTED ENVIRONMENT – Rio Grande Chub

Rio Grande chub (*Gila Pandora*) are native to the Rio Grande basin of Colorado, New Mexico, and Texas. In New Mexico the species is also found in the Pecos River and Canadian drainages, although it may be been introduced in the latter (Calamusso 2005). The Rio Grande chub is not a federally listed species, but it has special status throughout its range. The USFS Region 2 and 3 list Rio Grande chub as a Regional Forester's Sensitive Species. In the National Forest System, a sensitive species is a species for which population viability is a concern due to a current or predicted downward trend in population numbers or in habitat capability that would reduce its distribution. The Bureau of Land Management considers the Rio Grande chub to be a sensitive species in Colorado (Rees et al. 2005).

Rio Grande chub has Natural Heritage Program global rank of G3 (vulnerable), a state rank of S1 (critically imperiled) in Colorado and Texas, and a state rank of S3 (vulnerable) in New Mexico. The G3 ranking signifies that the species has a small range in New Mexico, western Texas, and south-central Colorado. It has experienced large declines in distribution and abundance. The S (state) rankings signify that the species is critically imperiled because of extreme rarity or because of some factor of its biology that makes it especially vulnerable to extirpation from the state (NatureServe Explorer 2009). Colorado Division of Wildlife (CDOW) considers the Rio Grande chub a species of concern but does not provide statutory protection (http://wildlife.state.co.us/species_cons/list.asp). Although New Mexico has relatively stable populations of Rio Grande chub, it considers this species to be sensitive, and a Species of

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Greatest Conservation Need (New Mexico Department of Game and Fish 2006). Texas lists Rio Grande chub as threatened.

Rio Grande chub spawn in riffle habitat in the spring and early summer, with peak spawning occurring on the descending limb of the spring hydrograph. Rio Grande chubs are mid-water feeders that feed on insects, zooplankton, and small fish. They are generally found in streams less than 2% gradient in low velocity habitats such as pools, runs, and glides, and are often associated with instream woody debris or aquatic vegetation (Calamusso 2005).

Populations of Rio Grande chub have been reduced by degradation of habitat and introductions of non-native fishes (Calamusso 2005 and references therein). Nonnative fish species, including brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*), both prey on Rio Grande chub as well as compete with them for food and space. Habitat degradation includes habitat loss (dewatering), habitat fragmentation (barriers to migration; including dams, diversion structures, and undersized culverts), and habitat modification. Habitat modification includes modification of stream channels due to channelization, scouring, or sedimentation; changes in stream temperature and flow regimes; and degredation of water quality due to pollution (Rees et al. 2005). Roads and trails can impact stream channels, especially when located on highly erodible riparian soils, through erosion at stream crossings, and through poorly placed or undersized crossings which create barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of habitat occupied by Rio Grande chub. The increased sediment load can cover substrate, thereby diminishing suitable spawning habitat, and reducing fitness by decreasing the nutritional value of the food base. Severely reduced stream flows may lead to increased water temperatures, changes in the algal community, and reduced dissolved oxygen levels especially in smaller tributary systems (Rees et al. 2005).

On the Santa Fe National Forest, habitat for Rio Grande chub occurs in several streams of the Jemez, Santa Fe, Rio Chama, Rio Grande, Cañones, Rio Puerco, and Gallina watersheds. Approximately 250 miles of 12 streams within or proximate to the Forest are currently known to be occupied by the species.

AFFECTED ENVIRONMENT – Rio Grande Sucker

Rio Grande sucker (*Catostomus plebeius*) are native to the Rio Grande basin of Colorado, New Mexico, and Mexico. In New Mexico, the species is also found in the Mimbres River, and introduced populations are found in the Rio Hondo (Pecos drainage), Gila River basin, and San Francisco drainage. They are also found in six river basins draining four states in Mexico (Calamusso 2005). The Rio Grande sucker is not a federally listed species, but it has special status throughout its range. The USFS Region 2 and 3 list Rio Grande sucker as a Regional Forester's Sensitive Species. In the National Forest System, a sensitive species is a species for which population viability is a concern due to a current or predicted downward trend in population numbers or in habitat capability that would reduce its distribution (Rees et al. 2005).

Rio Grande sucker has Natural Heritage Program global rank of G3G4 (globally vulnerable but apparently secure), a state rank of S1 (critically imperiled) in Colorado and a state rank of S2 (imperiled) in New Mexico. The G3 ranking signifies that the species, although wide ranging, is declining in the north, due primarily to hybridization with introduced white sucker (*Catastomus commersoni*), although habitat modifications have also contributed to the decline. The S (state) rankings signify that the species is critically imperiled because of extreme rarity or because of some factor of its biology that makes it especially vulnerable to extirpation from the state (NatureServe Explorer 2009). Colorado Division of Wildlife (CDOW) considers the Rio Grande sucker a state endangered species

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(http://wildlife.state.co.us/species_cons/list.asp). Rio Grande sucker has no special state designation in New Mexico (Rees et al. 2005).

Rio Grande suckers (*Catostomus plebeius*) typically occur in middle elevation streams (6,600-8,600 feet) of small to large size (Sublette et al. 1990). On the Santa Fe National Forest, Rio Grande sucker are found in low gradient (<3.2%) stream reaches at elevations from 5,600 – 9,600 feet. Juveniles and adults both preferred glides and pools with mean water column velocities <20cm/s. They favor low to moderate gradient riffles and pools below riffles in low velocity stream reaches, and are usually found over gravel and /or cobble, but can also be in backwater habitats. (Calamusso 2005). Rio Grande suckers prefer clear-water streams where periphyton is common and are rarely found in waters with heavy loads of silt and organic detritus (Sublette et al. 1990).

Rio Grande suckers are the only catastomid endemic to the Rio Grande basin (Sublette et al. 1990). Their decline in range and numbers is directly related to the introduction of nonnative species, especially the white sucker. The impact of white sucker introductions, along with predation by nonnative brown trout (Salmo trutta), may cumulatively affect the health of Rio Grande sucker populations. In addition, declining habitat conditions make the natives less fit to compete with these nonnative species (Calmusso and Rinne 1999). Rio Grande sucker is reported to be primarily algivorous, with specialized jaws to scrape periphyton from substrates and an elongated gut to facilitate plant digestion (Sublette et al. 1990). Increased sediment deposition and the resultant loss of their algal food source is one mechanism by which habitat degradation may negatively influence Rio Grande sucker (Swift-Miller et al. 1999).

On the Santa Fe National Forest, habitat for Rio Grande sucker occurs in several streams of the Jemez, Santa Fe, Rio Chama, Rio Grande, Cañones, Rio Puerco, and Gallina watersheds. Approximately 299 miles of 18 streams within or proximate to the Forest are currently known to be occupied by the species.

Issue 3: Effects on Regional Forester's Sensitive fish species.

Measure:

- The miles of open, motorized road within 300 feet of streams occupied by Rio Grande cutthroat trout, Rio Grande sucker, and Rio Grande chub.
- The acres of land available for motorized dispersed camping and motorized cross-country travel ("areas") within 300 feet of streams occupied by Rio Grande cutthroat trout, Rio Grande sucker, and Rio Grande chub.

Rational:

Studies have shown that roads are considered to have the highest potential for being a major long-term source of sediment in forested watersheds (Megahan and Kidd, 1972, Rice, Rothacher and Megahan, 1972). Additional studies have shown that road-related sediment can move as far as 300 feet via overland flow (Burroughs and King, 1989, Belt, O'Laughlin and Merrill, 1992). Based on this information, a buffer distance of 300 feet was selected for examining road and motorized cross-country trails adjacent to streams occupied by Rio Grande chub and Rio Grande sucker, as sediment is one of the key threats to habitat quality.

ENVIRONMENTAL CONSEQUENCES – Rio Grande Chub & Rio Grande Sucker

Table 3. Summary of miles of open, motorized road within 300 feet of streams occupied by Rio Grande chub.

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Alternative	Alt 1	Alt2	Alt 3	Alt 4	Alt 5
Motorized routes (roads & trails)- miles	28.92	23.87	22.12	24.17	23.59
Motorized corridors*	11.81 Camp	7.79 Camp & MBGR	n/a	7.79 Camp & 22.5 MBGR	7.71 Camp & 0.04 MBGR
Motorized areas	1948.56	0	0	0	0
Stream Crossings	31	20	19	27	26

* Motorized corridors include those designated for camping (camp) and those designated for motorized big game retrieval (MBGR).

Table 4. Summary of miles of open, motorized road within 300 feet of streams occupied by Rio Grande sucker.

Alternative	Alt 1	Alt2	Alt 3	Alt 4	Alt 5
Motorized routes (roads & trails)- miles	34.83	28.29	26.52	28.66	28.01
Motorized corridors*	12.78 Camp	8.75 Camp & MBGR	n/a	8.75 Camp & 26.94 MBGR	8.68 Camp & 0 0.04 MBGR
Motorized areas	2146.85	0	0	0	0
Stream Crossings	63	26	25	33	32

* Motorized corridors include those designated for camping (camp) and those designated for motorized big game retrieval (MBGR).

Effects Common to All Alternatives, including No Action

All action alternatives improve upon the current condition by reducing the miles of roads and trails open to vehicular traffic. In addition, many uninventoried motorized routes will be closed to vehicular use. These are user-developed or unauthorized routes that are not part of the Forest Service infrastructure and do not receive routine maintenance; as such, they are often not constructed in a manner that minimizes sediment delivery to streams.

Closing routes to vehicular traffic will have two effects on water resources:

1. Some of the closed roads will revegetate naturally, i.e. heal themselves,
2. Some of the closed roads will continue to create resource damage, because unpaved roads and compacted areas generate overland flow. Road cuts intercept surface and subsurface flow and the road network becomes an extension of the drainage network, routing run-off & sediment into the stream more rapidly (MacDonald and Stednick 2003).

The degree to which closed roads will recover on their own or continue to create resource issues is unknown. Those roads continuing to cause resource damage will be prioritized for future decisions regarding decommissioning or restoration to restore contours and native vegetation as appropriate to reduce erosion and compaction issues.

Potential impacts from motorized big game retrieval include cross-country vehicular travel through wetlands, riparian zones, and across streams inhabited by fish, which would increase the risk of sedimentation of key instream habitats. The potential impact is limited to the number of big game permits

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issued for units within the Forest, which average 438 per year (see Social and Economic Analysis Specialist Report). Motorized big game retrieval consists of a single or multiple cross-country trips to retrieve a downed animal. Not all permits issued result in a cross-country trip to retrieve an animal, because not all permits result in successful hunts (no animal to retrieve), and because some animals can be retrieved without a vehicle. There is insufficient information to identify where cross country trips will take place, so even distribution across the Forest is assumed. It is also assumed that motorized big game retrieval identified in Alternatives 2, 4, and 5 will result in 438 cross country two-way trips per hunting season on the Forest. Additionally, it is assumed that these trips will not create new motorized routes because in between hunting seasons, routes will have a year to naturally reclaim, and it is unlikely that game will be retrieved from the same area each year or multiple times within the year on the same track.

Alternative 1 – No Action

Direct/Indirect Effects – Alternative 1:

Alternative 1 retains the existing motorized travel routes, along with their direct and indirect effects. Direct effects include continued vehicular traffic on motorized routes which either ford streams or which lie within the stream itself. Unfortunately, the Santa Fe National Forest does not have a current inventory of the number of low-water crossings (or fords) or an assessment of their condition. However, the 34.8 miles of motorized roads and trails located within 300 feet of occupied Rio Grande sucker habitat cross occupied streams 63 times. For Rio Grande chub, 28.9 miles of motorized roads and trails are located within 300 feet of occupied streams, and these routes create 31 stream crossings. Stream crossings, including but not limited to low water crossings, can impact habitat for both Rio Grande chub and sucker by serving as a sediment source especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of occupied habitat.

In addition to the motorized routes, there are 11.8 and 12.8 miles of motorized camping corridors located within 300 feet of Rio Grande chub and sucker, respectively. In addition, because current Forest policy allows motorized cross country travel, there are over 1,948 and 2,146 acres within 300 feet of occupied Rio Grande chub and sucker habitat, respectively, that are open for motorized use. Indirect effects of these motorized routes and motorized camping corridors and areas include alteration/elimination of streamside and riparian vegetation through soil compaction and hardening of the sites, increased potential for introducing sediment into the stream through unauthorized stream crossings, and increased potential for channelizing the stream in narrow canyon areas. This Alternative has the greatest length of open motorized routes and areas within 300 feet of occupied Rio Grande chub and sucker habitat, but the amount of habitat potentially impacted is relatively small, around 10%. For Rio Grande cutthroat, the amount of habitat potentially impacted under Alternative 1 is approximately 24%.

Alternative 2 – Modified Proposed Action

Direct/Indirect Effects – Alternative 2:

Alternative 2 closes 5.1 miles of motorized routes within 300 feet of occupied Rio Grande chub streams, and 6.5 miles of motorized routes within 300 feet of occupied Rio Grande sucker streams. The 23.9 miles of motorized roads and trails located within 300 feet of occupied Rio Grande chub habitat cross those streams 20 times (a reduction of 11 stream crossings from Alternative 1). For Rio Grande sucker, 28.3 miles of motorized roads and trails are located within 300 feet of occupied streams, and these routes create 26 stream crossings (a reduction of 37 crossings from Alternative 1). Stream crossings, including

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but not limited to low water crossings, can impact habitat for both Rio Grande chub and sucker by serving as a sediment source especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of occupied habitat.

Under Alternative 2, motorized camping corridors and cross-country areas are also reduced. For Rio Grande chub, 7.8 acres within 300 feet of occupied streams would be available for motorized dispersed camping and big game retrieval (a reduction of 4 acres from Alternative 1), and for Rio Grande sucker, 8.8 acres would be available for motorized dispersed camping and big game retrieval (a reduction of 4 acres from Alternative 1). Although the acreage proposed for motorized dispersed camping is less than that provided under Alternative 1, it is assumed that the use will not change, as campers will be creating additional sites in fewer designated areas (see Assumptions, page 4-5 of this report). Indirect effects of the motorized routes and areas proposed in Alternative 2 include alteration/elimination of streamside vegetation through soil compaction and hardening of the sites, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream. The proposed effects of designating motorized routes in this Alternative are slightly reduced from the Existing Condition, especially due to the substantial reduction in the number of crossings on streams occupied by Rio Grande sucker and, to a lesser degree, on streams occupied by Rio Grande chub.

Alternative 3 –

Direct/Indirect Effects – Alternative 3:

Alternative 3 closes 13.6 miles of motorized routes within 300 feet of occupied Rio Grande chub streams, and 8.3 miles of motorized routes within 300 feet of occupied Rio Grande sucker streams. The 22.1 miles of motorized roads and trails located within 300 feet of occupied Rio Grande chub habitat cross those streams 19 times (a reduction of 12 stream crossings from Alternative 1). For Rio Grande sucker, 26.5 miles of motorized roads and trails are located within 300 feet of occupied streams, and these routes create 25 stream crossings (a reduction of 38 crossings from Alternative 1). Stream crossings, including but not limited to low water crossings, can impact habitat for both Rio Grande chub and sucker by serving as a sediment source especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of occupied habitat. Reducing these direct impacts on habitat by limiting the number of stream crossings and reducing the overall mileage of open, motorized roads and trails within 300 feet of occupied habitat will improve conditions for both Rio Grande chub and Rio Grande sucker.

Under Alternative 3, motorized camping and big game retrieval corridors and cross-country areas are eliminated. It is assumed that amount of motorized dispersed camping will decrease along routes, but not disappear under this Alternative. Campers may still park alongside the road and camp within the existing corridors at established dispersed campsites, but use is expected to decrease and vehicles will be prohibited from the riparian area. Indirect effects of these off-road dispersed campsites are expected to be less than under the Existing Condition. The reduction of campers within 300 feet of occupied habitat, along with the elimination of vehicular traffic from streamside areas will increase the potential for re-vegetation of the stream banks and riparian areas, increase surface filtration of run-off, and decrease siltation and sedimentation of habitat. Indirect impacts of continued camping in Alternative 3 include alteration/elimination of streamside vegetation through soil compaction and hardening of the sites,

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increased potential for introducing sediment into the stream, and increased potential for channelizing the stream, but impacts are expected to be minimal, compared to the Existing Condition (Alternative 1). This Alternative has the least impact and provides the greatest improvement with regard to motorized routes and areas along habitat occupied by both Rio Grande chubs and suckers.

Alternative 4 –

Direct/Indirect Effects – Alternative 4:

Alternative 4 closes only 4.8 miles of motorized routes within 300 feet of occupied Rio Grande chub streams, and 6.3 miles of motorized routes within 300 feet of occupied Rio Grande sucker streams. The 23.7 miles of motorized roads and trails located within 300 feet of occupied Rio Grande chub habitat cross those streams 27 times (a reduction of 4 stream crossings from Alternative 1). For Rio Grande sucker, 28.1 miles of motorized roads and trails are located within 300 feet of occupied streams, and these routes create 33 stream crossings (a reduction of 30 crossings from Alternative 1). Stream crossings, including but not limited to low water crossings, can impact habitat for both Rio Grande chub and sucker by serving as a sediment source especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of occupied habitat. Although this Alternative reduces the direct impacts on occupied habitat by limiting the number of stream crossings and reducing the overall mileage of open, motorized roads and trails within 300 feet of occupied habitat, for Rio Grande chub in particular, the reductions are minimal.

Under Alternative 4, motorized camping and big game retrieval corridors and cross-country areas are emphasized. There are 7.8 and 8.8 miles of motorized camping corridors located within 300 feet of Rio Grande chub and sucker, respectively. In addition, more areas of the Forest would be available for motorized big game retrieval (MBGR) than proposed under the other action Alternatives, and 22.5 miles of this MBGR corridor lie within 300 feet of streams occupied by Rio Grande chub, while 26.9 miles lie within 300 feet of streams occupied by Rio Grande sucker. No motorized cross-country areas would be designated with 300 feet of streams occupied by either species. Although the acreage proposed for motorized big game retrieval and dispersed camping under Alternative 4 are less than that provided under Alternative 1, it is assumed that not every acre of corridors designated for motorized dispersed camping and motorized big game retrieval will be driven on. Slope and vegetation limit motorized access in many places within the corridors. Secondly, we assume that although the area available is less, the amount of motorized dispersed camping will not change between this Alternative and Alternative 1, as campers will be concentrated in and creating additional sites in fewer designated areas (see Assumptions, page 4-5 of this report). Indirect effects of these motorized routes and motorized camping corridors and areas include alteration/elimination of streamside and riparian vegetation through soil compaction and hardening of the sites, increased potential for introducing sediment into the stream through unauthorized stream crossings, and increased potential for channelizing the stream in narrow canyon areas. This Alternative has the greatest length of open motorized routes and motorized corridors within 300 feet of occupied Rio Grande chub and sucker habitat than any of the Action Alternatives.

Alternative 5 –

Direct/Indirect Effects – Alternative 5:

Alternative 5 closes 5.3 miles of motorized routes within 300 feet of occupied Rio Grande chub streams, and 6.8 miles of motorized routes within 300 feet of occupied Rio Grande sucker streams. The 23.5 miles

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of motorized roads and trails located within 300 feet of occupied Rio Grande chub habitat cross those streams 26 times (a reduction of 5 stream crossings from Alternative 1). For Rio Grande sucker, 28.0 miles of motorized roads and trails are located within 300 feet of occupied streams, and these routes create 32 stream crossings (a reduction of 32 crossings from Alternative 1). Stream crossings, including but not limited to low water crossings, can impact habitat for both Rio Grande chub and sucker by serving as a sediment source especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of occupied habitat. Although this Alternative reduces the direct impacts on occupied habitat by limiting the number of stream crossings and reducing the overall mileage of open, motorized roads and trails within 300 feet of occupied habitat, for Rio Grande chub in particular, the reductions are minimal.

Under Alternative 5, motorized dispersed camping and big game retrieval corridors are designated. There are 7.7 and 8.7 miles of motorized camping corridors located within 300 feet of Rio Grande chub and sucker, respectively. However, fewer areas of the Forest would be available for motorized big game retrieval (MBGR), and only 0.04 miles of this MBGR corridor lie within 300 feet of streams occupied by either Rio Grande chub or Rio Grande sucker. It is assumed that although the area available is less, the amount of motorized dispersed camping will not change between this Alternative and Alternative 1, as campers will be concentrated in and creating additional sites in fewer designated areas (see Assumptions, page 4-5 of this report). No motorized cross-country areas would be designated with 300 feet of streams occupied by either fish species. Indirect effects of these motorized routes and motorized camping corridors and areas include alteration/elimination of streamside and riparian vegetation through soil compaction and hardening of the sites, increased potential for introducing sediment into the stream through unauthorized stream crossings, and increased potential for channelizing the stream in narrow canyon areas.

Determination:

Rio Grande cutthroat trout, Rio Grande chub, and Rio Grande sucker are Forest Service Region 3 sensitive fish species that historically inhabited the Rio Grande basin. All three species are present in the project area and occupy stream habitat within 300 feet of proposed motorized routes and trails.

Alternative 1 may impact individuals but is not likely to result in a trend toward federal listing or a loss of species viability. Though it has the most motorized use of the alternatives, the amount of occupied habitat potentially impacted by these roads and trails is relatively small for Rio Grande chub and sucker, around 10%, and about 24% of the Rio Grande cutthroat trout habitat. The effects to these fish from motorized use would continue at the present rate. This means that routes, driving cross-country, and people would contribute to habitat degradation in some locations. Other locations would remain inaccessible to people and vehicles and not change. The motorized use in alternative 1 is not likely to greatly improve the conditions of streams – they would remain the same or get worse.

Overall, Alternatives 2 through 5 improve conditions for both of these species to varying degrees by reducing the number of road and trail crossings and by reducing the mileage of motorized roads and trails, dispersed camping and big game retrieval corridors within 300 feet of occupied habitat. Having less motorized use near streams reduces the potential for sedimentation in streams, which in turn improves habitat by keeping water clear and not changing the stream channel morphology. Reducing the places where people can drive in the Forest would allow some routes to revegetate naturally over time; others would not (refer to the Soil and Water section for a description of the time and likelihood of routes and areas regenerating). Routes on steep slopes are likely to continue contributing sediment until they are decommissioned.

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Revegetation of streambanks is most likely to occur under Alternative 3, because it does not allow driving off roads or trails. Under alternatives 2, 4, and 5, motorized use near streams – especially for camping - would not be entirely eliminated, although there would be an improvement when compared to alternative 1.

Limiting camping to fixed distance corridors is likely to cause an increase in new hardened sites since people won't be able to spread out as much as they do now (See Assumption #21). While there could be adverse effects to occupied streams from localized road or trail erosion under any of the action alternatives, the amount of occupied habitat potentially impacted is generally low (approximately 10% for both nongame species). Rio Grande chub occupies approximately 250 miles of 12 streams within or proximate to the Forest and Rio Grande sucker occurs in approximately 299 miles of 18 streams within or proximate to the Forest.

Overall, effects of the action alternatives (2,3,4,5) on the species are expected to be minor. Therefore, all of the action alternatives may impact individuals but are not likely to result in a trend toward federal listing or a loss of species viability.

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ISSUE 4: FISH-BEARING STREAMS

AFFECTED ENVIRONMENT – Fish-Bearing Streams

The Santa Fe National Forest encompasses approximately 1,000 miles of fish-bearing coldwater streams and 20 lakes, totaling nearly 430 acres. An additional 5,300 miles of non fish-bearing perennial, intermittent or ephemeral channels provide input into the fish-bearing streams. Watersheds of the Santa Fe drain primarily into the Rio Grande and Mississippi Basins.

Recreation use on the Forest is high, and fishing is a popular pastime, with nearly 150,000 angler days per year. In fact, the streams and lakes of the Santa Fe National Forest provide some of the best fishing in northern New Mexico. Of the 1,522,307 estimated site visits on the Santa Fe National Forest 2002-2003, 9.35% were participating in fishing (USDA Forest Service 2004b).

The Forest hosts regionally sensitive Rio Grande cutthroat trout, Rio Grande chub and Rio Grande sucker as well as nine other native large river fish (see Table 5). The Forest currently manages Rio Grande cutthroat trout as both a Sensitive Species and a Management Indicator Species, with specific standards and guidelines outlining its conservation in the Forest Plan (see page 7 of this report for the effects analysis relating to this species). Rio Grande chub and Rio Grande sucker are both Regional Sensitive Species (see page 21 of this report for the effects analysis relating to these species), and the federally Endangered Rio Grande silvery minnow has been extirpated from waters on the Santa Fe, but watersheds of the Forest drain into occupied Critical Habitat (see page 14 of this report for the effects analysis relating to this species). The American eel is likely extirpated, as is the Rio Grande form of bluntnose shiner (*Notropis simus simus*). The Pecos form of the bluntnose shiner (*Notropis simus pecosensis*) is located significantly downstream and outside of the influence of management practices from the Forest.

Table 5. Native Fish of the Santa Fe National Forest

Species Common Name	Species Scientific Name	Status
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	State and USFS Sensitive, MIS, candidate ESA, SGCN
Rio Grande chub	*Gila Pandora*	State and USFS Sensitive, SGCN
Rio Grande sucker	*Catostomus plebeius*	USFS Sensitive, SGCN
Rio Grande silvery minnow	*Hybognathus amarus*	Endangered, Extirpated from Forest, SGCN
American eel	*Anguilla rostrata*	Likely extirpated
Flathead chub	*Platygobio gracillis*	
Red shiner	*Cyprinella lutrensis*	
Bluntnose shiner	*Notropis simus*	State Endangered, Extirpated
Fathead minnow	*Pimephales promelas*	
Longnose dace	*Rhinichthys cataractae*	
River carpsucker	*Carpoides carpio*	
Mosquitofish	*Gambusia affinis*	
Bluegill	*Lepomis macrochirus*	
Speckled chub	*Macrhybopsis aestivalis aestivalis*	SGCN
Rio Grande shiner	*Notropis jemezanus*	State Endangered, Federally Threatened, SGCN, Extirpated in Rio Grande drainage
MIS = Management Indicator Species (USFS) SGCN = New Mexico Species of Greatest Conservation Need		

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Many of these extirpations are the result of extreme changes in management of the Rio Grande. However, impacts to the native species are also due to the presence and active management of non-native fish species, several of which reside in streams and lakes of the Santa Fe. Most notably, rainbow (*Oncorhynchus mykiss)*, brown (*Salmo trutta)*, brook (*Salvelinus fontinalis)* and various sub-species of cutthroat trout (*Oncorhynchus clarki)* have been stocked on the Forest as early as 1896 and populate nearly all fish-bearing streams and lakes. These non-native, but naturalized, species impact native fish species through competition for food and habitat, direct predation on the species, or hybridization, which reduces fitness of the native species.

Elevation of the Forest ranges from about 5,300 feet along the Rio Grande to 13,100 at the summit of Truchas Peak. The streams support a primarily coldwater fishery dominated by rainbow and brown trout. Rio Grande cutthroat trout are generally restricted to the higher elevation streams behind manmade or natural barriers which restrict the non-native species. In a recent research study commissioned by the New Mexico Department of Game and Fish to assess angler satisfaction with fishing experiences in New Mexico, a random sample of 301 resident anglers and 101 non-resident anglers were interviewed by telephone. Telephone numbers were generated by Research & Polling from a database of residents and non-residents who purchased a New Mexico fishing license in 2008. Thirty-seven percent of anglers who fished for cold water species said they choose their fishing locations based on where fish such as rainbow trout have been recently stocked, while 33% of the cold-water anglers chose their fishing locations based on where they expected to find wild fish such as brown or cutthroat trout. One-in-five cold water anglers said they look for both qualities when choosing a location (New Mexico Department of Game & Fish Angler Satisfaction Survey April 2009).

Roads and trails may affect stream channel form and function, including sediment delivery to streams with subsequent effects on aquatic habitat and biota. Much research exists that shows evidence of increased erosion and sediment delivery to streams from roads and trails (Gucinski et al. 2001). Roads disturb soils and increase the potential for erosion and sediment transport and deposition in streams (Furniss et al. 1991). Summer motorized and non-motorized uses on trails (motorcycles, ATVs, horses, mountain bikes, hikers) can also disturb soils and increase potential for erosion and sediment delivery. Sediment concerns are generally highest when roads and trails are not sufficiently drained, as water and sediment can concentrate on roads and trails during spring snowmelt runoff or periods of intense rain and be delivered to streams. However, with sufficient drainage, water and sediment can be diverted off of upland road and trail segments and filtered through forest vegetation, instead of being routed to streams (Furniss et al. 1991). As such, upland segments of roads and trails can generally be designed to mitigate sediment delivery to streams and wetlands.

The effects of roads are not limited to those associated with increases in fine-sediment delivery to streams; they can include barriers to migration, water temperature changes (through loss of stream cover and slowing of water), and alterations to streamflow regimes. Improper culvert placement at road-stream crossings can reduce or eliminate fish passage (Belford and Gould 1989), and road crossings are a common migration barrier to fish (Furniss et al. 1991). Eaglin and Hubert (1993) detected a positive correlation with numbers of culverts and stream crossings and amount of fine sediment in stream channels, and a negative correlation with fish density and numbers of culverts in the Medicine Bow National Forest. Roads and trails can also fragment aquatic habitats where stream crossings create barriers for upstream movement of fish (Furniss et al. 1991). This typically occurs where culverts and fords are not designed to allow for upstream fish and amphibian passage. Crossings with culverts can be barriers usually because of outfall barriers, excessive velocities, insufficient water depths, disorienting turbulent flow patterns, lack of resting pools below the barrier or a combination of these conditions. Fish upstream of the barrier are then geographically and reproductively isolated from the

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downstream population. Habitat fragmentation can reduce viability of fish populations by a variety of stochastic, deterministic and genetic mechanisms (e.g., Rieman et al. 1993).

Issue 4: Effects on fish-bearing streams

Measure:

- The miles of open, motorized roads and trails within 300 feet of fish-bearing streams.
- The acres of land available for motorized dispersed camping and motorized cross-country travel ("areas") within 300 feet of fish-bearing streams.
- The number of stream crossings for open, motorized roads and trails on fish-bearing streams

Rational:

Studies have shown that roads are considered to have the highest potential for being a major long-term source of sediment in forested watersheds (Megahan and Kidd, 1972, Rice, Rothacher and Megahan, 1972). Additional studies have shown that road-related sediment can move as far as 300 feet via overland flow (Burroughs and King, 1989, Belt, O'Laughlin and Merrill, 1992). Based on this information, a buffer distance of 300 feet was selected for examining road and motorized cross-country trails adjacent to perennial fish-bearing streams, as sediment is one of the key threats to habitat quality.

ENVIRONMENTAL CONSEQUENCES – Fish-Bearing Streams

Table 5. Summary of miles of open, motorized roads, trails, and areas within 300 feet of perennial, fish-bearing streams and the number of stream crossings on those routes.

Alternative	Alt 1	Alt2	Alt 3	Alt 4	Alt 5
Motorized routes (roads & trails)- miles	365.85	203.91	175.76	228.51	211.15
Motorized corridors *	39.64 camp	34.45 camp & MBGR	0	39.1 camp + 198.11 MBGR	27.94 camp + 27.55 MBGR
Motorized areas	16,802.73	0	0	0	0
Stream crossings on perennial streams	967	479	355	570	561

* Motorized corridors include those designated for camping (camp) and those designated for motorized big game retrieval (MBGR).

Effects Common to All Alternatives, including No Action

All action alternatives improve upon the current condition by reducing the miles of roads and trails open to vehicular traffic. In addition, many uninventoried motorized routes will be closed to vehicular use. These are user-developed or unauthorized routes that are not part of the Forest Service infrastructure and do not receive routine maintenance; as such, they are often not constructed in a manner that minimizes sediment delivery to streams.

Closing routes to vehicular traffic will have two effects on water resources:

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1. Some of the closed roads will revegetate naturally, i.e. heal themselves,
2. Some of the closed roads will continue to create resource damage, because unpaved roads and compacted areas generate overland flow. Road cuts intercept surface and subsurface flow and the road network becomes an extension of the drainage network, routing run-off & sediment into the stream more rapidly (MacDonald and Stednick 2003).

The degree to which closed roads will recover on their own or continue to create resource issues is unknown. Those roads continuing to cause resource damage will be prioritized for future decisions regarding decommissioning or restoration to restore contours and native vegetation as appropriate to reduce erosion and compaction issues.

Potential impacts from motorized big game retrieval include cross-country vehicular travel through wetlands, riparian zones, and across streams inhabited by fish, which would increase the risk of sedimentation of key instream habitats. The potential impact is limited to the number of big game permits issued for units within the Forest, which average 438 per year (see Social and Economic Analysis Specialist Report). Motorized big game retrieval consists of a single or multiple cross-country trips to retrieve a downed animal. Not all permits issued result in a cross-country trip to retrieve an animal, because not all permits result in successful hunts (no animal to retrieve), and because some animals can be retrieved without a vehicle. There is insufficient information to identify where cross country trips will take place, so even distribution across the Forest is assumed. It is also assumed that motorized big game retrieval identified in Alternatives 2, 4, and 5 will result in 438 cross country two-way trips per hunting season on the Forest. Additionally, it is assumed that these trips will not create new motorized routes because in between hunting seasons, routes will have a year to naturally reclaim, and it is unlikely that game will be retrieved from the same area each year or multiple times within the year on the same track.

Alternative 1 – No Action

Direct/Indirect Effects – Alternative 1:

Alternative 1, Existing Condition, retains the existing motorized travel routes, along with their direct and indirect effects. Direct effects include continued vehicular traffic on motorized routes which either ford streams or which lie within the stream itself. Unfortunately, the Santa Fe National Forest does not have a current inventory of the number of low-water crossings (or fords) or an assessment of their condition. A GIS query of roads and trails within 300 of fish bearing streams, shows that the motorized routes create 967 stream crossings (see Assumptions, page 6 of this report, for an explanation of the limitations of using GIS for this analysis). With 365.8 miles of road within 300 feet of perennial, fish-bearing streams, this equals approximately 2.6 stream crossings per mile of stream. Stream crossings, including but not limited to low water crossings, can impact habitat for most fish species by serving as a potential sediment source, especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision). These modifications alter width:depth ratios, pool:riffle ratios, and other aspects such as pool depth that affect the quality of occupied habitat.

In addition to the 365.8 miles of motorized routes under Alternative 1, there are 39.6 miles of motorized camping corridors and 16,802.7 acres open to cross-country travel within 300 feet of perennial, fish-bearing streams. Indirect effects of these motorized routes, corridors, and areas include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. This Alternative has

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the greatest length of open motorized routes within 300 feet of perennial, fish-bearing streams, and the greatest potential to negatively impact the quality of fish-bearing streams.

Alternative 2 – Modified Proposed Action

Direct/Indirect Effects – Alternative 2:

Alternative 2, Modified Proposed Action, reduces the number and mileage of existing motorized travel routes within 300 feet of perennial, fish-bearing streams and their stream crossings by almost one-half. Under Alternative 2, 203.9 miles of motorized roads and trails would be designated "open" within 300 feet of fish-bearing streams (a 44% reduction from Alternative 1), These roads cross fish-bearing streams 479 times (a 51% reduction from Alternative 1); approximately 2.4 stream crossings per mile of stream. Stream crossings, including but not limited to low water crossings, can impact habitat for most fish species by serving as a potential sediment source, especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision, loss of pool depth) that affect the quality of occupied habitat. Reducing the number and mileage of motorized routes and stream crossings by nearly one-half is a benefit to fish-bearing streams.

In addition to the 203.9 miles of motorized routes under Alternative 2, there are 34.5 miles of motorized camping and big game retrieval corridors (a 5.2 acre reduction from Alternative 1). No "areas" open to cross-country travel other than these corridors are within 300 feet of perennial, fish-bearing streams. Indirect effects of these motorized routes, corridors, and areas include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas.

Alternative 3 –

Direct/Indirect Effects – Alternative 3:

Alternative 3 reduces the number and mileage of existing motorized travel routes within 300 feet of perennial, fish-bearing streams and their stream crossings by over one-half. Under Alternative 3, 175.8 miles of motorized roads and trails would be designated "open" within 300 feet of fish-bearing streams (a 52% reduction from Alternative 1). These roads cross fish-bearing streams 355 times (a 63% reduction from Alternative 1); approximately 2.0 stream crossings per mile of stream. Stream crossings, including but not limited to low water crossings, can impact habitat for most fish species by serving as a potential sediment source, especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision, loss of pool depth) that affect the quality of occupied habitat. Reducing the number and mileage of motorized routes and stream crossings by well over one-half is a benefit to fish-bearing streams.

Under Alternative 3, there are no motorized camping and big game retrieval corridors and no "areas" open to cross-country travel. It is assumed that amount of motorized dispersed camping will decrease along routes, but not disappear under this Alternative. Campers may still park alongside the road and camp within the existing corridors at established dispersed campsites, but use is expected to decrease and vehicles will be prohibited from the riparian area. Indirect impacts of off-road dispersed campsites in Alternative 3 include some alteration/elimination of streamside vegetation through soil compaction and hardening of the sites resulting in the potential for introducing sediment into the stream, but impacts are

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expected to be minimal, compared to the Existing Condition (Alternative 1). The reduction of campers within 300 feet of occupied habitat, along with the elimination of vehicular traffic from streamside areas will increase the potential for re-vegetation of the stream banks and riparian areas, increase surface filtration of run-off, and decrease siltation and sedimentation of habitat. This Alternative has the least impact and provides the greatest improvement with regard to motorized routes and areas along perennial, fish-bearing streams.

Alternative 4 –

Direct/Indirect Effects – Alternative 4:

Under Alternative 4, 228.5 miles of motorized roads and trails would be designated "open" within 300 feet of fish-bearing streams, a reduction of only 38% from Alternative 1. These roads cross fish-bearing streams 570 times (a 41% reduction from Alternative 1); approximately 2.5 stream crossings per mile of stream. Stream crossings, including but not limited to low water crossings, can impact habitat for most fish species by serving as a potential sediment source, especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision, loss of pool depth) that affect the quality of occupied habitat. However, reducing the number and mileage of motorized routes and stream crossings is a benefit to fish-bearing streams.

In addition to the 228.5 miles of motorized routes under Alternative 2, there are 39.1 miles of motorized camping (a 0.5 acre reduction from Alternative 1)and 198.1 miles of big game retrieval corridors. No "areas" open to cross-country travel other than these corridors are within 300 feet of perennial, fish-bearing streams. Indirect effects of these motorized routes, dispersed camping corridors, and big game retrieval corridors include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas. This Alternative has the greatest length of open motorized routes and motorized corridors within 300 feet of perennial, fish-bearing streams of any of the action Alternatives, and poses the greatest potential for negative impacts.

Alternative 5 –

Direct/Indirect Effects – Alternative 5:

Under Alternative 5, 211.2 miles of motorized roads and trails would be designated "open" within 300 feet of fish-bearing streams, a reduction of 42% from Alternative 1. These roads cross fish-bearing streams 561 times (a 42% reduction from Alternative 1); approximately 2.7 stream crossings per mile of stream. Although the miles of motorized roads and trails designated "open" is reduced, the number of times those roads cross streams actually increases 0.1% from the Existing Condition (Alternative 1). Stream crossings, including but not limited to low water crossings, can impact habitat for most fish species by serving as a potential sediment source, especially when located on highly erodible soils. In addition, poorly placed or undersized crossings can create physical barriers. These can all lead to an increase in the stream sediment load and a subsequent change in stream channel geometry (e.g., widening, incision, loss of pool depth) that affect the quality of occupied habitat. While reducing the number and mileage of motorized routes is a benefit to fish-bearing streams, maintaining, or slightly increasing the number of stream crossings is a negative impact.

In addition to the 211.2 miles of motorized routes under Alternative 5, there are 27.9 miles of motorized camping (an 11.7 acre reduction from Alternative 1) and 27.6 miles of big game retrieval corridors. No

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"areas" open to cross-country travel other than these corridors are within 300 feet of perennial, fish-bearing streams. Indirect effects of these motorized routes, dispersed camping corridors, and big game retrieval corridors include alteration/elimination of streamside vegetation, increased potential for introducing sediment into the stream, and increased potential for channelizing the stream in narrow canyon areas.

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Cumulative Effects Common to Action Alternatives

Cumulative effects are the combined impacts of past, present and reasonably foreseeable events on fish and their habitats. These habitats have been altered in many cases by mining, recreation, grazing, vegetation management, road and trail construction, and other factors. Activities considered in the cumulative effects analysis include those directly modifying fish habitat as well as those indirectly modifying sediment delivery and hydrologic regimes.

These activities include past road construction and stabilization, development of access to oil and gas and mining claims, vegetation management and associated road development, grazing, dispersed and developed recreation and associated authorized and unauthorized road development, trail creation and maintenance, and past wildfires. The following analysis was derived by reviewing the compilation of past, present, and reasonably foreseeable programs and activities.

Past Actions (1987 – 2009)
Past actions on the Santa Fe National Forest that are relevant to the discussion of cumulative effects on fish and their habitats include: subdivision and development of private inholdings and access to them, past road construction and stabilization for access across the Forest, development of access to oil and gas and mining claims, vegetation management and associated road development, grazing, dispersed and developed recreation and associated authorized and unauthorized road development, trail creation and maintenance, and past wildfires. The cumulative effect of these past programs and activities was a reduction in aquatic habitat quantity and quality which affected native fish, including Rio Grande cutthroat, chubs and suckers. However, these effects are highly variable and localized. Since the last collection of Rio Grande silvery minnow from the Rio Chama was in 1949, and the last collection from the Rio Grande above Cochiti Lake was in the late 1970's following construction of Cochiti Dam, it is unlikely that these activities had much effect on that species.

During the mid-to-latter part of this period 1987-2009, the Forest implemented several programs and activities to improve (or with a side benefit of improving) management of aquatic resources. These included development of management plans for Wild and Scenic rivers that restricted the type of access in those Management Areas, creation of the Jemez National Recreation Area, road decommissioning and obliteration, improvements to roads and trails impacting watersheds through the 10% Fund (now Legacy Roads program), and finally, development and implementation of Respect the Rio, an education-based program promoting river-friendly camping in the Jemez Watershed.

Present or Reasonably Foreseeable Actions (2009-2025)
In general, present programs and activities are either maintaining or reducing impacts on native fish and their habitats, with an overall beneficial effect. These activities include road reconstruction and road decommissioning (i.e. Forest Roads 612, 87, 488, 10J), stream crossing modification (i.e. State Highway 4), reanalysis and modification of range management permits, reduced timber harvest, trail improvements and dispersed campsite modification in the Jemez Watershed through Respect the Rio (ongoing partnership), and the future expansion of this program to the Upper Pecos Watershed. Watershed and fish population and habitat restoration projects, including the Peralta, San Antonio, and Cañones watershed improvement projects, and the Polvadera CWA §319 partnership, provide locally significant beneficial effects to native Rio Grande cutthroat trout, chubs, suckers, and other native or naturalized fishes.

Although some programs and activities may have localized short-term negative effects on fish and their habitats, the cumulative effects of present and reasonably foreseeable programs and activities, including the reduction of open, motorized roads and trails and cross-country travel through designation under the Travel Management Rule, are generally beneficial. Remaining degraded aquatic habitats will continue to

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be targeted for restoration. Management plans and/or range improvements will be updated in range allotments with degraded riparian and stream habitats, and additional roads and stream crossings will be modified to improve aquatic organism passage and reduce impacts to stream channels and fish habitat.

EFFECTS OF PLAN AMENDMENTS

Forest Plan amendments would be required to keep the action alternatives (2-5) in conformance with the Forest Plan, because the proposed motorized use is not consistent with current Plan direction for several Management Areas. In addition, a forestwide amendment is necessary to modify the language in the Plan to close the entire Forest (except designated routes and areas) to cross-country travel, except in designated areas, and to remove the lower bounds of route density. These amendments would have no additional effects on fish or their habitats beyond what was analyzed in the direct and indirect effects by alternative.

In some instances, amendments would change boundaries of Management Areas to legitimize designated motorized routes or motorized dispersed camping which is currently occurring in Management Areas that are closed to motorized use or cross-country travel. These include Management Areas I, L, N, and X. In most cases, these amendments would result in changing a given area's current Management Area designation to one that more accurately reflects the motorized use that is already occurring on the ground (existing condition). As a result, these changes or effects are considered in the analysis of the direct and indirect effects of the alternatives, and these proposed Forest Plan amendments would have no additional effects on fish or their habitats.

An amendment would also be required to allow licensed hunters to retrieve tagged big game (elk and mule deer) with a motor vehicle (i.e. cross-country travel) in the areas shown on the motor vehicle use map during hunting season only. Management Areas that currently prohibit cross-country use and would be affected by these amendments include Management Areas F, I, J, K, L, M, N, and X. The acres impacted range from 661 (Alternative 2) to 299 (Alternative 5) to 204 (Alternative 4), to 0 (Alternative 3). Big game retrieval is defined as one trip in and one trip out using the most direct path available to the animal. The activity is limited by the number of big game permits issued within the Forest (438 per year), and the dispersed nature of use is not expected to cause resource impacts. These changes are considered in the analysis of the direct and indirect effects of the alternatives, and these proposed Forest Plan amendments would have no additional effects on fish or their habitats.

COMPLIANCE WITH REGULATORY DIRECTION AND FOREST PLAN

All alternatives would be consistent with Forest Plan standards and guidelines, because they would meet design criteria set for the project, meet standards and guidelines for affected land management allocations, and provide for viable populations of fish. All alternatives would provide for the diversity of plant and animal communities in the project area, based on the suitability and capability of the project area.

This project would not reduce population viability for any management indicator species, and as such, there would be no measurable difference between the No Action and the action alternatives for Rio Grande cutthroat trout in the Planning Area.

Based upon the available information and the evaluation of the direct, indirect, and cumulative effects, and interrelated and interdependent actions, it has been determined that the implementation of the proposed project activities "may affect, but will not likely to adversely affect" the Rio Grande silvery

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minnow. All action alternatives would be consistent with the Rio Grande Silvery Minnow Recovery Plan (USFWS 1999).

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS

There are no irreversible commitments of fishery resources as a result of any of the action alternatives reviewed.

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