Santa Fe National Forest Management Indicator Species Assessment

February 2012 Update

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FOREST PLAN MANAGEMENT INDICATOR SPECIES SUMMARY

The Land and Resource Management Plan (LRMP) for the Santa Fe National Forest, adopted in 1987, identified eight (8) Management Indicator Species (MIS). These species are Rocky Mountain bighorn sheep, Rocky Mountain elk, Mexican spotted owl, Merriam's turkey, hairy woodpecker, Rio Grande cutthroat trout, pinyon jay, and the mourning dove.

The reason each species was selected is described in the Environmental Impact Statement (EIS), Santa Fe National Forest Plan, 1987. The objective was to select species that would indicate possible effects of changing plant communities and associated seral habitats on each species. These species were selected for their association with plant communities or seral stages, which management activities are expected to affect. Other factors considered in the selection of these species were monitoring feasibility, migratory habits, and habitat versatility (LRMP EIS page 96).

The Forest Plan EIS identified the habitat types and the projected influences of management actions for each species. Information pertinent to the management indicator species is summarized as follows:

Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*)

Bighorn sheep serve as a management indicator for alpine meadow habitat. Changes in bighorn sheep habitat capability result from changes in the health of alpine meadow areas and from encroaching canopy closure. Little or no effects were expected on Bighorn sheep due to plan implementation.

Rocky Mountain Elk (*Cervis elaphus nelsoni*)

Elk serve as a management indicator for mid elevation (generally less than 9000'[1]) grasslands, meadows, and forested areas. Elk habitat capability was modeled based on forage availability during winter months. Harvest in mid elevation areas, and improving range conditions was expected to increase habitat capability for elk. The loss of grasslands to a forested ecosystem through succession was modeled to be a negative effect on elk habitat. Road densities are also a factor affecting the quality of habitat.

Merriam's Turkey (*Meleagris gallopavo*)

Merriam's turkey serves as a management indicator of healthy, mature ponderosa pine habitat. Merriam's turkey habitat capability was modeled based on winter habitat. Feeding habitat was the primary limiting factor. Timber harvest, particularly in the ponderosa pine zone, was the primary factor modeled to affect turkey habitat. Activities that opened the forest canopy, allowing grass, forbs and mast-producing vegetation to grow, improve turkey habitat. Road densities are also a factor affecting the quality of habitat.

[1] In normal years, winter range habitat for elk would generally be below 9000' elevation due to snow.

Mourning Dove (*Zenaida macroura*)

Mourning dove serves as a management indicator of healthy, mid and low elevation grasslands, woodlands and ponderosa pine habitats. Mourning dove habitat capability is influenced by improved ecological condition in low elevation grasslands, harvested/thinned woodland, and ponderosa pine areas. Activities that improve the amount of feed available have a positive influence on mourning doves.

Hairy Woodpecker *(Picoides villosus)*

Hairy woodpeckers serve as a management indicator for mature forest and woodland habitats (i.e. PP, MC, SF, Aspen, Oak woodland). They are also found in mature pinyon – juniper, but typically pinyon trees are not large enough to provide suitable snags for nesting. Hairy woodpecker habitat quality was expected to increase over time as young stands of forest mature. Activities that reduce the older tree component reduce habitat capability. Activities or events that create snag habitat would benefit hairy woodpeckers.

Pinyon Jay *(Gymnorhinus cyanocephalus)*

Pinyon jays serve as a management indicator of healthy pinyon – juniper habitat. Habitat capability for the pinyon jay was expected to benefit from increasing foraging areas. Activities that favor a variety of mast-producing plants, found in early forest seral stage, increase habitat capability. The Forest Plan projected minimal changes in pinyon jay habitat over time.

Mexican Spotted Owl *(Strix occidentalis lucida)*

Mexican spotted owls serve as a management indicator for late seral stage mixed conifer habitat. Changes in Mexican spotted owl habitat capability result primarily from changing the seral stage of mixed conifer habitat. The Forest Plan projected most changes in habitat capability would be caused by the harvest of trees. Harvested acres were expected to decrease in habitat capability. Unharvested areas were expected to improve over time. Since the Forest Plan was written, major changes have occurred in both the amount and type of timber harvest that occurs on the Forest. The primary factor influencing Mexican spotted owl habitat has been and continues to be uncharacteristic wildfire.

Rio Grande Cutthroat Trout (*Oncorhynchus clarki virginalis*)

Rio Grande cutthroat trout serve as a management indicator of healthy riparian and stream habitat and good water quality. The primary factors expected to influence cutthroat trout habitat were grazing, roads, other resource activities, and investments in habitat improvements.

Forest Wide Vegetation Summary

The Santa Fe LRMP EIS (page 82, Table 35) displays the major vegetative communities on the Forest as follows:

Table 1

Major Vegetative Communities of the Forest (Forest Plan EIS)		
Vegetative Community	**Acres**	**Percent**
Alpine Meadow	5,206	0.3%
Spruce / Fir	221,439	14%
Douglas Fir	313,482	20%
Aspen	70,414	4%
Mountain Grassland	31,424	2%
Coniferous Riparian	21,749	1%
Ponderosa Pine	339,187	22%
Gambel Oak	22,681	1%
Deciduous Riparian	5,165	0.3%
Pinyon-Juniper	468,486	30%
Sage	29,655	2%
Grama grassland	38,292	2%
Total	1,567,180	100%

In updating the Santa Fe National Forest's MIS report, it was desired to employ the Forest Service's Mid-Scale (1:100,000) Existing Vegetation geospatial information for the Southwestern Region. In some cases, this resulted in significant changes to the amount of species habitat available on the Forest. As an example, habitat available for the hairy woodpecker in the 2006 MIS report was 1,065,164 acres. Using the Mid-scale/PNVT vegetation modeling, available hairy woodpecker habitat is reduced to 80,174 acres. This is the result of other criteria, such as stand age and structure that is part of the Mid-scale information, better refining the modeling of species habitat.

To develop spatial models depicting broad habitat types that may be associated with wildlife, potential and existing vegetation map data were intersected. For planning purposes, potential vegetation is expressed in PNVT mapping, where "potential natural vegetation types (PNVTs) represent the vegetation patterns and characteristics that would occur when natural disturbance regimes and biological processes prevail." PNVT mapping is used as a coarse delineation of major ecosystems and key analysis strata for planning in the Southwestern Region. On the other hand, existing vegetation are expressions of current conditions as represented in the Region's Mid-Scale Existing Vegetation Map by dominance, size (tree and shrub dominance types), and canopy cover class (tree and shrub dominance types).

Potential and existing mapping were intersected to: 1) build additional thematic detail and 2) to leverage the greater accuracy that may exist in one map product or the other. By combining, for instance, the "semi-desert grassland" PNVT with "grass mix" from the Mid-Scale data, one can spatially identify areas of semi-desert grassland that are actually grass-dominated, as opposed to areas that shrub- or tree-dominated, or sparsely vegetated, that have different habitat features and may have different wildlife associations. In the development of Mid-Scale data many dominance types were grouped into map units to improve map accuracy, albeit at the expense of precision. "Grass mix" is one such map unit. Though the unit itself is very general, when intersected with PNVT mapping the

precision lost in grouping can be partially recovered. And the TEUI (Terrestrial Ecosystem Unit Inventory) data that PNVT mapping is built from is highly accurate, particularly at the coarse thematic level of PNVT, not to mention TEUI represents the base-level map scale of 1:24,000 (vs. 1:100,000 in Mid-Scale mapping). See Appendix C for the MIS Mid-scale\PNVT quantitative analysis.

There is really no direct comparison or crosswalk between the vegetation classification used in developing of the LRMP and the mid-scale vegetation. The mid-scale geospatial information for the Santa Fe National Forest (Table 2) is more current and provides more overall information about the vegetative communities than that developed for the LRMP. Mid-scale is also the geospatial product that will be used as the forests of the Southwestern Region move into the planning revision process. Therefore, it is appropriate to use this information in revising this MIS report.

Table 2

Major Vegetative Communities of the Forest using mid-scale		
Vegetation Community	Sum of acres	Acres on USFS*
Aspen	40,978	38,233
big sagebrush	48,055	43,731
blue grama	11,472	11,430
deciduous shrub mix	69,235	61,316
Juniper	138,290	129,666
perennial grass mix	73,554	61,115
pinyon, pinyon-juniper	218,566	198,386
ponderosa pine mix	545,008	500,378
sparsely vegetated	9,972	9,226
spruce-fir	148,041	147,333
upper deciduous-evergreen forest tree mix	368,503	347,146
upper forb mix	5,188	5,188
Total	1,676,862	1,553,148

*****This is the acreage on USFS lands only (excluding private in-holdings)

Changes in vegetative communities occur naturally and as a result of forest management activities. Activities or events that typically have the greatest impact on these communities include fire (wildfire and prescribed fire), insects and disease, road densities, timber treatments (timber harvest, thinning, etc,) and grazing. Depending on the MIS and their habitat requirements, these events or activities may have a positive, neutral, or negative effect on the quantity and quality of habitat, which translates into effects on MIS populations on the Forest.

The following table (Table 3) shows acres of vegetative communities affected by various events and activities. The nature of these effects on MIS species and habitat will be discussed in the individual species sections. Activities and treatments were taken from the FACTS database. Only those activities and treatments that actually changed vegetation since 1987 were used. This may not be a complete list and in many cases, treatments are overlapping the same acres. Consequently, actual acres affected will be somewhat less than indicated in this table. A list of all the activity and treatment types is in Appendix A.

Table 3

Vegetation Communities and Activities – Santa Fe National Forest					
Sum of acres on USFS Lands Only					
Vegetation Community	Mechanical Treatments	Pest Damage	Rx Burns	Wildfire	Total
aspen	5,032	26,768	945	7,531	40,275
big sagebrush	6,360	47	1,980	2,849	11,236
blue grama	38		1		39
deciduous shrub mix	12,388	9,519	3,803	12,771	38,481
juniper	5,521	441	6,438	6,730	19,130
perennial grass mix	3,729	8,233	1,635	5,681	19,279
pinyon, pinyon-juniper	17,673	2,383	11,727	20,124	51,907
ponderosa pine mix	124,768	50,962	44,832	90,087	310,650
sparsely vegetated	1,440	1,008	117	7,171	9,736
spruce-fir	3,376	196,448	29	16,556	216,409
upper deciduous-evergreen forest tree mix	38,137	238,998	11,553	67,044	355,733
upper forb mix	0	205		27	232
Totals	218,463	535,013	83,058	236,572	1,073,105

*Activities are since 1987, except for Pest Damage which is since 2006.

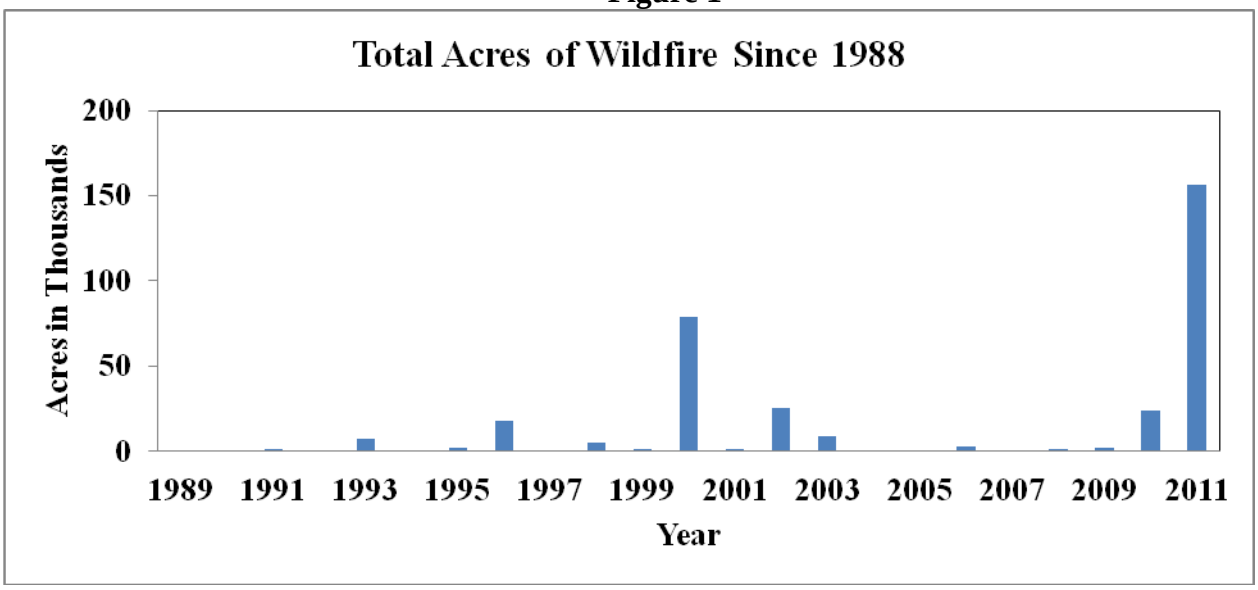
Insects/Disease

Since 1987, we have experienced substantial western pine beetle and Ips beetle infestations. The data as shown in Table 3 is from 2006 through 2011. Significant acreage has been affected, and in some areas there has been significant mortality. This is especially true with pinyon pine, which has been most affected since 2002 due to drought conditions.

Wildland Fire

Since 1987, wildland fires have been the primary influence on forest succession on the Santa Fe National Forest. Approximately 236,572 acres have burned. The largest, most intense fires have occurred since 1993. In the larger fires, such as the Dome, Cerro Grande, Viveash, and Las Conchas, significant areas burned with stand-replacing crown fires. Overly dense forest conditions, high accumulations of fuels, and drought conditions have resulted in a higher likelihood that wildland fires will be larger and of higher severity. Table 3 provides an estimate of acres burned by vegetation type. Figure 1 shows the acres of all wildfires by year since 1988.

Figure 1



Grazing

Since 1987, there have been significant improvements in grazing practices on the Santa Fe National Forest. Improving the distribution of cattle and controlling the amount of forage use in both riparian and upland areas has been a major emphasis. In 1996, the Forest Plan was amended with a focus on achieving proper forage use. Currently, the Forest has 73 active allotments. Since 1996, the Forest has completed environmental analyses on 72 allotments, with the remaining allotment scheduled for completion by the end of 2012. These analyses identified problem areas and issues and provided for corrective actions or improvements in livestock distribution and use and include grazing use standards. Annual Operating Instructions (AOIs) guide the use of the allotments on an annual basis. For 2011, approximately 35% of the allotments were reported as being administered to standard.

Timber Management

Since 1987, significant changes have occurred in the timber management program. When the Forest Plan was first implemented, timber management was focused on the harvest of larger trees along with thinning to promote timber production. Beginning in about 1993, the focus of the program changed. Instead, the focus was more on thinning and improving forest health. Timber management activities ranged from pre-commercial thinning to overstory removal. Activities that removed most or all of the overstory (See Appendix A for a listing of activities) resulted in stands being modified to an early seral condition. Activities that removed the smaller trees tended to move a stand towards a later seral condition. In either case, the result was opening up the forest canopy to allow for more understory vegetation growth.

Current emphasis on the Santa Fe National Forest and throughout the Southwest Region is on restoration of healthy forest ecosystems with a reduction of accumulated fuels in order to avert catastrophic wildfires. This emphasis is particularly keen in the wildland urban interface (WUI). Timber management activities are geared toward these ends.

Table 4 summarizes the effects of forest management activities by vegetation type.

Table 4

Effects of forest management activities by vegetation type since 1987.		
	Acres on USFS Only	
Vegetative Community	Forest Activities Tending to Early Sere	Forest Activities Tending to Later Sere
aspen	1,759	3,273
big sagebrush	4,232	2,128
blue grama		38
deciduous shrub mix	4,078	8,310
juniper	637	4,884
perennial grass mix	1,721	2,008
pinyon, pinyon-juniper	6,670	11,003
ponderosa pine mix	36,057	88,712
sparsely vegetated	1,059	381
spruce-fir	2,892	484
upper deciduous-evergreen forest tree mix	16,131	22,007
upper forb mix	0	
Total	75,236	143,227

The effects of forest management activities will be assessed in the individual species sections.

Roads

For two of our MIS species, elk and turkey, the Forest Plan identified road densities as a factor in determining the quality of habitat. The concern is not one of habitat fragmentation, but rather the disturbance factor relating to the use of roads. The Forest Plan identifies goals and objectives for road management. Table 5 is taken from the Forest Plan (page13):

Table 5

Road Summary for First Ten Years (1987)	
	Total Miles
Current Inventory	3400
Existing Un-inventoried	+ 1000
New Construction	+ 95
Obliteration	- 660
Total	**3835**
Road Management Closures	- 2035
Roads Open to Use	1800

Table 6 shows the current status of the road system on the Forest by vegetation type:

Table 6

Road System Status by Vegetation Community – Santa Fe National Forest 2011[1]			
Vegetation Community	Closed	Decommissioned	Open
aspen	46.0	7.3	93.6
big sagebrush	67.4	10.5	234.9
blue grama	21.5	0.9	36.3
deciduous shrub mix	74.1	18.4	188.8
juniper	126.1	32.2	207.1
perennial grass mix	43.6	20.8	432.0
pinyon, pinyon-juniper	125.9	41.7	628.6
ponderosa pine mix	526.2	111.5	1,902.4
sparsely vegetated	13.2	0.5	18.2
spruce-fir	32.2	41.1	115.2
upper deciduous-evergreen forest tree mix	333.7	39.1	863.4
upper forb mix			0.6
Total	1,409.9	324.1	4,721.1

[1] This table is a summary of roads on USFS lands only.

There are more roads than were originally identified in the Forest Plan. This difference is mostly due to an intensive inventory that counted roads that had not been included in the system. Many of these roads were "user created" over the years. Some were "project created" and were never added to the system. This information has been improved due to the forest's ongoing Travel Management analysis.

The Santa Fe National Forest, to comply with the Travel Management Rule, proposes to provide for a system of roads, trails, and areas designated for motorized use by making changes to the current travel system. The proposed changes will reduce the places where people can drive in the Santa Fe National Forest. The proposed changes do not restrict where non-motorized activities, such as hiking, camping, bicycling, and hunting, may take place. This process of designating a motorized route system is nearing completion, but is not done. Therefore, this MIS report reflects the current road system.

FOREST-WIDE MIS POPULATION AND TREND ASSESSMENT

Populations of wildlife are extremely difficult to quantify and in some cases can vary substantially from year to year. Environmental factors can dramatically influence recruitment of young and survival of adults. A precise figure on the number of animals is very difficult if not impossible to attain and would only be valid for a short time period. In order to estimate populations for MIS species, we evaluated a number of sources for each species and then ranked the population into descriptive categories. Populations of MIS species would be expected to fluctuate within a category from year to year. However, we would not expect a species to switch from category to category without some long-term change in environmental conditions. For instance, a change in ranking from uncommon to rare would be a cause for concern and would warrant intensive evaluation of a species. A ranking system is based on the predicted number of breeding pairs or adult females, depending on which is most appropriate for the species addressed.

The ranking system for the Forest-wide evaluation is as follows:

CATEGORY	BREEDING PAIR/ADULT FEMALE
Not Present	0
Extremely Rare	1-10
Rare	10-100
Uncommon	100-1,000
Common	1,000-10,000
Abundant	10,000-100,000
Very Abundant	>100,000

Population trend is most appropriately addressed at scales above the project. Many of these selected MIS species occur and range far beyond a local scale, such as a project analysis area. Individuals, family groups, or herds such as elk, annually use areas much larger than a typical analysis area and population trend must be examined on a much larger scale to be meaningful. For National Forest Management Act implementation, this is at the scale of the Santa Fe National Forest. At a site-specific project level, there is a great deal of fluctuation in wide ranging populations. For most species, it would be technically and practically inappropriate to conduct population trend sampling at the scale of individual projects.

SPECIES ASSESSMENTS

Wildlife management, as practiced by federal land management agencies, has always focused on managing and improving habitat. The States govern the harvest of fish and game (*Geer v. Connecticut*, 161 U.S. 519 (1896) 39, 40, 42, 45). The exceptions are species covered under the Migratory Bird Treaty Act or the Endangered Species Act.

The Santa Fe National Forest relies on survey data collected by the New Mexico Department of Game & Fish (NMDGF) for population numbers and trend analysis of all game species {36 CFR 219.19(6)}. The NMDGF uses this data to set harvest regulations and population goals for the species under their jurisdiction.

Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*)

Habitat and Habitat Trend

Bighorn sheep serve as a management indicator for alpine meadow habitat. On the Santa Fe NF, Rocky Mountain bighorn sheep inhabit the highest alpine areas of the Sangre de Cristo Mountains within the Pecos Wilderness. This includes the cliffs, crags or other extremely rocky areas around the mountain peaks and open alpine meadow areas down to the edge areas of the spruce / fir type. The total range within the Pecos Wilderness encompasses approximately 17,500 acres, but only 7,810 acres are on the Santa Fe NF. Bighorn sheep are generally found in the alpine areas between Pecos Baldy and Jicarita Peak. Bighorn prefer precipitous terrain adjacent to suitable feeding sites of high mountain meadows with grasses, forbs and browse species. Within this area, approximately 4,370 acres are perennial grass and forb mix (see Table 7). The Santa Fe Forest Plan estimated habitat capability for bighorn sheep habitat based on the health of alpine and meadow areas and effects of encroaching canopy closure. Habitat conditions in the Pecos Wilderness Area are generally fair to good, but the limiting factor is severe winter conditions where quality and quantity of forage can fluctuate significantly. Cattle grazing can and does occur, but typically cattle use is minimal in the alpine areas and non-existent on the steeper terrain.

Table 7

Vegetative Communities Represented by Big Horn Sheep	
Vegetative Community	**Acres**
aspen	12
perennial grass mix	897
ponderosa pine mix	95
sparsely vegetated	308
spruce-fir	3,021
upper deciduous-evergreen forest tree mix	4
upper forb mix	3,473
Total*	7,810

*Habitat acreage in Quantitative Analysis from Mid-Scale\PNVT report is 7,902ac, but included slivers of land extending outside the forest boundary.

Since the entire bighorn habitat is within Wilderness, there have been and will be no projects or treatments affecting alpine meadow habitat. **The habitat trend for bighorn sheep on the Santa Fe Forest is stable.**

Species Status and Population Trend

Bighorn sheep were reintroduced to the Pecos Wilderness in the 1960's. The estimated carrying capacity, based on winter range, has been 175 to 330 animals. Though the overall population in the state appears to be doing well, the population in the Pecos Wilderness on the forest has declined in recent years and the cause is unknown. The population is currently estimated at 110 to 125 adults (pers. comm. May 2, 2011, NMDGF/SFNF coordination meeting). To date, the decline cannot be attributed to management activities on the Santa Fe NF based on the small amount of change that has occurred in the alpine habitat since implementation of the Forest Plan. **Therefore, the bighorn sheep population on the Santa Fe National Forest is ranked as uncommon due to population**. This means that the estimated number of breeding females ranges between 100 and 1000 individuals. In the past, the NMDGF regularly conducted captures and transplants to maintain this population at or below carrying capacity and to supplement other populations within New Mexico and Arizona. As an example, 29 bighorn sheep were captured and removed from this population in August 2005. The only potentially serious threat to the population is disease (DRAFT Long Range Plan for the Management of Rocky Mountain Bighorn Sheep in New Mexico 2004-2014).

Monitoring recommendations

Continue surveys by NMDGF.

Rocky Mountain Elk (*Cervis elaphus nelsoni*)

Habitat and Habitat Trend

Rocky Mountain elk are primarily grazers and inhabit most forest types with good forage and cover. However, they were selected to represent mid elevation (generally less than 9000'[2]) grasslands, meadows, and forested areas. The Forest plan modeling predicted that elk were limited primarily by low winter forage availability with road densities having a negative effect on elk habitat. Activities or events that open closed canopy forests, maintain or create grassland or shrub land, or reduce road densities generally improve elk habitat. Hiding and thermal cover are not limiting factors on the Santa Fe NF.

[2] In "normal" years, elevations greater than 9000' are generally snow covered and not used by elk.

The following (Table 8) shows vegetative communities that elk represent on the Santa Fe NF.

Table 8

Vegetative Communities Represented by Elk	
Vegetative Community	**Acres**
aspen	27,630
big sagebrush[2]	43,790
blue grama[2]	10,993
deciduous shrub mix	59,447
Juniper[2]	129,639
perennial grass mix[2]	55,552
pinyon, pinyon-juniper[2]	197,941
ponderosa pine mix	490,968
sparsely vegetated	5,533
spruce-fir[1]	21,925
upper deciduous-evergreen forest tree mix[1]	240,822
upper forb mix	3,400
Total	1,287,640[3]

1 A substantial amount of these communities is at elevations exceeding 9,000' and would not be assessed as habitat represented by elk.

2 The vegetative communities within the Caja del Rio, Glorieta Mesa, and the Anton Chico Grant areas are not managed for elk habitat.

3 Habitat acreage in MIS analysis report (Appendix C) is 1,425,341ac. but includes the Villa Caldera and private in-holdings.

Recent habitat improvement projects such as water developments, prescribed burns, timber harvest, and the thinning of pinyon-juniper woodlands have greatly contributed to the expansion of existing herds into previously unoccupied habitats.

Table 9 shows activities or events affecting elk habitat.

Table 9

Treatments / Events within all Vegetative Communities Represented by Elk	Acres or Miles	Effect
Mechanical (tend to early sere)	68,097	Positive
Mechanical (tend to later sere)	142,095	Slight positive
Rx burns	82,697	Positive
Wildfires (since 1988)	195,721	Positive
Insects and Disease	297,490	Slight Positive
Total open roads (miles)	4,853	Negative
Closed or decommissioned roads (miles)	1,700	Positive

In most cases, treatments would open forest canopy, which would allow increased herbaceous production. Consequently, almost all treatments within elk habitat could be regarded as beneficial to elk. Wildfires would have a similar effect. Acres that were unaffected by disturbance are gradually declining in quality as encroachment of forest habitat on meadows and other open areas occurs over time.

In general, there is sufficient habitat to support the current population of elk on the Forest. However, there are conflicts with grazing permittees due to the allocation of forage between livestock and elk. Habitat conditions (forage conditions) are negatively affected when forage use exceeds allowable levels. Part of the problem is the increased elk population since they were reintroduced to the Santa Fe. This is exacerbated by the fact that canopy closure is rapidly occurring across much of the Forest, reducing understory forage production. Even so, significant improvement has been made in grazing practices since 1987. Forage utilization standards (by all ungulates) are applied on all grazing allotments.

In the long term, good habitat for elk is dependent on projects specifically designed to provide understory forage recovery, away from streams and riparian vegetation, and to improve small parks and openings through meadow maintenance and thinning near these sites. The Santa Fe National Forest has undertaken several projects to improve habitat conditions. These include various hazardous fuels projects that result in a reduction of understory trees that opens the forest floor, improving forage for elk and livestock. The Forest has also constructed several water catchment tanks that help distribute wildlife and other water developments specifically to provide better distribution of livestock.

Overall, elk habitat is rated as stable. Forest treatments and events are somewhat offsetting forest encroachment. Emphasis in healthy forest restoration should result in an upward trend.

Species Status and Population Trend

Elk were extirpated from New Mexico by 1909. In 1911, efforts to restore elk to New Mexico began with transplants near Raton and Las Vegas (Bison-M 2011). Since that time, elk have been steadily increasing in many areas of the state. This is true for the Santa Fe NF. There is no concern with population viability of elk on the Forest. Elk numbers have steadily increased over the past two decades. They have increased to the point that the NMDGF has made a concerted effort to control the population in certain areas with special hunts. Population information from the 2006 MIS Report is presented in Table 10.

Table 10 shows the Game Management Units with estimated elk numbers per GMU that are located on the Santa Fe NF from 1999 through 2005.

Table 10

Estimated Elk Population by GMU							
Game Management Unit (GMU)	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
43							
44							
45			1421	1395			2541
5B			668	1039	1167		
6 (A,B&C)	3958	4283		4434			
6A							933
6B							1182
6C							1325
Total	3958	4283	2089	**6868**	1167		**5981**

Data for this table (Table 10) was provided by Steve Kohlmann, PhD, Elk Program Manager, NMDGF, July 27, 2005. Adding in the 2003 value for GMU 5B for year 2005, total elk within GMUs 45, 5B, and 6A-C would be approximately 7,148. Therefore, the total number of elk for the Santa Fe NF is currently estimated to range from 6,000 to 8,000 elk.

The total number of elk for the Santa Fe NF is currently estimated to range from 7,500 to 11,000 elk (pers. comm., M. Birkhauser, NMDGF June, 2011). **The Rocky Mountain elk population ranks as common for the Santa Fe NF.** This means that the estimated number of breeding females ranges between 1,000 and 10,000 individuals. The population may fluctuate from year to year based on hunting pressure and a variety of environmental factors. This estimate is based on actual counts and surveys conducted periodically by the New Mexico Department of Game and Fish. The New Mexico Department of Game and Fish manages the elk herd by game management unit (Unit). The existing units that are present on the Forest are Units 5B, 6A, 6C, 43, and 45. Unit 6B is the Valles Caldera National Preserve. Units 6A, 6B, and 6C are reported in the Jemez Region along with Unit 7. Unit 45 includes most of the Pecos and Las Vegas Ranger Districts with the exception of Glorieta Mesa and the Anton Chico Grant which lies in Unit 43. Unit 5B which is the northern area of the Coyote Ranger District and is included in the North Central Region that also includes Unit 4, 50, 51, and 52. A small population of elk resides on Glorieta Mesa (probably less than 50 head). Neither area in Unit 43 is managed for elk. Population numbers of elk are based on estimates derived from aerial surveys conducted by the NMDGF. Not all GMUs are surveyed each year and numbers are now reported by regions. Table 11 shows estimated elk numbers per Region that incorporate the Santa Fe NF, but also include areas outside of the Forest.

Table 11

Estimated Elk Population by Region or GMU		
Game Management Unit (GMU)	**2010/2011 Year**	**bull:cow:calf ratio**
Pecos Unit 45	1,665-2,604	27:100:27
North Central Region	18,060-22,584	40:100:41
Jemez Region	5,824-8,412	40:100:25

The population trend for the Rocky Mountain elk is ranked as increasing on the Forest. The objective, however, is to maintain the herd at about its current level. In recent years, the NMDGF has increased the number of elk licenses, including late season cow permits, in an attempt to maintain current elk populations.

Monitoring recommendations

Continue to support the current elk studies in conjunction with the Villas Caldera. These studies are underway to understand calf mortality in the Jemez Mountains. Continue to cooperate with the NMDGF to evaluate population and habitat data to improve elk management.

Merriam's Turkey (*Meleagris gallopavo*)

Habitat and Habitat Trend

Merriam's turkey uses a wide range of vegetative communities (Table 12), but they were selected to **serve as a management indicator of healthy, mature ponderosa pine habitat.** Merriam's turkey utilizes ponderosa pine, a source of mast and its favorite roosting tree. Ponderosa pine is an essential component of its permanent habitat, while surface water is a range requirement. Turkeys prefer to roost in tall mature or over-mature ponderosa pines with relatively open crowns and large horizontal branches starting at 20 to 30 feet from the ground. Trees with a diameter at breast height (DBH) of over 14 inches are often used as roosts. Roost trees generally have excellent protection from the wind and are usually located in sites with an open ridge or rocky ledge nearby to provide ease in entering and exiting the roost site. Hens normally nest within ½ mile of water. A good, healthy understory provides cover and forage. Turkeys forage in grasslands, brush communities, deciduous tree-brush and in ponderosa pine. They eat grasses and grasshoppers in the summer. They eat acorns and mature ponderosa pine seeds in the fall. Tall grasses are eaten in the winter when the heavy snows come. Pinyon nut crops are the turkey's "corn" of the southwestern forest (BISON-M 2011).

Table 12

Vegetative Communities Represented by turkey	
Vegetative Community	**Acres**
aspen	21,135
juniper	18,926
pinyon, pinyon-juniper	92,785
ponderosa pine mix	206,331
spruce-fir	90,053
upper deciduous-evergreen forest tree mix	174,005
Total	603,235

* Habitat acreage in Quantitative Analysis from Mid-Scale\PNVT report is 633,916 acres, but included some private in-holdings.

Suitable, mature ponderosa pine habitat is abundant on the Santa Fe National Forest; however, much of this forest type has become crowed and overstocked with relatively young trees. Open areas are gradually filling in with trees. This situation is causing a decline in the quality of turkey habitat. Events or activities that maintain nesting and roosting areas within ponderosa pine, allow for herbaceous production in the understory, or improve herbaceous production in adjacent vegetation types improve turkey habitat. Closing or decommissioning roads within the ponderosa pine also improves the quality of the habitat. The Santa National Forest has done many habitat improvement projects with turkey in mind; including thinning, water developments, under burning in ponderosa pine, and creating slash piles for nesting habitat. For most projects within ponderosa pine, effects on turkey and turkey habitat would have been considered. In most cases, treatments would open forest canopy, which would allow increased herbaceous production. Consequently, almost all treatments within the ponderosa pine could be regarded as beneficial or neutral to turkey. Smaller wildfires would have a similar effect. Although, larger fires with large areas of severe burn have had a net negative effect on turkey habitat. Acres that were unaffected by disturbance are gradually declining in quality as encroachment of forest habitat on meadows and other open areas occurs over time. Activities or treatments that move this forest type to within the natural range of variability will improve turkey habitat and will allow turkey populations to continue to thrive. Table 13 illustrates the

affects of management treatments, wildfires, insects and disease, and road management on turkey habitat in ponderosa pine.

Table 13

Treatments / Events within all Vegetative Communities Represented by Wild Turkey			
	Acres or Miles	**Positive Effect**	**Negative Effect**
Mechanical (tend to early sere)	26,125	X	
Mechanical (tend to later sere)	59,874	X	
Rx burns	37,030	X	
Wildfires (since 1988)	124,579	X	
Large Wildfires (w/ high severity)	25,732		X
Insects and Disease	267,609	X	
Total roads (miles)	1,530.7		X
Closed or decommissioned roads (miles)	676.4	X	

Livestock grazing also affects turkey habitat and occurs in varying degrees throughout turkey habitat on the Santa Fe National Forest. Significant improvement has been made in grazing practices since 1987. Forage utilization standards are applied on all grazing allotments. In general, grazing use of herbaceous production would have a negative effect on turkey foraging habitat. Application and adherence to forage-use standards minimizes this effect. There are undoubtedly localized areas where the effects of grazing are more obvious. Overall, on the Santa Fe NF, grazing is having a slight negative effect, but not enough to significantly affect turkey habitat.

On balance, **the estimated habitat trend for turkey is relatively stable** based on disturbed acres providing additional feeding habitat and undisturbed areas declining in quality due to forest encroachment issues. Emphasis in healthy forest restoration should result in an upward trend.

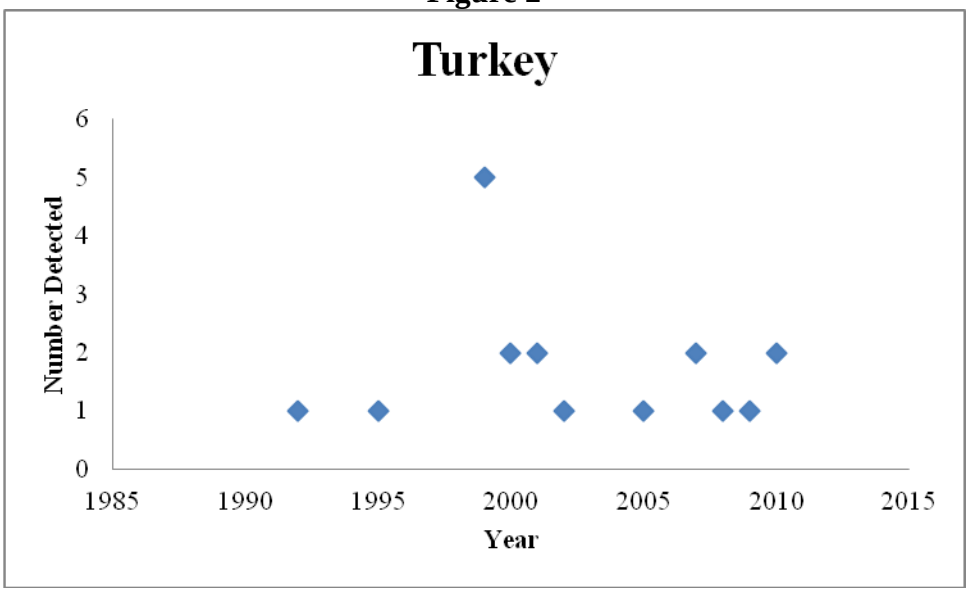
Species Status and Population Trend

The Merriam's turkey has the widest distribution and is the most common subspecies of turkey. Most mountain ranges in New Mexico support healthy, self-sustaining Merriam's turkey populations. They are widespread and are known to reside on all the Ranger Districts on the Santa Fe National Forest. **They are ranked as common on the Forest,** which means that the estimated number of breeding female birds ranges between 1,000 and 10,000 individuals. This estimate is based on the amount of habitat available, hunter success information, breeding bird surveys and the professional judgment of Forest biologists. The New Mexico Department of Game and Fish (NMDGF) estimates between 35,000 and 40,000 wild turkey throughout the state (NMDFG 2007). The population may fluctuate from year to year, based on a variety of environmental factors. These factors include predation, weather, disease, and hunting (legal and illegal). Providing quality habitat can reduce the effects of these factors.

The population trend for the Merriam's turkey on the Santa Fe NF is rated as stable. This estimate is based on the amount of habitat available, breeding bird surveys, and the professional opinion of local biologists. Statewide, population numbers are expected to increase in the future (NMDGF 2007). Figure 2 shows number of turkey detected during breeding bird surveys as reported to the USGS. Though wild turkeys are elusive and widely distributed among a variety of different habitats and are less likely to be detected by this individual survey technique, the number of wild turkeys detected has been relatively constant since the early 1990's. The NMDGF has not conducted

hunter success surveys over the past few years and currently does not conduct population surveys for the Merriam's turkey (NMDGF 2007).

Figure 2



Survey results reported to the USGS between 1968 and 2009 indicate an increasing population of wild turkey within New Mexico (Figure 3). USGS uses a hierarchical model to produce annual indices of abundance for a region, then estimates trend as the ratio of the annual indices for the first and last year of the interval (http://www.mbr-pwrc.usgs.gov). From 1999 to 2009, the population trend of wild turkey in the western part of the United States has increased by over 14.9 percent. The wild turkey is listed as secure in New Mexico (NatureServe. 2011). Figure 4 displays the turkey harvest results for the State from 1984 to 2004 which also supports the population determination (NMDGF 2007).

Figure 3

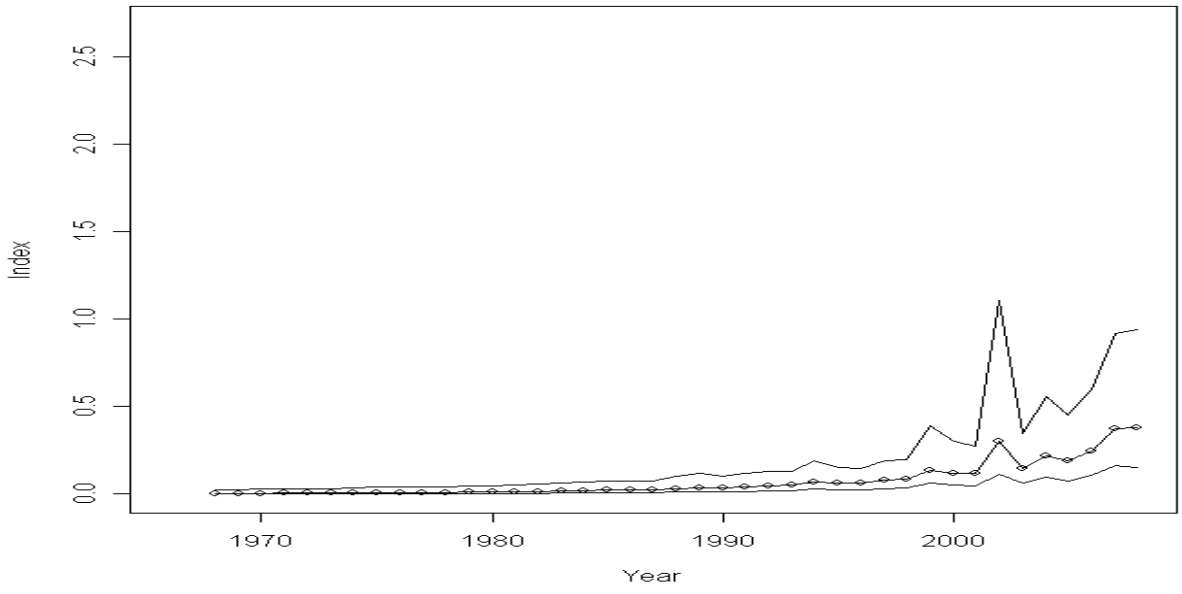
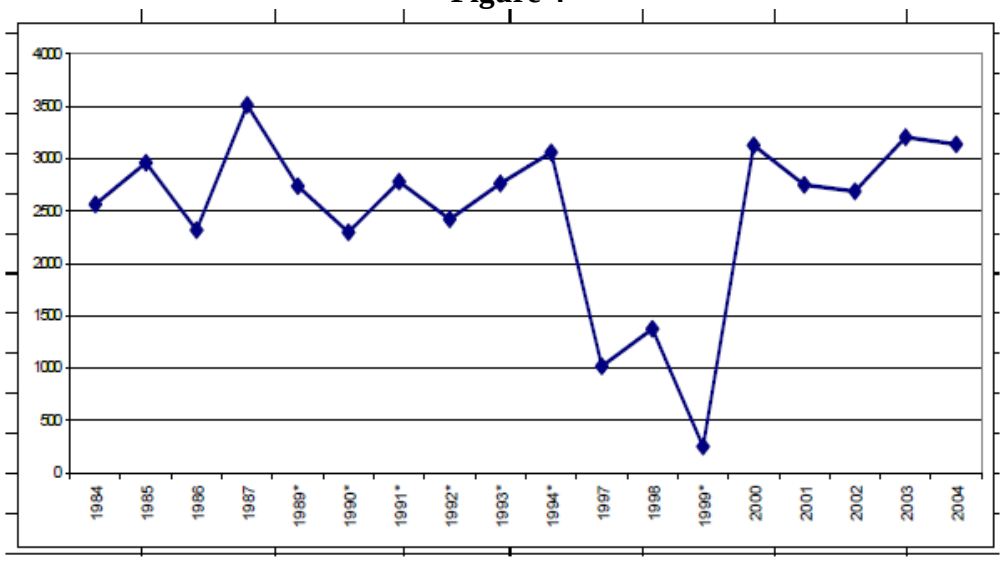


Figure 4



Monitoring recommendations

The Forest Service will continue to work closely with the NM Department of Game and Fish to develop or assist in studies of Merriam's turkey populations on the Santa Fe National Forest.

Mourning Dove (*Zenaida macroura*)

Habitat and Habitat Trend

Mourning dove serves as a management indicator of healthy, mid and low elevation grasslands, woodlands and ponderosa pine habitats. They can be found in higher elevation communities but are typically regarded as casual above 7,000 feet. They nest in a variety of habitats including shrub lands and forests. Fields used for feeding are often characterized by an abundance of small weed seeds and grain on relatively bare ground (Otis et al 2008). Activities that improve the amount of feed available have a positive influence on mourning doves.

The mourning dove is found across North America in many types of habitat, including most forest types though avoids dense woodlands (Otis et al 2008). It is wide spread except in the Arctic and closed forests. It is abundant and increasing near farms and suburbs and frequents backyard feeders, suburbs, and towns. They are common to abundant in most counties in New Mexico. Mourning dove habitat is abundant on the Santa Fe NF. The Santa Fe National Forest LRMP predicted that mourning dove habitat would improve through improving the ecological condition of low elevation grassland and by harvesting and thinning in woodland and ponderosa pine areas. For the Santa Fe NF, low elevation grassland equates to grama grassland. Mourning dove can be found in higher elevation communities of Douglas Fir, White Fir, and Spruce but they were not chosen to represent these communities. Table 14 shows the vegetative communities for mourning dove on the Santa Fe National Forest.

Table 14

Vegetative Communities Represented by Mourning Dove	
Vegetative Community	**Acres**
aspen	4,555
big sagebrush	33,997
blue grama	10,393
deciduous shrub mix	31,937
juniper	116,372
perennial grass mix	34,242
pinyon, pinyon-juniper	138,338
ponderosa pine mix	157,525
sparsely vegetated	1,179
spruce-fir	2,218
upper deciduous-evergreen forest tree mix	47,038
upper forb mix	3,626
Total*	581,419

* Habitat acreage in Quantitative Analysis from Mid-Scale\PNVT report is 647,460 acres, but included the Villa Caldera and some private in-holdings.

For habitat to be favorable, abundant food and water must be available within 20-30 km. The habitats found on the Forest meet the feeding requirements for the mourning dove. Water developments and treatments that open closed canopies to allow for increased herbaceous growth, improve habitat for mourning dove. Most nesting occurs in lower elevation habitats. The abundance of nesting and cover opportunities on the Santa Fe contribute to maintaining viable populations of mourning dove.

In general, habitat affected by disturbance will have the canopy opened up, allowing for the growth of more understory vegetation and improving mourning dove habitat (Table 15). Burned areas are particularly desirable since mourning doves generally will not scratch in litter for seeds and will avoid areas with dense vegetation when feeding (BISON-M 2011). Livestock grazing occurs throughout mourning dove habitat but is not regarded as a significant factor affecting mourning dove habitat (Bock et al, 1993). "Manipulation of fields by mowing, light discing, grazing by livestock, and other agricultural practices can enhance dove feeding areas." (BISON-M 2011)

Table 15

Treatments and Events within all Vegetative Communities Represented by Mourning Dove		
	Acres	**Effect**
Mechanical (tend to early sere)	18,179	Positive
Mechanical (tend to later sere)	40,982	Positive
Rx burns	38,854	Positive
Wildfires (since 1988)	72,889	Positive
Insects and Disease	43,588	Slight Positive

The habitat trend for the mourning dove is stable to increasing across the Forest. Emphasis in healthy forest restoration should result in an upward trend.

Species Status and Population Trend

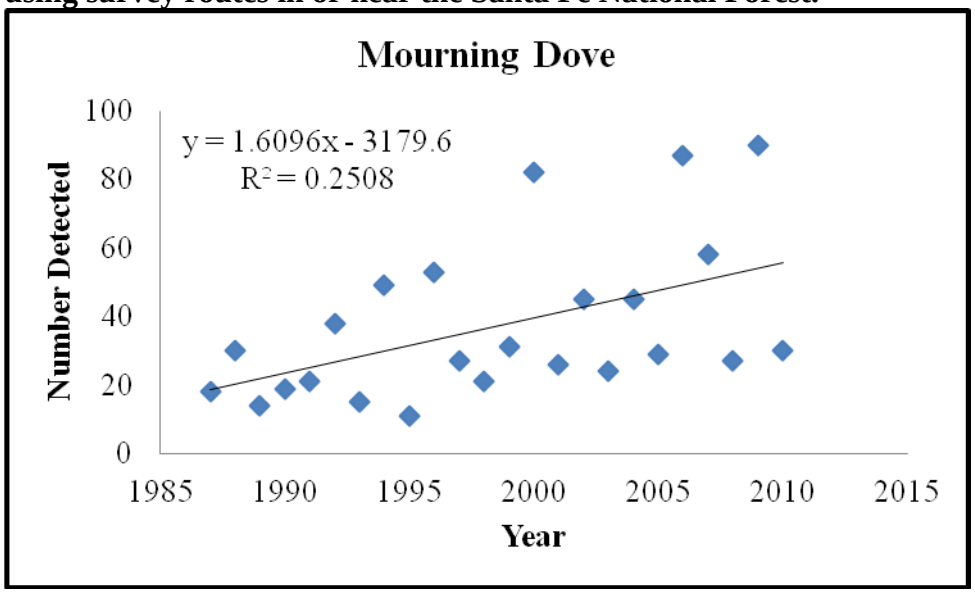
Mourning doves are common throughout the state. **They are ranked as common for the Santa Fe NF.** This means that the estimated number of breeding pairs ranges between 1,000 and 10,000. The population may fluctuate from year to year based on a variety of environmental factors. This estimate is based on the amount of habitat available, hunter success statistics, breeding bird surveys and the professional opinion of local biologists.

No threats to the mourning dove are known except for human encroachment or overhunting. The New Mexico Natural Heritage Program ranks mourning dove in New Mexico as "Demonstrably Secure." It is a multiple brooder and the most abundant dove in North America, as well as the most widely hunted and harvested game bird. Natural mortality factors include predation of adults and free-flying young by avian and mammalian predators and destruction of eggs and nestlings.

A report by David Dolton, (et al 2007) compiling survey information for mourning dove within the conterminous United States, found an increasing trend for mourning dove in New Mexico. This is contrary to his previous report and to the overall population trend for the central region of the country. Breeding bird surveys just for northern New Mexico show a similar stable trend (Figure 5). Fluctuations can be attributable to many factors such as weather, food supply and observer ability.

The mourning dove is listed as secure in New Mexico (NatureServe. 2011). **The population trend for the mourning dove on the Santa Fe Forest is stable** based on the statewide trend and breeding bird surveys in and adjacent to the Forest.

Figure 5. USGS New Mexico Mourning dove trend data 1987 – 2010 using survey routes in or near the Santa Fe National Forest.



Monitoring recommendations

Continue to use Fish and Wildlife Service Central Management Units and USGS Breeding Bird Survey data.

Hairy Woodpecker (*Picoides villosus*)

Habitat and Habitat Trend

Hairy woodpeckers serve as a management indicator for mature forest and woodland habitats (i.e. Ponderosa pine, mixed conifer, spruce/fir, aspen, and oak woodland). They are also found in mature pinyon-juniper, but typically, pinyon trees are not large enough to provide suitable snags for nesting. They are primarily insectivorous and feed on insects associated with snags and down logs. Consequently, snags and down logs are key components of hairy woodpecker habitat. Hairy woodpecker habitat quality was expected to increase over time as young stands of forest mature. Activities that reduce the older tree component typically reduce habitat capability. Activities or events that create snag habitat or that move forest areas to later seral stages, benefit hairy woodpeckers. The species is a forest generalist, keying in on available snags and live aspen. Snags most often used for cavity nesting by hairy woodpeckers are 15+ inches diameter at breast height (with bark), and are more often in soft snags than hard (BISON-M 2011). Down logs are also important to support insect populations for foraging. Removal of large snags, future snags and down logs increases the probability of decreased population numbers of hairy woodpeckers. The Santa Fe Forest Plan modeling predicted that hairy woodpecker habitat quality would improve over time as young stands mature into diameter classes acceptable as cover. Nesting habitat was more limiting than feeding habitat. Table 16 shows the vegetative communities on the Santa Fe NF that hairy woodpeckers represent. The acre of available habitat in the Mid-scale\PNVT Quantitative analysis is significantly lower than that reported in the 2006 MIS Report (1,065,164 acres vs. 80,174 acres). This difference can be attributed to the ability to query the data for larger tree diameter and canopy cover. Table 17 shows activities or events affecting hairy woodpecker habitat.

Table 16

Vegetative Communities Represented by Hairy Woodpecker	
Vegetative Community	**Acres**
aspen	106
juniper	5,664
pinyon, pinyon-juniper	19,354
ponderosa pine mix	46,178
spruce-fir	1,181
upper deciduous-evergreen forest tree mix	7,691
Total*	80,174

* Habitat acreage in Quantitative Analysis from Mid-Scale\PNVT report is 84,130 acres, but included some private in-holdings.

Table 17

Treatments and Events within all Vegetative Communities Represented by Hairy Woodpecker	Acres or Miles	Effect
Mechanical (tend to early sere)	6,691	Negative
Mechanical (tend to later sere)	17,554	Positive
Rx burns	6,438	Positive
Wildfires (since 1988)	24,068	Positive
Insects and Disease	12,241	Positive
Total open roads (miles)	467.3	Negative
Closed or decommissioned roads (miles)	141.7	Positive

Large trees, which are future down logs and snags, are maintained across the Santa Fe National Forest in accordance with the Forest Plan. Snags and down woody debris comprise important elements of the forested landscape. Road accessibility and increasing demand for firewood make snags and down woody debris susceptible to removal. Areas with high road density have a higher rate of snag removal than areas with low road densities. In areas inaccessible to the public, snags are maintained under normal conditions at far greater numbers than the Forest Plan guidelines of 2-3 snags per acre, thus the National Forest supports adequate numbers of snags and down logs for hairy woodpecker habitat. Prescribed burning and recent wildfires have created large snags in inaccessible areas (steep slopes) or areas with limited road access.

As illustrated in Table 16, the area affected by insects and disease, prescribed fire, and wildfire far exceed areas of treatments that would tend to have a negative effect on hairy woodpecker habitat. In general, habitat affected by fire, disease, and bug kill will have many more snags than the minimum levels required by the Forest Plan. With the rate of insect and disease infestation, the habitat trend for hairy woodpecker is increasing on the Forest.

Species Status and Population Trend

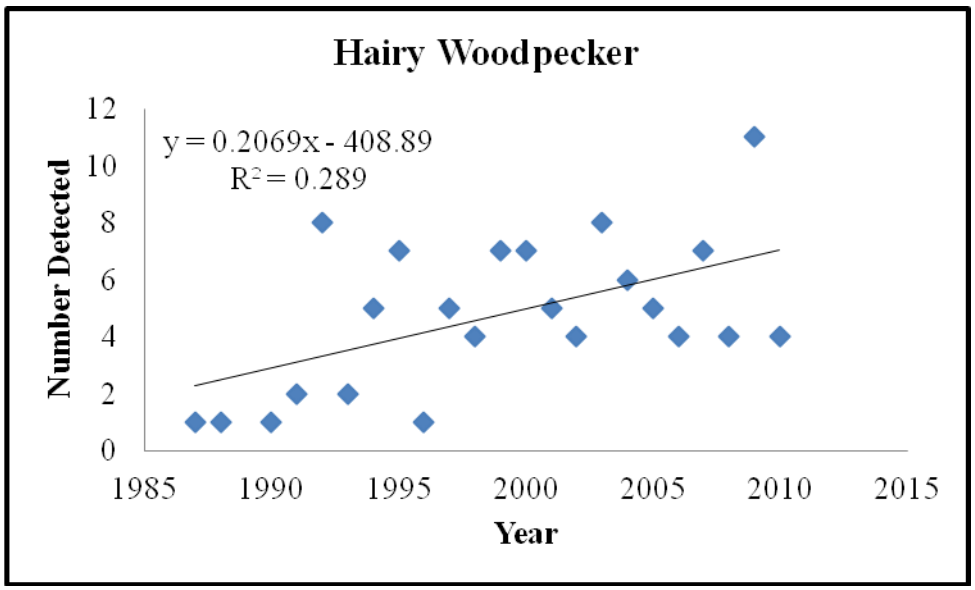
Hairy woodpeckers are year-round residents of nearly all forest types from central Canada to the southern United States (Scott et al. 1977). This species is one of the most common woodpeckers in the Southwest, particularly in riparian habitats and in ponderosa pine, mixed species and spruce-fir forests (Hubbard, 1978). Overall, the US population is stable. This species is widespread across the Santa Fe National Forest and can be found in any of the suitable habitat types.

The hairy woodpecker population is ranked as abundant for the Santa Fe NF. This means that the estimated number of breeding pairs, ranges between 10,000 and 100,000 pair. The population may fluctuate from year to year based on a variety of environmental factors. This estimate is based on the amount of habitat available, breeding bird surveys, local studies and the professional opinion of local biologists. A study conducted by Eagle Environmental in the spring and summer of 1985 in an area west of the Questa Ranger District on public lands administered by the Bureau of Land Management evaluated woodpecker populations (Stahlecker et al. 1989). Data for this species comes from the wooded canyon benches (WCB) habitat, which is similar to the transition zone between the pinyon-juniper and ponderosa pine type common across the Santa Fe National Forest. This habitat type contains a mix of juniper, pinyon and ponderosa pine. The survey also includes the upland forest (UF) habitat, which is similar to the lower elevation mixed conifer habitats on the Santa Fe, but is generally a more open canopy than most of the Santa Fe's forested stands. The UF habitat contains ponderosa pine, but Douglas fir is the dominant tree species. The WCB habitat had not been harvested, while the

UF habitat was historically harvested. Population densities for the WCB average 11 breeding pair per square kilometer. The UF habitat type averaged 12 breeding pair per square kilometer. Based on this study, 0 to 22 breeding pair per square kilometer can be estimated across mixed conifer vegetation type of the Santa Fe National Forest. Competition from other woodpecker species for cavity sites could affect populations of this management indicator species; however, in this study, Northern flickers averaged almost identical population densities by habitat type. The Santa Fe NF has over a million acres of forested habitats suitable for use by the hairy woodpecker.

Breeding bird surveys routes on or near the Santa Fe NF reported to the USGS between 1987 and 2010 indicate a stable to increasing trend for hairy woodpecker on the forest (Figure 6). The hairy woodpecker is listed as secure in New Mexico (NatureServe. 2011).

Figure 6 USGS New Mexico Hairy woodpecker Trend Data



Monitoring recommendations

Monitor as per Partners in Flight recommendations for habitat types where the species is found.

Pinyon Jay (Gymnorhinus cyanocephalus)

Habitat and Habitat Trend

Pinyon jays can be found in a wide variety of vegetative communities (Table 18), but they were selected to **serve as a management indicator of healthy pinyon-juniper habitat.** Pinyon jays nest mainly in stands of pinyon-juniper. It needs open woodlands for nesting and an adequate supply of seeds, especially nuts. They are gregarious and breed in colonies up to 150. They spend the winters in large flocks of 10's or 1000's moving in search of pinyon stands with a successful crop of pinyon nuts that are a primary food source along with other seeds, fruits and insects (Balda 2002). The Forest Plan modeling predicted that pinyon jay habitat would improve by increasing foraging areas. Alternatives

that favored a variety of mast producing plants found in early seral stage forests were best for pinyon jays.

Stands of mature pinyon-juniper provide quality habitat for the pinyon jay on the Santa Fe National. Stand improvements to grow large nut-producing pinyon trees and reduce the risk of crown fires in the pinyon-juniper type continues through managed fuelwood programs to thin dense stands. Prescribed fire is used to reduce woody debris after thinning.

Table 18

Vegetative Communities Represented by Pinyon Jays	
Vegetative Community	**Acres**
aspen	65
big sagebrush	17,784
blue grama	8,617
deciduous shrub mix	5,858
juniper	61,974
perennial grass mix	25,449
pinyon, pinyon-juniper	69,540
ponderosa pine mix	39,513
sparsely vegetated	37
spruce-fir	22
upper deciduous-evergreen forest tree mix	3,346
Total*	232,204

* Habitat acreage in Quantitative Analysis from Mid-Scale\PNVT report is 250,170 acres, but included some private in-holdings.

Beginning around 2002, much of the southwest has experienced severe mortality of pinyon stands. The Santa Fe National Forest is no exception. This die off was a result of severe drought conditions that weakened trees and made them susceptible to an infestation of pinyon bark beetle (pinyon ips). Aerial surveys by Forest Pest Management personnel indicate that more than 65,000 acres of pinyon stands on the Santa Fe NF have been affected. In some stands, pinyon mortality is 100%. Pinyon stands that were at lower elevations and that were very dense were affected the most.

Table 19 illustrates the affects of management treatments, wildfires, and insects and disease on pinyon jay habitat within the pinyon-juniper community.

Table 19

Treatments and Events within Pinyon/Juniper			
Acres of Pinyon - Juniper	**27,537**	**Positive Effect**	**Negative Effect**
Mechanical (tend to early sere)	3,751	X	
Mechanical (tend to later sere)	6,528	X	
Rx burns	11,632	X	
Wildfires (since 1988)	4,093	X	
Insects and Disease	1,533		X

The greatest threat to the pinyon jay is the continued loss of cone producing pinyon due to drought and insect infestation. Because of this wide scale loss of pinyon, **the habitat trend for pinyon jay is**

ranked as declining on the Forest. Treatments that thin dense pinyon and juniper stands to increase the vigor and drought resistance of remaining trees would be beneficial.

Species status and Population Trend

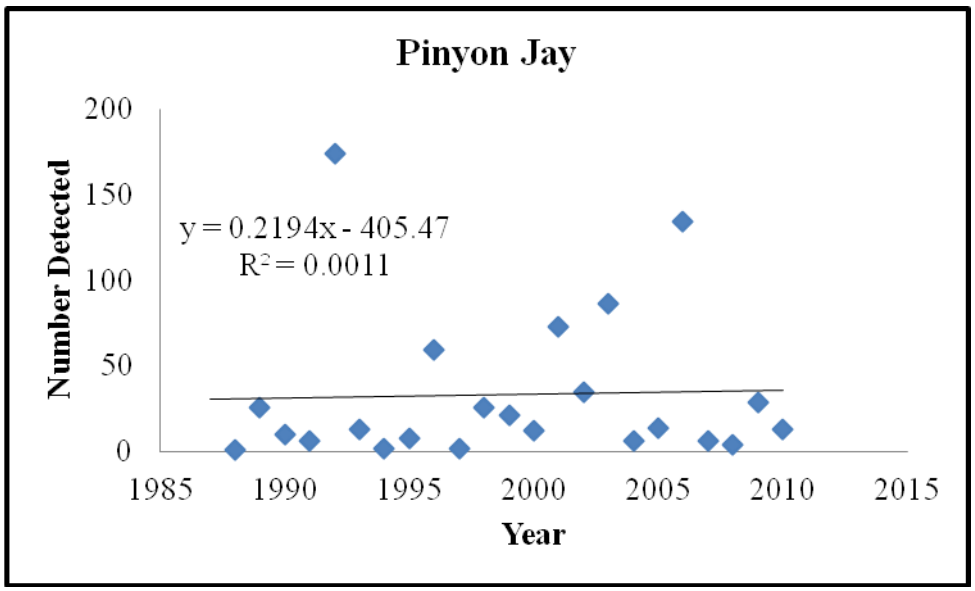
The species occupies New Mexico as a breeding and winter resident. They are variable residents in mainly middle elevation areas containing pinyon-juniper woodlands almost statewide, and are considered uncommon to locally abundant. Even within these habitats, however, their occurrence may be very unpredictable and seasonally sporadic. In mass movements during years of poor seed crop especially pinyon nuts, flocks may move hundreds of miles.

The Santa Fe NF contains over 232,204 acres of pinyon-juniper woodlands suitable for pinyon jay distributed across all Ranger Districts. Pinyon jay use would be widespread across this area with actual use varying by season and year.

In spite of the high pinyon mortality, the pinyon jay population remains ranked as common for the Santa Fe NF. This means that the estimated number of breeding pairs ranges between 1,000 and 10,000. The population may fluctuate from year to year based on a variety of environmental factors. This estimate is based on the amount of habitat available, breeding bird surveys and the professional opinion of local biologists. Current drought condition may continue to stress pinyon and increase pinyon mortality in the near future.

Surveys results for routes on or near the Santa Fe NF reported to the USGS between 1987 and 2010 indicate a **stable population trend** for pinyon jay on the forest (Figure 7), although the USGS data indicates a downward trend throughout New Mexico and the west (www.mbr-pwrc.usgs.gov). Nature Serve lists the pinyon jay as vulnerable in New Mexico (NatureServe. 2011).

Figure 7 USGS New Mexico Pinyon Jay Trend Data



Monitoring Recommendations

Consider establishing bird survey routes in pinyon stands to augment statewide monitoring. Continue review of local breeding bird survey rout information.

FEDERALLY LISTED SPECIES

Mexican Spotted Owl (*Strix occidentalis lucida*)

Habitat and Habitat Trend

Mexican spotted owls serve as a management indicator for late seral stage mixed conifer habitat. Changes in MSO habitat capability result primarily from changing the seral stage of mixed conifer habitat. For this assessment, potential habitat for MSO was developed from a regional database of 1,911 of MSO locations, including those locations on the Santa Fe NF (Appendix C). Mexican spotted owls may be found in other vegetative communities, but on the Santa Fe National Forest, they are closely linked to the mixed conifer and riparian vegetative types. Table 20 shows the vegetative communities represented by the Mexican Spotted Owl.

Table 20

Vegetative Communities Represented by MSO	
Vegetative Community	**Acres**
aspen	27,799
juniper	4,072
pinyon, pinyon-juniper	30,953
ponderosa pine mix	181,489
spruce-fir	125,013
upper deciduous-evergreen forest tree mix	260,864
Total*	630,191

* Habitat acreage in Quantitative Analysis from Mid-Scale\PNVT report is 667,811 acres, but included some private in-holdings.

In addition to the forested areas, MSO within the Jemez Mountains also occupy canyon habitats and are cliff nesters. These canyon habitats range from those with a high degree of forest structure on at least one of the slopes above the canyon wall, to little or no tree cover present; although, typically mixed conifer habitat is in very close proximity.

The MSO is most common in mature and old-growth forests throughout much of its range. The most highly sought habitat characteristics include high canopy closure, high stand density, a multi-layered canopy, uneven-aged stands, numerous snags, and downed woody matter. Dominant and co-dominant trees in the main canopy are often 18 inch DBH or larger, with 18 inch DBH or greater in the mature and old forest types -- best expressed in old-growth mixed-conifer forests (usually more than 200 years old). These characteristics may also develop in younger stands that are unmanaged or minimally

managed, especially when the stands contain remnant large trees or patches of large trees from earlier stands (USDI, FWS 1993).

The Santa Fe Forest Plan predicted that Mexican spotted owl habitat would improve over time as unharvested acres mature. Harvested acres would decrease habitat capability. The Forest Plan was amended in 1996. Appendix D of the Plan provides standards and guidelines for management of MSO and its habitat. It incorporates key elements from the Recovery Plan for the Mexican Spotted Owl (*Strix occidentalis lucida)*, December 1995. Specific standards and guidelines are provided for "Protected", "Restricted", and "Other Forest and Woodland Types" (Appendix D, Santa Fe Forest Plan, 1996). Since the 1996 Forest Plan Amendment, forest management activities within MSO habitat have complied with these standards and guidelines. Any deviations would have been rare and would have been done through consultation with the US Fish and Wildlife Service.

Forest management treatments within protected habitat (includes Protected Activity Centers or PACs) have been extremely limited particularly since the 1996 Amendment. Management activities within restricted habitat have typically included thinning and prescribed fires.

The greatest threat to MSO habitat is catastrophic wildfire. The largest, most intense fires have occurred since 1993, resulting in drastic changes is stand structure and composition on at least 11 PACs. Treatments or events that reduce the threat of catastrophic wildfire or tend to move mixed conifer areas to a climax condition are generally beneficial to MSO habitat (Table 21). Treatments or events that reduce mixed conifer habitat or move it away from climax condition is generally detrimental to MSO habitat.

Table 21

Treatments / Events within all Vegetative Communities Represented by MSO	Acres or Miles	Effect
Mechanical (tend to early sere) [1/]	24,486	Negative
Mechanical (tend to later sere)	45,024	Positive
Rx burns	26,476	Positive
Wildfires (since 1988)	103,528	Positive
Wildfires (high severity)[2]	20,737	Negative
Insects and Disease	417,808	Neutral
Total open roads (miles)	1,396	Negative
Closed or decommissioned roads (miles)	562	Positive

[1/] The bulk of these treatments would have been prior to the 1996 Forest Plan Amendment

[2/] Large fires from 1996 to present. Only high severity acres reported. Acres of moderate severity burn may also contribute to a negative effect.

The Forest is actively pursuing treatment of mixed conifer areas, as well as other vegetative communities, to reduce the threat of catastrophic wildfire. Treatments within this vegetative type are constrained by the MSO standards and guidelines within the Forest Plan. In addition, much of the mixed conifer type is on steep, inoperable slopes. The threat of catastrophic wildfire will continue well into the foreseeable future. **The habitat trend on the Forest is slightly declining since implementation of the Forest Plan.** The Las Conchas fire severely affected nine (9) MSO PACs that had not been previously affected by fire since enacting the Forest Plan. Two (2) other PACs were burned during the Las Conchas fire that were also burned during the Cerro Grande Fire in 2000. This

accounts for about 20 percent of the PACs currently identified on the forest. Future monitoring will tell whether these PACs are still suitable for MSO, but fire severity for the Las Conchas fire indicates complete loss of forest structure and change in community type that would not be suitable for MSO.

Species status and Population Trend

The Mexican spotted owl is federally listed as Threatened. It is found from parts of central Colorado and Utah, south through Arizona, New Mexico, and west Texas, then south through northwestern Mexico to the State of Michoacán. It has the largest geographic range of the three spotted owl subspecies. Its range extends from the southern Rocky Mountains in Colorado and the Colorado Plateau in southern Utah, southward through Arizona and New Mexico and, discontinuously, through the Sierra Madre Occidental and Oriental to the mountains at the south end of the Mexican Plateau (USDI, FWS, 1993). Global range-wide abundance is 1,000-3,000 individuals. Though 16 years has passed since the first recovery plan, total population size is not reliably known (USFWS, 2011).

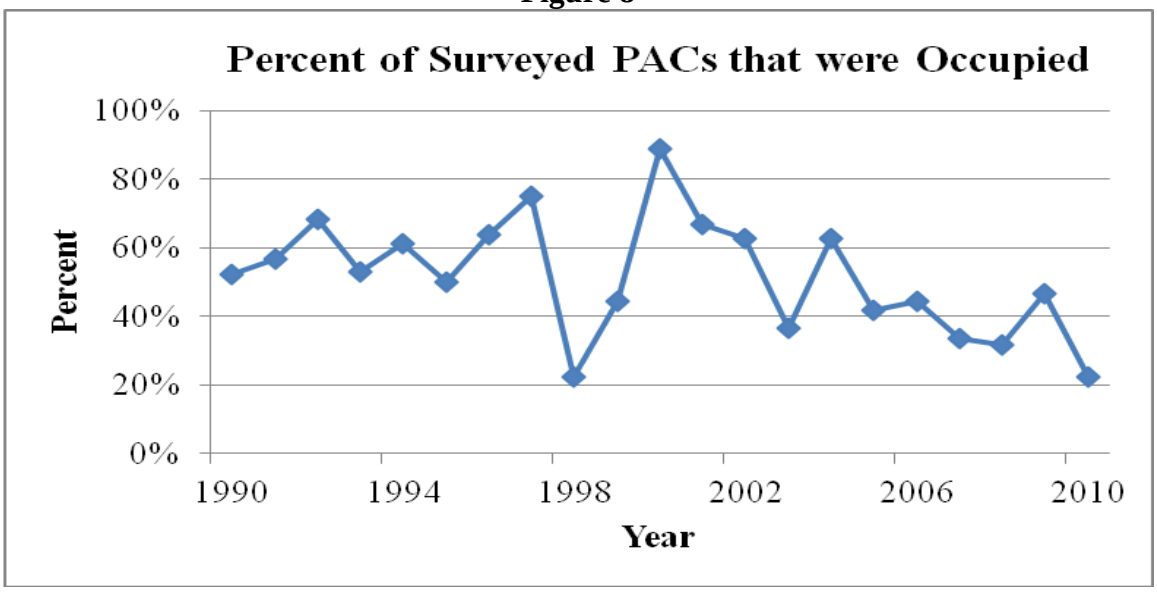
MSO are residents in the mountains of New Mexico, being most regular in the south. They can be found in the San Juan, Jemez, Sangre de Cristo, Mount Taylor, Sandia, Manzano, San Francisco, Tularosa, Mogollon, San Mateo, Pinos Altos, Black, White, Sacramento, Guadalupe and Animas mountains (Hubbard, 1978). In the Rocky Mountain region, the MSO is considered uncommon to rare, local in distribution and relatively habitat-specific (Finch, 1992). The MSO is threatened by destruction and modification of habitat caused by timber harvest and fires. Fuel accumulation and forests overstocked with trees place spotted owl habitat at risk to stand-replacing fires. Lack of small-scale, low intensity ground fires has increased this risk.

The MSO has limited distribution across the Santa Fe National Forest. There are historical records from all Ranger Districts; most occurrences are on the Jemez and Pecos-Las Vegas Ranger Districts. Within these Districts, it is found in very specific habitat types.

The MSO population is ranked as rare for the Santa Fe NF. This means that the estimated number of breeding pairs ranges between 10 and 100 pair. The population may fluctuate based on a variety of environmental factors. This estimate is based on the amount of habitat available, Mexican spotted owl surveys, and the professional opinion of local biologists. To date, 50 PACs have been identified in response to MSO surveys located on the Forest.

Since 1988, the Forest has been actively surveying for MSO. As new areas were surveyed, the number of PACs also increased as owls were located. The number of PACs identified has increased from 19 in 1989 to 50 in 2009. Monitoring of existing PACs to determine occupancy has been somewhat sporadic. Since 2001, the number of PACs surveyed or monitored has ranged between 8 and 21 annually. Figure 8 displays the percent occupancy of PAC's that were surveyed.

Figure 8



It is possible that continued surveys would reveal owls in habitats thought unoccupied. The rate of occupancy of surveyed PACs has fluctuated, but it does not necessarily indicate a change in MSO population on the Santa Fe NF. Our ability to detect owls from year to year can vary depending on survey routes, local conditions, and whether owls are responsive at the time of survey. The current loss of habitat through catastrophic fire could affect population on the forest, though a more intense annual survey effort would be needed to make that determination. There is still ample habitat that appears unoccupied that fire-displaced owls could occupy. For now, **the population trend for the MSO is rated as stable on the Santa Fe National Forest.**

Monitoring recommendations

Continue inventories on an as needed basis. Follow recommendations in the Recovery Plan for the Mexican Spotted Owl.

REGION 3 SENSITIVE SPECIES

RIO GRANDE CUTTHROAT TROUT (*Oncorhynchus clarki virginalis*)

Rio Grande cutthroat trout serve as a management indicator of healthy riparian and stream habitat and good water quality. Rio Grande cutthroat trout (RGCT) is one of 14 subspecies of cutthroat trout native to the western United States (Behnke 2002). They are found primarily in clear, cold mountain lakes and streams in Colorado and New Mexico within the Rio Grande Basin (Sublette et al. 1990). In New Mexico, RGCT exist in mountain streams primarily within the Sangre de Cristo and Jemez Mountain ranges within the Carson and Santa Fe National Forests. 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. Conservation populations of Rio Grande cutthroat trout occupy approximately 10 percent of their historical habitat (Alves et al. 2008).

Streams currently capable of supporting Rio Grande cutthroat trout are at elevations of 6,000 feet (ft) (1,829 meters (m)) and above. Historically (circa 1800), 43 percent of Rio Grande cutthroat trout populations occupied streams 8,000 ft (2,438 m) or less in elevation (Alves et al. 2008). Currently, only about 1.6 percent of the populations are in streams with elevation less than 8,000 ft (Alves et al. 2008). Conservation populations (those populations with 10 percent or less introgression (hybridization) from nonnative trout genes) are concentrated in streams with elevations from 9,000–10,000 ft (2,743–3,048 m). Because Rio Grande cutthroat trout are now restricted to first, and second order headwater streams that are narrow and small compared to the larger third, and fourth order streams they once occupied, the absolute loss of habitat is much greater than stream miles might indicate.

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^{o}C (50^{o}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 (Sublette et al. 1990). 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^{o}C (52^{o}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.

Rio Grande cutthroat trout are also a USFS Region 3 Sensitive Species and a candidate for federal protection under the Endangered Species Act "with a listing priority of 9, because the threats affecting it have a moderate magnitude and are imminent" (USFWS 2008; Federal Register May 14, 2008). The Santa Fe National Forest manages approximately 1,072 miles of perennial stream. Approximately 965 miles were thought to be historically occupied prior to stocking of non-native trout, and all are considered potential habitat in the State-Wide Conservation Agreement.

HABITAT AND HABITAT TREND

In 2001, in order to assess the quantity and quality of stream habitat, the Santa Fe NF adopted the Hankin-Reeves stream habitat inventory methodology, modifying the survey so that it meshed with geologic conditions related to RGCT (USFS 2005). The inventory is used to assess fish habitat condition and floodplain function, and establishes a baseline for future monitoring. Inventory data are analyzed to determine whether factors and indicators for specific habitat and water quality elements are properly functioning, at risk or not properly functioning within the range of natural variability as it relates to Rio Grande cutthroat trout historic and currently occupied streams (see Table RGCT-1). The Matrix of Factors and Indicators was developed through a peer and literature review process while incorporating similar formats developed by U.S. Fish & Wildlife Service and NOAA Fisheries Service for Section 7 project review. In addition, water temperature standards related to coldwater fisheries as established by the State of New Mexico Environment Department were incorporated as part of the matrix.

Table RGCT-1. Matrix of Factors and Indicators of Stream Health Condition for Historic and Occupied Rio Grande Cutthroat Trout Streams as Related to R3 Stream Habitat Inventory.

FACTORS	INDICATORS	Properly Functioning	At Risk	Not Properly Functioning
Water Quality	***Temperature – State of New Mexico Standards***	**Fully Supporting** <73.4°F at one time; or ≤ 68°F for 4 consecutive hours over 4 consecutive days		**Non Supporting** ≥ 73.4°F at one time; or > 68°F for 4 consecutive hours over 4 consecutive days
	Temperature – Salmonid Development	≤17.8°C (64°F) (7 day avg. max)	>17.8º (64ºF) < 21.1º (70ºF) (7 day avg. max)	≥21.1ºC (70ºF) (7 day avg. max)
Habitat Characteristics	**Sediment**	<20% fines (sand, silt, clay) in riffle habitat. Fine sediment within range of expected natural streambed conditions		≥20% fines (sand, silt, clay) in riffle habitat. Fine sediment outside of expected natural streambed conditions.
	Large Woody Debris[1]	>30 pieces per mile, >12" diameter, > 35 feet (or twice bankfull width) in length	20-30 pieces per mile, >12" diameter, > 35 feet (or twice bankfull width) in length	<20 pieces per mile, >12" diameter, > 35 feet (or twice bankfull width) in length
	Pool Development[2]	≥30% pool habitat by area[3]		<30% pool habitat by area[3]
	Pool Quality	Average residual pool depth ≥1 foot		Average residual pool depth <1 foot
Channel Condition and Dynamics	**Width/Depth Ratios by Channel Type** *(utilize Rosgen type[4] and range given if applicable)*	Width/depth ratios and channel types within natural ranges and site potential		Width/depth ratios and channel types are well outside of historic ranges and/or site potential
		Expected range of bankfull width/depth ratios and channel type	**Rosgen Type[4]** A, E, G B, C, F D	**W/D Ratio** <12 12-30 >40
	Stream Bank Condition[5]	<10% unstable banks (lineal stream bank distance)	10-20% unstable banks (lineal stream bank distance)	>20% unstable banks (lineal stream bank distance)

[1] Large Woody Debris numeric are not applicable in meadow reaches. For this survey a meadow reach can be defined as an area where there is no natural local recruitment of LWD.
[2] Pool Development numeric are applicable to 3rd order or larger streams.
[3] Area is defined by habitat length.
[4] Rosgen stream typing is used throughout this document to determine stream channel type, condition, and dynamics (Rosgen and Silvey 1998).
[5] Stream Bank Condition numeric are not applicable in reaches with > 4% gradient.

Quality of habitat conditions is generally less than moderate across the SFNF. In high elevation locations where access is limited by topography and wilderness regulations, stream habitat quality is moderate to excellent. Where poor habitat and water quality conditions occur, the size of RGCT populations is affected. Decreased water quality can be attributed, but not limited to, soil compaction, road run-off, unstable banks, and delivery of pollutants from non-point sources. 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.

At the conclusion of 2010, the Forest had surveyed over 299 miles of stream using the Region 3 Stream Habitat Inventory protocol. An analysis of the habitat data collected between 2001 and 2005 shows that streams in the wilderness average 33 pieces of large wood per mile. In similar stream types outside of the wilderness, streams achieved only 11 pieces per mile, in many cases going several miles without one piece of wood. Other habitat indicators often below standard include: 1) excessive sediment and fines in riffle habitat (>20%); 2) stream widening which has led to high water temperatures; 3) unstable stream banks, 4) too few and small pools with low pool volume; and 5) a lack of side channel development (Table RGCT-2).

Factors contributing to these degraded stream habitat condition may include:

1) Active removal of current and potential large woody debris from riparian areas and streams, which eliminates fish and macroinvertebrate habitat, destabilizes streams, and potentially delivers non-point source pollutants. Wood was removed as a result of past timber and firewood management practices, in addition to the deliberate removal from streams up until the 1980's because of previous scientific thought that wood was a barrier to migration (AFS 1983).
2) Fire suppression, which has resulted in conifer encroachment into riparian habitats and has diminished the delivery of large wood and nutrient cycling;
3) Grazing in riparian areas, which alters floodplain dynamics and reduces riparian vegetation, destabilizes streambanks, widens streams, introduces sediments, and increases nutrient loading;
4) Construction and maintenance of roads within riparian areas, which impact stream structure and floodplain dynamics, straightens channels, introduces non-point source pollutants, and hardens stream banks; and
5) Dispersed and developed recreation, which can result in altered riparian habitats, hardened floodplains, wide streams, increased non-point source pollutants, and removal of stream structure.

Good baseline information on RGCT stream habitat at the time the Forest Plan was adopted does not exist. However, we continue to collect stream habitat information each year. Table RGCT-2 shows twenty-five streams that have been inventoried in the last decade. Unfortunately, every stream has at least two habitat components that are not properly functioning, and these conditions likely existed at the time of the Forest Plan development. Since then, efforts have been made to improve conditions affecting stream habitat such as closing or decommissioning roads, providing buffer areas between streams and treatment areas, employing best management practices on treatments affecting watersheds, and improving grazing practices on many grazing allotments on the Forest. Direct stream and riparian habitat improvements have included thinning of conifers along streams to improve riparian vegetation, placing large woody debris in stream channels, resizing and replacing small culverts with larger channel-spanning structures, fencing sensitive areas against livestock and recreation use. Efforts such as Respect the Rio have been and continue to be successful in restoring the health of stream and riparian systems. In addition, the current emphasis on restoration of healthy forest ecosystems should

result in improved watershed conditions and reduce the threat of catastrophic wildfire, which is a serious threat to stream conditions and RGCT habitat on the Santa Fe NF.

While watershed restoration efforts have been implemented or are on-going, stream habitat conditions have minimally improved and in some locations declined. We compared habitat data collected via a similar stream inventory protocol in the early 1990's to data collected from those same streams in the last decade. While some habitat attributes changed, two components (pool volume and pool quality) are comparable. In three streams that have been re-inventoried, the trend indicates status quo or a decline. In addition, photopoints of streams that have been surveyed in the last several years have been compared to photos taken 10 to 20 years ago, and some areas do indicate improving trends.

Since development of the Forest Plan, stream habitat conditions for RGCT have varied from slightly declining to slightly improving. However, 3 large catastrophic wildfires have severely impacted 6 important Rio Grande cutthroat trout streams in the last two years (see pages 10 – 12 of this report for a description of the wildfires and the RGCT streams affected). **Therefore, the habitat trend for RGCT is rated as declining.**

Table RGCT-2 shows the current conditions of streams surveyed from 2001 to 2010 as related to Factors & Indicators of stream health for historic & occupied RGCT streams.

Stream	Total Channel Length Surveyed (mi)	Temperature (State)	Temperature (Salmonid)	Sediment	LWD	Pool Development	Pool Quality	W:D Ratio	Streambank Condition	Year Surveyed
Cow Creek	18.4	PF	PF	NPF	NPF	NPF	PF	PF	PF	2001
Elk Creek	4	PF	PF	NPF	NPF	*	PF	NPF	PF	2001
Sheep Creek	1.5	PF	PF	NPF	NPF	*	NPF	PF	PF	2001
Gallinas River	9.84	PF	PF	PF	NPF	NPF	PF	PF	PF	2001
Rio de las Vacas	22.6	NPF	NPF	NPF	NPF	NPF	PF	NPF	PF	2003
RGCT Occupied		PF	PF	PF	PF	*	PF	PF	PF	
Rio Cebolla	19.5	NPF	NPF	NPF	NPF	NPF	PF	AR	NPF	2001
RGCT Occupied		PFF	NPF	NPF	NPF	NPF	NPF	PF	AR	
Rio Frijoles	5.5	2	2	PF	PF	NPF	PF	PF	PF	2001
RGCT Occupied		2	2	NPF	3	NPF	PF	PF	PF	
East Fork Jemez	21.4	NPF	NPF	NPF	NPF	NPF	PF	AR	PF	2001
San Antonio Creek	30.5	PF	NPF	NPF	NPF	NPF	1	NPF	PF	2002
Pecos River	22.4	PF	AR	PF	NPF	NPF	PF	NPF	PF	2002
RGCT Occupied		PF	PF	NPF	NPF	*	PF	PF	PF	
Rito Peñas Negras	11.9	NPF	NPF	NPF	NPF	PF	PF	AR	NPF	2005
Chihuahueños Creek *(RGCT Occupied)*	9.5	PF	PF	NPF	PF	NPF	NPF	NPF	NPF	2005
Polvadera Creek * *(RGCT Occupied)*	12.4	PF	AR	NPF	AR	NPF	NPF	NPF	AR	2004
Panchuela Creek	8.3	PF	PF	PF	PF	NPF	PF	PF	PF	2004
Horsethief Creek	4.6	PF	PF	PF	PF	NPF	PF	PF	PF	2004
Rito Perro	1.5	PF	PF	PF	PF	*	PF	PF	PF	2004
Cave Creek	4.2	PF	PF	PF	NPF	NPF	PF	PF	PF	2004
RGCT Occupied		PF	PF	PF	NPF	*	PF	PF	PF	

Stream	Total Channel Length Surveyed (mi)	Temperature (State)	Temperature (Salmonid)	Sediment	LWD	Pool Development	Pool Quality	W:D Ratio	Streambank Condition	Year Surveyed
Canones Creek *(RGCT Occupied)*	7.6	AR	AR	PF	NPF	NPF	PF	PF	AR	2002
Rio Guadalupe	13.4	NPF	NPF	PF	NPF	NPF	PF	AR	PF	2004
Rio Puerco	12.1	PF	PF	NPF	NPF	NPF	PF	??	PF	2006
Capulin Canyon*	7.2	AR	AR	NPF	PF	NPF	NPF	??	AR	2006
Jemez River	12.8	NPF	NPF	NPF	NPF	NPF	PF	??	PF	2006
Rio Mora	19.5	PF	PF	PF	PF	NPF	PF	NPF	PF	2007
Rio Nambe*	12.1	N/A	N/A	??	PF	PF	??	??	PF	2009
Rio Capulin*	6.7	N/A	N/A	??	PF	NPF	??	??	NPF	2010

PF – Properly Functioning AR – At Risk NPF – Not Properly Functioning
* - Pool development is not applicable to 1st and 2nd order streams
[1] - Not analyzed due to surveyor error
[2] - Long-term water temperature data has not been collected
[3] - RGCT occupied portion is a meadow reach; thus, LWD is not applicable
* **-** Indicates a stream that has been severely impacted by catastrophic wildfire since the stream habitat inventory was completed.

Wildfire: Southfork, Pacheco, Las Conchas

The **South Fork** fire began on June 10, 2010 as the result of a lightning strike. It burned a total of 17,086 acres, and was located primarily north of Polvadera Peak on National Forest System lands managed by the Espanola Ranger District of the Santa Fe National Forest (Table RGCT-3). The areas of high burn severity are located on steep slopes of Polvadera Peak, Polvadera Canyon (mainstem and South Fork) and headwaters of Canada del Ojitos in the Polvadera watershed and moderately steep and steep slopes of El Canoncito. Slopes within areas mapped as high burn severity range from 25 to 75 percent, and soils are variable, ranging in depth from shallow to deep. Rock outcrop is a major component of the soils along the slopes of Polvadera Canyon (Table RGCT-3).

Polvadera Creek was a Core population of RGCT, meaning it had >99% genetic purity (NMDGF 2002). It, along with South Fork Polvadera Creek was the longest occupied RGCT stream system on the Santa Fe, at 8.1 miles (Table RGCT-4). There were an estimated 1,000 adult Rio Grande cutthroat in the stream. During the fire, a team of biologists from New Mexico Department of Game and Fish (NMDGF) and the Santa Fe National Forest (SFNF) removed approximately 271 Rio Grande cutthroat trout from Polvadera Creek. The fish were transported to Seven Springs Hatchery near Fenton Lake to wait out the fire. After the 2010 monsoon season, a crew from NMDGF and SFNF went back to Polvadera to assess the remaining fishery. In the lower meadow area (at the USFS administrative site), the stream channel experienced severe erosion. In addition, there was extensive filling in of the channel, with about a foot of freshly deposited sediment and debris across the floodplain and debris jams in the channel, which caused the cutting of new channel segments.

Farther up in the canyon, the stream and riparian area were severely impacted. The riparian vegetation (willow & alder) was flattened and mostly broken off at the base, and the channel was completely filled in with sediment and ash, with about 2 inches of water running over a 30-40 foot wide channel. There were no fish in the 3 miles above the administrative site. Farther up in the canyon near the headwaters, 7 Rio Grande cutthroat trout were later found. As a result of the habitat destruction, the fish collected during the fire were later stocked into the Rio Molino in the Pecos Wilderness.

The **Pacheco** fire began on June 18, 2011 as the result of unknown causes. It burned 10,057 acres: 9,868 acres managed by the Espanola Ranger District of the Santa Fe National Forest located primarily within the Pecos Wilderness, 158 acres of Nambe Pueblo lands, and 31 acres of private land. The burned area included the Rio Nambe and Rio Frijoles sub-watersheds (Table RGCT-3).

The fire burned hot in the headwaters of these watersheds. Aerial recon of the burn area indicated the areas of high burn severity are located on steep to very steep slopes above the Rio Nambe and Rio Capulin. Slopes within the high burn severity areas range from 35 to 75 percent, and soils are variable with moderately deep soils with cobble and stone surfaces occurring along ridge lines and deeper, less rocky soils present on smooth mountain side slopes.

Rio Nambe, Rio Capulin, and **Rio Frijoles** are RGCT streams within the Pacheco fire (Table RGCT-4). Rio Nambe and Rio Capulin are Recreation populations, meaning they are hybridized and have <90% genetic purity. Rio Frijoles is a Conservation population, meaning it has >90% genetic purity (NMDGF 2002). At 7.9 miles in length, the Rio Frijoles/Rito Jaroso system is one of the longest occupied stream systems. As of October 2011, post-monsoon season assessments of the Pacheco RGCT populations have not been made, but there are reports of severe down-cutting in the Rio Nambe, and heavy ash and debris flows which killed a significant number of fish in Nambe Reservoir approximately 3 miles downstream of the fire.

The **Las Conchas** fire started on June 26, 2011, as the result of a windthrown tree striking and shorting out a powerline. The burned area is located southwest, west, north and northwest of the town of Los Alamos, NM. The fire was located on portions of the Espanola, Coyote, Jemez Districts of the Santa Fe National Forest, Bandelier National Monument, Los Alamos National Laboratory, Los Alamos County, Valles Caldera National Preserve, Jemez Pueblo, Santo Domingo Pueblo, Santa Clara Pueblo, and numerous private inholdings. It burned 156,593 acres and was the largest recorded wildfire in New Mexico's history.

Slopes within the burned area are predominantly moderately steep-to-steep, with lesser amounts of flat mesas. The tuff and pumice derived soils are productive but have very high erosion potentials due to low bulk density of extrusive volcanic parent material. Many channels have not experienced high flows in many years and consequently have large amounts of stored sediments that could entrain easily under peak flows (USFS 2011).

Post-fire discharge calculations range between 280 and 3600 cfs. Within the burn perimeter, critical values at risk were identified in 6 of 33 watersheds, including the risk to Rio Grande cutthroat trout habitat in 4 of these watersheds. Approximately 21% (32,992 acres) of the fire burned with high severity and 34% (53,904 acres) burned with moderate severity. Combined, the high and moderate severity accounted for 55% (86,896 acres) of the burned area. From a soils and watershed condition standpoint, these burned acres will account for a majority of the erosion and sedimentation in the burned area. In high burn severity areas, soils may become water repellent (hydrophobic tendency),

which impacts the potential runoff hazard and predicted sediment production of the burned area. Results of hydrophobicity tests from 30 sites throughout the burn area indicated highly variable soil conditions; nonetheless, watersheds will realize significant increased hydrologic response and loss of control of water. Potential effects of this include accelerated soil erosion, potential flooding, sedimentation and debris flows and torrents downstream of the burn area, and loss of long-term site productivity (USFS 2011).

As a result of the fire's severity and extent, little can be done to mitigate losses to wildlife and fisheries resources. Four populations of Rio Grande cutthroat trout are within the Las Conchas burn area. Of these populations, one is a recreation population (**Peralta Canyon**), two are conservation populations (**Medio Dia Canyon and Rio del Oso and tributaries**), and one is a core population (**Capulin Canyon**). Because of the fire's size and severity, the steepness of slopes, and the proximity of the wildfire to aquatic habitats, Rio Grande cutthroat trout are at a very high risk of impact. Impacts include changes in peak flows and deposition of ash and sediment which negatively alter fish and macro-invertebrate habitat and water quality. Fish deaths due to fire are also associated with ash flows, which can obstruct gill membranes and cause asphyxiation. As of October 2011, post-monsoon season assessments of these RGCT populations have not been made.

Table RGCT- 3. Burn Severity within Sub-Watersheds Occupied by Rio Grande Cutthroat Trout.

Fire/ HUC 12 Watershed	RGCT Stream	Wtrshd Acres	High Severity	Moderate Severity	Low Severity	Unchanged	Burn Acres Total
South Fork Fire – 2010	Polvadera	10,092	766	1,476	2,669	5,140	10,051
Pacheco – 2011	Rio Nambe, Capulin, Rio Frijoles	31,679	3,723	2,048	4,479		
Las Conchas – 2011							
Capulin Canyon	Capulin	26,889	511	6,605	6,408	2,159	15,683
Rio Choquito	Medio Dia	30,176	9,712	5,225	4,911	816	20,664
Peralta Canyon	Peralta	28,434	2,644	7,432	5,800	1,722	17,598
Rio del Oso	Rio del Oso & tributaries	26,766	737	3,724	2,210	740	7,411

Table RGCT- 4. Rio Grande cutthroat trout populations within the South Fork, Pacheco, and Las Conchas fires and their status.

Rio Grande cutthroat trout population	Population Status	Length of occupied habitat	Genetics / origin
South Fork - 2010			
Polvadera/ South Fork Polvadera	Core	8.1	Endemic
Pacheco - 2011			
Rio Nambe/Capulin	Recreation	Unknown; >2 miles	>10% hybridization; Yellowstone cut
Rio Frijoles & Rito Jarosa	Conservation	7.9 miles	Genetic testing old
Las Conchas – 2011			
Peralta Creek	Recreation	1.9 miles	>10% hybridization; possible Yellowstone cutthroat introgression; genetic testing old (1982, 1990)
Medio Dia Creek	Conservation	0.4 mile	This population originated from 15 RGCT moved from Rio las Vacas to Medio Dia in 1995. The Vacas population is now known as a Yellowstone cutthroat trout hybrid population (Conservation population) so presumably Medio Dia is the same (NMDGF 1996).
Capulin Canyon	Core	7.4 miles	Re-stocked with fish from Cañones Creek in 2006
Rio del Oso; Rito del Oso; Rito de Abiquiu	Conservation	7.8 miles	Endemic; Genetic testing late 1990's

Species Status and Population Trend

The Regional Forester for the Southwest Region of the Forest Service designated Rio Grande cutthroat trout as a sensitive species in New Mexico. 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. In addition, the U.S. Fish and Wildlife Service listed the species as a candidate for Endangered Species Act protection in 2008 (USFWS 2008; Federal Register May 14, 2008).

The Santa Fe NF (SFNF) manages 1,072 miles of perennial stream length. Approximately 965 miles were thought to be historically occupied prior to stocking of non-native trout (the first stocking record noted in New Mexico was in 1896 (Sublette et al. 1990)) and all are considered potential habitat in the State-Wide Conservation Agreement. As of 2011, New Mexico Department of Game and Fish (NMDGF) and SFNF biologists had identified 44 Core and Conservation streams on the Forest, totaling 128.7 miles of occupied stream (Table RGCT-5; Appendix B). Core or Conservation populations on the Santa Fe NF tend to be in small, isolated segments of stream high up in the Wilderness in both the Pecos and Jemez areas. The average length of an occupied stream is approximately 3 miles. The longest networked system is the Rio de las Vacas/Rito de las Perchas/Rito

Anastacio in the San Pedro Parks Wilderness Area at 12 miles. The shortest occupied stream segment was the Medio Dia, at 0.5 miles.

In order to understand the historic, current, and potential Rio Grande cutthroat trout distribution, the forest is divided into four significant Geographical Management Units (GMU's): 1) Jemez Mountains (Rio Grande); 2) Sangre de Cristo Mountains (Rio Grande); 3) Pecos River; and 4) Canadian River (Table RGCT-5).

Table RGCT-5. Miles of Stream Occupied by Core and Conservation Populations of RGCT on SFNF

Geographic Management Unit	Total Miles	Core	Conservation
Jemez Mountains	64.7	18.4	33.9
Sangre de Cristo	30.9	16.9	14
Pecos	37.2	23.4	13.8
Canadian	8.3	8.3	0.0
Total Miles	**128.7**	**67**	**61.7**

Within each GMU, Core and Conservation populations are rated as 1) Secure; 2) At Risk; and 3) Unknown (Appendix B). "Secure" are populations that are currently known to be inhabited and have populations that are considered genetically intact and free of invasive species. Secure populations also have habitat that is relatively intact. "At Risk" populations are either genetically introgressed, and/or occupied by invasive species, or severely threatened by habitat loss, such as those 7 populations affected by the 2010/2011 wildfires on the Santa Fe National Forest (Table RGCT-4). Of the occupied stream miles from Table RGCT-5, 69.5 miles are currently considered secure. In addition, 59.2 miles are at risk (Table RGCT-6).

However, of the streams currently considered "secure", the average length of occupied habitat is 2.8 miles and the majority of the occupied segments are isolated. In fact, across the range (Colorado and New Mexico), 93% of the conservation populations, representing 80% of the occupied miles, are in isolated stream fragments (Alves et al. 2008). This isolation likely reduces habitat complexity and ultimately leads to a loss of genetic diversity. Populations that are isolated and in stream lengths less than 6 mi (9.6 km) may not be able to provide the necessary habitat for all life stages in times of stress (e.g., reduced flows, increased temperature) and therefore the viability of the populations in the shorter stream segments over the long term is questionable (USFWS 2011). Only 2 "secure" populations on the Santa Fe occupy stream segments at or over 6 miles in length – Cañones Creek (Jemez GMU) and Jacks Creek (Pecos GMU; Appendix B). Capulin Canyon and Polvadera Creek were once considered "secure" populations occupying stream segments at or over 6 miles in length. However, these populations and their habitat have recently been compromised by catastrophic wildfire – the extent of population and habitat impacts are still unknown.

No miles are currently proposed for occupation. A recent re-introduction occurred in the Rio Molino in the Pecos Wilderness, using fish that were rescued from Polvadera Creek during the South Fork fire in 2010. Assessments are forthcoming on future proposals.

Table RGCT-6. Historic, Secure, At Risk and Proposed Stream Miles of RGCT on SFNF

Geographic Management Unit	Secure (miles)	At Risk (miles)	Total Current Occupied (miles)	Historic Occupied w/in SFNF Boundary (approximate; miles)
Jemez Mountains	21.6	30.7	52.3	402
Sangre de Cristo	16.9	14	30.9	141
Pecos	31	6.2	37.2	339
Canadian	0.0	8.3	8.3	83
Total	**69.5**	**59.2**	**128.7**	**965**

Today, total known occupied stream miles are over 128 miles. Only approximately 100 miles were known to be occupied in the early 1990's (Lee Johnson, personal communication). This number has jumped for two reasons: 1) further data collection has located previously unknown occupied sites that were once listed as suspected (or unconfirmed); 2) re-introductions were undertaken to secure and/or expand the range of RGCT in streams where they were completely or nearly extirpated (i.e. Capulin Canyon, Rio Cebolla, Rio de las Vacas, Jacks Creek, Doctor Creek, Valdez Creek, Rito del Padre and Pecos River).

While RGCT occupied stream mileage on the Santa Fe National Forest has generally increased since the onset of the Forest Plan, mileage has declined since originally reported during the 2002 USFWS Candidate Assessment. This is due to an assortment of factors: 1) Better information about population range; 2) further genetic analysis; 3) population loss due to drought; and 4) invasion of exotic species. In 2002, the Santa Fe National Forest reported to USFWS that there were approximately 158.7 miles of occupied habitat. Rio Grande cutthroat trout occupied stream mileage has also decreased since 2006 as a result of the 2010 South Fork fire, which eliminated approximately 6.6 miles of habitat in Polvadera Creek when monsoon storms carried ash and debris downslope, filling in the stream channel and eliminating fish habitat. NMDGF and the Forest have identified 128.7 occupied miles on the Santa Fe National Forest (RGCT-Table 7 & Appendix B).

RGCT-Table 7. Trend of Stream Miles Occupied from 2002 to 2011

SFNF Occupied Waters	Stream Miles		
	2002	2006	2011
Secure	81.0	76.4	69.5
At Risk	77.7	59.8	59.2
Total	158.7	136.2	128.7

Comparison between the data reported in the 2006 MIS Report and 2011 is difficult because of the way the data are reported. We now have a rangewide RGCT Access database with accompanying GIS (Geographic Information System) data layers. This database has standardized the way we report occupied habitat, and it includes barrier locations. This has led to subtle differences in mileage being reported as occupied. Between 2006 and 2011, we did also learn more about the genetics of more RGCT populations (i.e. Peralta Canyon, Chihuahueños, Doctor Creek, Indian Creek, Rio Nambe, and a

few others). Unfortunately, these populations have more than 10% introgression, so they no longer count as Conservation Populations, and probably should not have been included in the 2006 report either. They are, however, still important recreational fisheries (Appendix B).

Observations by field biologists (USFS, NMGF) note that RGCT populations have declined in areas where they are unprotected from brown and rainbow trout. Secure populations seem to be stable in low elevation, front country and high elevation, wilderness areas.

The greatest threats to the RGCT population on the Santa Fe NF are:

- Presence of exotic trout, i.e. brown trout and rainbow trout. Brown trout compete directly with RGCT as well as prey on their young. Rainbow trout hybridize with RGCT and essentially breed them out of existence.

- Whirling disease. In 1999, whirling disease, a debilitating and fatal parasite introduced by unsanitary hatchery practices, was discovered in waters in New Mexico. This includes waters on the SFNF (Pecos River, Dalton Canyon, Rio Cebolla below Seven Springs Hatchery). In 2006, the MIS report included Cañones Creek and Jacks Creek as waters testing positive for whirling disease. Subsequent testing has not found any evidence of whirling disease in these two streams. It is unclear at this time what effects this may have on the overall population of RGCT in the long-term.

- Catastrophic fire. Large, intense fires can totally wipe out a fish population due to ash flow and sedimentation and make streams uninhabitable for several years. The Viveash Fire of 2000 and the South Fork Fire in 2010 are prime examples of this.

Since the Forest Plan (USFS 1987), the RGCT population on the Santa Fe NF has increased. This is largely due to efforts to re-introduce RGCT into various streams on the Forest. This is offset by population losses due to invasive species and catastrophic events (fires, drought); but overall, occupied miles has increased since 1987.

RGCT are afforded a number of protections as a Region 3 Regional Forester's Sensitive Species, as a candidate for protection under the Endangered Species Act, as a New Mexico Species of Special Concern, and as a Santa Fe National Forest Management Indicator Species.

The Santa Fe National Forest has an obligation to conserve the species and its habitat. Regulation 9500-4 (1983) mandates that "Habitats for all existing native…fish…species will be managed to maintain at least viable populations of such species." In order to achieve this, "habitat must be provided for the number and distribution of reproductive individuals to ensure the continued existence of a species throughout its geographic range." This is further supported by the National Forest Management Act (36 CFR, Ch. 2, 1990), which states that the FS must "provide for adequate fish…habitat to maintain viable populations of existing native…species and provide that for species chosen [as management indicator species]." NFMA further protects riparian areas, defined as "land and vegetation…approximately 100 feet from the edges of perennial streams, lakes and other bodies of water" by stating that "no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment shall be permitted within these areas which seriously and adversely affect water conditions or fish habitat" (36 CFR, Ch. 2, 1990). The Forest Plan (amended 1996), also specifies that the Forest will "continue activities to

improve Rio Grande cutthroat trout habitat with the objective of securing the species; develop RGCT fisheries within selected areas identified in conjunction with the New Mexico Game and Fish."

These previous mandates and the risks to the species spurred the development of conservation agreements at the State and Range-wide levels, in order to assure the conservation of RGCT. The state-wide conservation agreement (USFS 2002), of which the Southwest Region of the Forest Service is a party, states that the FS 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 FS shall "prevent or alleviate management related impacts that could degrade occupied or potential Rio Grande cutthroat trout habitat and/or impair current populations."

The Range-wide conservation agreement for Rio Grande Cutthroat Trout in the states of Colorado and New Mexico (RGCT Conservation Team 2009) was signed 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. It updates the 2003 Range-wide Conservation Agreement. The overall goal of the 2009 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.

Given the loss of Conservation populations in the catastrophic wildfires of 2010 and 2011, the Forest needs to further evaluate conditions in watersheds containing Conservation populations of RGCT and start preparing for the replication of key populations to ensure their survival. In addition, more genetic analyses are needed to accurately assess what the current status of RGCT on the Forest is. Despite the loss of key populations in 2010 and 2011, with protections in place and with the success and continued efforts to improve stream habitat and to re-introduce RGCT into recipient streams, **the population trend (1987-2011) for Rio Grande cutthroat trout on the Santa Fe NF, is precariously upward.**

MONITORING RECOMMENDATIONS

- Continue to coordinate with NMDGF and USFWS on RGCT population monitoring.
- Continue with stream inventory and monitoring of habitat conditions.
- Proceed with genetic testing of isolated populations.
- Evaluate risk of catastrophic fire in watersheds containing Conservation Populations of RGCT.

CITATIONS

Alves, J. E., K. A. Patten, D. E. Brauch, and P. M. Jones. 2008. Range-wide status of Rio Grande cutthroat trout (Oncorhynchus clarki viginalis): 2008. Unpublished report and Access data base.

American Fisheries Society (AFS). 1983. Stream obstruction removal guidelines. C. McConnell et al., editors.

Balda, Russell P. 2002. Pinyon Jay (Gymnorhinus cyanocephalus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/605

Behnke, R.J. 2002. Trout and Salmon of North America. Illustrated by Joseph R. Tomelleri; foreword by Thomas McGuane. 1st Edition. Free Press. New York City, New York. 360 pp.

[BISON-M] Biota Information System of New Mexico. Nov. 2011 BISON-M home page. http://www.bison-m.org. Accessed Nov., 2011.

Bock, Carl E.; Saab, Victoria A.; Rich, Terrell D.; Dobkin, David S. 1993. Effects of livestock grazing on neotropical migratory landbirds in western North America. In: Finch, Deborah M.; Stangel, Peter W. (eds.). Status and management of neotropical migratory birds: September 21-25, 1992, Estes Park, Colorado. Gen. Tech. Rep. RM-229. Fort Collins, Colo.: Rocky Mountain Forest and Range Experiment Station, U.S. Dept. of Agriculture, Forest Service: 296-309.

Dolton, D.D., R.D. Rau, and K. Parker. 2007. Mourning dove population status, 2007. U.S. Fish and Wildlife Service, Laurel, Maryland, USA.

"Elk." New Mexico Department of Game and Fish. http://www.gmfsh.state.nm.us

Finch, D. M. 1992. Threatened, endangered, and vulnerable species of terrestrial vertebrates in the Rocky Mountain region. General Technical Report RM-215. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Goldstein, Elise. April 20, 2006. Bighorn Sheep Biologist, New Mexico Department of Game and Fish, Wildlife Management Division, personal communication.

Harig, A.L. and K.D. Fausch. 1999. Minimum habitat requirements for establishing translocated cutthroat trout populations. Annual Progress Report to Colorado Division of Wildlife, U.S. Forest Service and Trout Unlimited. 90pp.

Harig, A.L and K.D. Fausch. 2000. Factors influencing success of cutthroat trout translocations. Final Project Report to Colorado Division of Wildlife, U.S. Forest Service and Trout Unlimited. 140 pp.

Hubbard, J. P. 1978. Revised checklist of the birds of New Mexico. New Mexico Ornithological Society Publication No. 6: 5-6.

Johnson, J. A.; Johnson T. H. 1985. The status of the spotted owl in northern New Mexico. Contract No. 516.6-73-03. Santa Fe, NM: New Mexico Department of Game and Fish. 39p.

Johnson, Terrell H. 1999. Status of the Spotted Owl in the Jemez Mountains – 1998-99. PO 98CRSA1406. US Geological Survey, Los Alamos National Laboratory Agreement C-6832.

Johnson, Lee. 2001. Personal communication with Santa Fe National Forest Biologist.

Magee, J.P., T.E. McMahon and R.F Thurow. 1996. Spatial variation in spawning habitat of cutthroat trout in a sediment-rich basin. Transactions of the American Fisheries Society 125:768-779.

NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: November 3, 2011).

New Mexico Department of Game and Fish. 1996. Rio Grande Cutthroat Trout Management. Federal Aid Grant F-60-M-3. Project Number 11. 33 pp. Santa Fe, New Mexico

New Mexico Department of Game and Fish. 1998. Elk Harvest Data 1987-1996

New Mexico Game and Fish. 2001. Rio Grande Cutthroat Trout Management Plan. Publication pending.

New Mexico Department of Game and Fish. 2002. Long-Range Management Plan for the Conservation of Rio Grande Cutthroat Trout. Santa Fe, New Mexico.

New Mexico Department of Game and Fish, Division of Wildlife. 2007. Draft Long-Range Plan for the Management of Wild Turkey in New Mexico 2007-2012.

New Mexico Department of Game and Fish, Wildlife Management Division. 2004. Long range plan for management of Rocky Mountain Bighorn Sheep in New Mexico, 2004 - 2014. (DRAFT) 49 p.

New Mexico Department of Game and Fish. 2007. Draft Long Range Plan for the Management of Wild Turkey in New Mexico 2007-2012

New Mexico Department of Game and Fish. May 3, 2011. Annual coordination meeting between the Department and the Santa Fe National Forest. Pers. Comm.

New Mexico Department of Game and Fish. March 21, 2011. Rocky Mountain Bighorn Sheep Population update. http://wildlife.state.nm.us/conservation/bighorn/documents/Rockypopulationtrends.htm

Otis, David L., John H. Schulz, David Miller, R. E. Mirarchi and T. S. Baskett. 2008. Mourning Dove (Zenaida macroura), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/117

RGCT Conservation Team. 2009. Conservation agreement for Rio Grande cutthroat trout (Oncorhynchus clarki virginalis) in the states of Colorado and New Mexico. Colorado Division of Wildlife, Fort Collins. 24 pp.Scott, Virgil E.; Evans, Keith E.; Patton, David R.; Stone, Charles P. 1977. Cavity-Nesting Birds of North American Forests. Agriculture Handbook 511. Washington DC: US Department of Agriculture, Forest Service. 112 p.

Scott, V. E.; Patton, D R. 1989. Cavity-Nesting Birds of Arizona and New Mexico forests. General Technical Report RM-10. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 72 p.

Stahlecker, D. W.; Kennedy, P. L.; Cully, A. C.; Kuykendall, C. B. 1989. Breeding bird assemblages in the Rio Grande Wild and Scenic River Recreation Area, New Mexico. Southwestern Naturalist. 34(4): 487-498.

Steve Kohlmann, PhD, Elk Program Manager, NMDGF. Personal communication, July 27, 2005.

Stumpff, W.K. 1998. Rio Grande cutthroat trout management. Final Report, Federal Aid Grant F-60-M, Project 11. New Mexico Department of Game and Fish. 1998. Handbook of threatened and endangered species of New Mexico. Santa Fe, NM.

Sublette, James E., M.D Hatch, M. Sublette. 1990. The Fishes of New Mexico. University of New Mexico Press. 393 pp.

USDA Forest Service. 1983. Departmental Regulation, 9500-4, Fish and Wildlife Policy. August 22, 1983. Washington, DC.

USDA Forest Service (USFS). 1987. Santa Fe National Forest Plan, as amended (1996 and 2004). Santa Fe, New Mexico. USDA, Forest Service, Southwest Region (3).

USDA Forest Service. 1990. National Forest Management Act, 36 CFR, Ch. 2 (7-1-90 edition, §219.27)

USDA Forest Service. 1991. Forest and Rangeland Birds of the United States. Agriculture Handbook 688.

USDA, Forest Service. 1995. Final Environmental Impact Statement for Amendment of Forest Plans. Albuquerque, NM: US Department of Agriculture, Forest Service, Southwestern Region. 262 p.

USDA, Forest Service. 1996. Record of decision for amendment of forest plans. Albuquerque, NM: US Department of Agriculture, Forest Service, Southwestern Region. 96 p.

USDA Forest Service. 1996a. Santa Fe National Forest Plan, as amended. Santa Fe, New Mexico.

USDA Forest Service. 2002. Conservation Agreement for the Rio Grande cutthroat trout between and among New Mexico Department of Game and Fish, USDA Forest Service, and USDI Fish and Wildlife Service. Southwest Region, Albuquerque, New Mexico.

USDA Forest Service. 2006. Santa Fe National Forest Fisheries Program Files. Jemez Springs, New Mexico.

USDI Fish and Wildlife Service. 1993. Rule to list the Mexican spotted owl as a threatened species. Federal Register, Volume 58, Number 49. March 16, 1993. Rules and Regulations: 50 CFR Part 17. RIN 1018-AB 56. Washington DC: US Department of Interior, Fish and Wildlife Service: 14248-14271.

USDI Fish and Wildlife Service. 1995. Recovery Plan for the Mexican Spotted Owl (*Strix occidentalis lucida*): Volumes I and II. Albuquerque, NM: US Department of Interior, Fish and Wildlife Service. Volume I, 172 p. and Volume II 145 p.

USDA Forest Service (USFS). 2005. Stream Inventory Handbook: Level I and II. Version 3.1. U.S. Forest Service, Southwestern Region, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 2011. Draft Recovery Plan for the Mexican Spotted Owl (Strix occidentalis lucida), First Revision. U.S. Fish and Wildlife Service. Albuquerque, New Mexico, USA. 399 pp.

USDA Forest Service (USFS). 2011. Burned Area Emergency Rehabilitation (BAER) Report, Reference FSH 2509.13, 07/29/2011. http://www.inciweb.org/incident/article/2406/12597/

USGS. Patuxent Research Center, Breeding Bird Surveys. http://www.mbr-pwrc.usgs.gov/bbs.html.

APPENDIX A

Relevant Activities	Tends toward early sere	Tends toward later sere
Commercial Thinning		X
Construction of Fuel Breaks	X	
Disease Control	X	
Group selection cut (UA/RN/F	X	
Improvement Cut		X
Individual tree release and		X
Man-Caused Fire Damage	X	
Natural Changes (no timber h	X	
Overstory removal cut (from	X	
Partial removal		X
Patch clearcutting (EA/RN/FH	X	
Permanent Land Clearing	X	
Precomm thinning/cleaning ne		X
Precommercial thinning - ind		X
Range Control Vegetation	X	
Salvage cut (intermediate tr	X	
Sanitation (salvage)	X	
Sanitation Cut	X	
Seed-tree seed cut (EA/RN/NF	X	
Shelterwood cut (EA/RN/NFH)	X	
Shelterwood final removal cu	X	
Shelterwood preparation cut		X
Single-tree selection cut (U		X
Special Cut		X
Stand Clearcutting(EA/RH/FH)	X	
Thin of Natural Fuels		X
Tree Encroachment Control	X	
Watershed Resource Non-Struc	X	
Wildlife Habitat Grasses and	X	
Wildlife Habitat Precommerci		X
Wildlife Habitat Prescribed		X
Wildlife Habitat Rehabilitat	X	

APPENDIX B

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RGCT occupied streams on the Santa Fe National Forest

Jemez Mtns GMU

Secure	Miles 2002	2006	2011*	Difference	Reason for change	Status
Peralta Canyon	5.6	4.4	0.0	-4.4	2005 genetic testing	>10% hybridization
Rito Resumidero	2.6	2.6	0.0	-2.6	2005 genetic testing	>10% hybridization
Rio Puerco de Grande & unnamed tributary	8.7	8.7	9.1	0.4	Better data from Rangewide database	2005 genetic sampling; low level of introgression with Yellowstone Cutt. Conservation population
Cañones Creek & unnamed tributary	11.1	6.1	6.7	0.6	Better data from Rangewide database	genetic results pure (2005); Core population (2002)
Chihuahueños Creek	9.5	9.5	0.0	-9.5	2005 genetic testing	>10% hybridization
Polvadera Creek & South Fork Polvadera	0.0	5.4	1.5	-3.9	2010 South Fork Fire eliminated all but 1.5 miles of headwater habitat;	Core population
Rio Cebolla	5.1	0.0	0.0	0.0	brown trout found above barrier; population "At Risk"	chemically restored 1994; brown trout above barrier, multiple age class (2005); core population (2002); follow-up genetics conducted in 2005
La Jara Creek	0.0	1.3	2.7	1.4	Better data from Rangewide database	Unscheduled
Capulin Canyon (Dome Wilderness)	0.0	1.6	1.6	0.0	Population introduced March 2006	Cañones RGCT; pure; 6.0 additional miles on Bandelier; 2011 Las Conchas fire potential impacts
Total	**42.6**	**39.6**	**21.6**	**-18.0**		

At Risk	Miles 2002	2006	2011*	Difference	Reason for change	Status
Rio de las Vacas & trib (Rito Anastacio)	11.1	11.1	9.9	-1.2	Better data from Rangewide database	brown trout above barrier; genetics in question (results expected 2005); includes tribs
Rito de las Perchas			2.4		Better data from Rangewide database	brown trout present; tributary to Rio de las Vacas
Rito de las Palomas	4.5	4.5	4.3	-0.2	Better data from Rangewide database	brown trout; genetics are in question; unscheduled
La Jara Creek	3.7	0.0	0.0	0.0	Better data	Secure
Rio Cebolla	0.0	5.6	4.5	-1.1	Better data from Rangewide database	brown trout found above barrier (McKinney Pond)
Clear Creek	2.9	2.9	0.0	-2.9	genetics are in question (assumed introgressed)	>10% hybridization w/rainbow trout
American Creek	2.3	2.3	0.0	-2.3	genetics are in question (assumed introgressed)	>10% hybridization; brown trout, rainbow trout
Rito Café	2.4	2.4	0.0	-2.4	genetics initially show introgression	>10% hybridization; brown trout above barrier (2001); stream survey done in 2006
Cecilia Creek	0.0	0.2		-0.2	Better data need; suspected introgression	brown trout, rainbow trout; genetics are in question
Rio Capulin (this is not DOME; not sure where…)	3.3	0.2		-0.2	Better data need; suspected introgression	brown trout, rainbow trout; genetics are in question
Rito de los Pinos	3.9	2.1	1.4	-0.7	Better data from Rangewide database	brook trout; 2005 sampling,
Medio Dia Canyon	0.0	0.5	0.4	-0.1	Better data from Rangewide database	genetics are in question; 2005 sampling,
Rio del Oso, Rito del Oso, Rito de Abiquiu	0.0	0.0	7.8	7.8	Better data from Rangewide database; mileage is suspect	headwaters burned in Las Conchas fire (2011); impacts unknown
Polvadera Creek	17.8	1.0	0.0	-1.0		rainbow trout below barrier; Core population
Total	**51.9**	**32.8**	**30.7**	**-4.5**		

Recreation (>10% hybridization)	Miles 2002	2006	2011*	Difference	Reason for change	Status
Peralta Canyon	0.0	0.0	4.4	4.4	2005 genetic testing	>10% hybridization w/ Yellowstone Cutt
Rito Resumidero	0.0	0.0	2.6	2.6	2005 genetic testing	>10% hybridization w/ Yellowstone Cutt
Chihuahueños Creek	0.0	0.0	9.5	9.5	2005 genetic testing	>10% hybridization w/ Yellowstone Cutt
Clear Creek	0.0	0.0	2.9	2.9	genetics are in question (assumed introgressed)	>10% hybridization w/rainbow trout
American Creek	0.0	0.0	2.3	2.3	genetics are in question (assumed introgressed)	>10% hybridization; brown trout, rainbow trout
Rito Café	0.0	0.0	2.4	2.4	genetics show introgression (2004)	>10% hybridization ; brown trout above barrier (2003); stream survey done in 2006
Total	**0.0**	**0.0**	**24.1**	**24.1**		

Pecos GMU

Secure	Miles 2002	2006	2011*	Difference	Reason for change	Status
Pecos River	4.2	3.2	3.9	0.7	Better data from Rangewide database	chemically restored 1991; genetics are in question; unscheduled
Doctor Creek	3.5	0.0	0.0	0.0	genetics show introgression (2004)	brown trout above barrier; >10% hybridization
Cave Creek	0.0	1.9	1.7	-0.2	Better data from Rangewide database	Conservation Population
Dalton Creek	3.6	3.6	4.2	0.6	Better data from Rangewide database	Core population (2005)
Indian Creek	4.4	4.4	0.0	-4.4	genetics show introgression (2004)	>10% hybridization; Recreation Population
Macho Creek	4.6	4.6	2.1	-2.5	Better data from Rangewide database	Core Population (2005)
Jack's Creek	6.8	6.8	7.0	0.2	Better data from Rangewide database	chemically restored 1992; population crashed in 2002; Core Population
Rio Mora	1.2	1.2	2.8	1.6	Better data from Rangewide database	collected in 2000; Core Population
Rio Valdez	3.1	3.1	2.3	-0.8	Better data from Rangewide database	collected in 2000; Core Population (2005)
Rito los Esteros	1.7	1.7	1.5	-0.2	Better data from Rangewide database	collected in 2000; Core Population (2005)
unnamed tributary to Mora	2.3	2.3	2.0	-0.3	Better data from Rangewide database	collected in 2000; pure (2005)
Bear Creek	2.0	2.0	3.5	1.5	Better data from Rangewide database	collected in 2000; Core Population (2005)
Cow Creek	1.0	0.0	0.0	0.0	genetics show introgression (2004)	>10% hybridization
Total	**38.4**	**34.8**	**31.0**	**-3.8**		

At Risk	Miles 2002	2006	2011*	Difference	Reason for change	Status
Doctor Creek	0.0	3.5	0.0	-3.5	>10% hybridization; brown trout found above barrier	1 km chemically restored 1996; Recreation Population
Rito del Padre	4.2	4.2	4.1	-0.1	Better data from Rangewide database	genetics show introgression with Snake River (2005)
Rito Maestas	2.1	2.1	2.1	0.0	N/A	genetics show introgression with Snake River (2005)
Rito Azul	3.3	0.0	0.0	0.0	extirpated due to drought	Extirpated (2002); needs to be reconned for recolonization after drought
Cow Creek	0.0	1.0	0.0	-1.0	Genetic analysis showed >10% hybridization	Recreation Population
Total	**9.6**	**10.8**	**6.2**	**-4.6**		

Recreation (>10% hybridization)	Miles 2002	2006	2011*	Difference	Reason for change	Status
Doctor Creek	0.0	0.0	3.5	3.5	>10% hybridization w/ Yellowstone Cutt (2005)	1 km chemically restored 1996; brown trout found above barrier
Indian Creek	0.0	0.0	4.4	4.4	Genetic analysis showed introgression	>10% hybridization w/ Yellowstone Cutt
Cow Creek	0.0	0.0	1.0	1.0	Genetic analysis showed introgression	>10% hybridization w/ Yellowstone Cutt
Rito de los Chimayosos	0.0	0.0	3.6	3.6	genetics show introgression with Snake River (2005)	>10% hybridization
Total	**0.0**	**0.0**	**12.5**	**12.5**		

Sangre de Cristo GMU

Secure	Miles 2002	2006	2011*	Difference	Reason for change	Status
Rio Nambe / Rio Capulin	0.0	2.0	0.0	-2.0	genetic testing (2005)	>10% hybridization w/ Yellowstone Cutt & rainbow trout
Quemado (incl. North & South Forks & Tribs.)	0.0	0.0	10.4	10.4		Core population; mostly on private lands
Rio de Truchas	0.0	0.0	6.5	6.5		Core population; mostly on private lands
Total	**0.0**	**2.0**	**16.9**	**14.9**		

At Risk	Miles 2002	2006	2011*	Difference	Reason for change	Status
Rio Frijoles, Rito Jaroso,	7.1	7.1	7.9	0.8	Better data from Rangewide database	brown trout, rainbow trout; genetics are in question; includes tribs; unscheduled
Rio Medio	5.5	5.5	6.1	0.6	Better data from Rangewide database	brown trout; genetics are in question; includes tribs; unscheduled
Total	**12.6**	**12.6**	**14.0**	**1.4**		

Recreation (>10% hybridization)	Miles 2002	2006	2011*	Difference	Reason for change	Status
Rio Nambe	0.0	0.0	2.0	2.0	genetic testing (2005)	>10% hybridization w/ Yellowstone Cutt
Total	**0.0**	**0.0**	**2.0**	**2.0**		

Canadian

At Risk	Miles 2002	2006	2011*	Difference	Reason for change	Status
Rito Morphy & trib	0.0	0.0	4.2	4.2		Core population
Santiago			4.1	4.1		Core population
Total	**0.0**	**0.0**	**8.3**	**8.3**		

Total RGCT Occupied Waters

Santa Fe National Forest	**Miles 2002**	**2006**	**2011***
Secure	81.0	76.4	69.5
At Risk	77.7	59.8	59.2
Total Miles Occupied	**158.7**	**136.2**	**128.7**

2011* - occupied stream length is taken from 2009 Rangewide database

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APPENDIX C

SANTA FE NATIONAL FOREST
MIS HABITAT QUANTATIVE ANALSYS
FROM MID-SCALE\PNVT MAPS

Bryce Rickel
Jack Triepke

September 2011

Information on the potential habitats used by MIS on the Santa Fe National Forest herewith is developed in two parts. The first part was the development of a Mid-Scale vegetation map for the Santa Fe and the second part was the development of the descriptions of the habitats used by each MIS species.

DEVELOPMENT OF THE GIS MAP

This is a description of the GIS procedures used to identify the potential habitats for Santa Fe National Forest's Management Indicator Species (MIS). It was desired to employ the R3 Mid-Scale Existing Vegetation Map. To develop spatial models depicting broad habitat types that may be associated with wildlife, potential and existing vegetation map data were intersected. For R3 planning purposes, potential vegetation is expressed in *PNVT* mapping, where "potential natural vegetation types (PNVTs) represent the vegetation patterns and characteristics that would occur when natural disturbance regimes and biological processes prevail." Similar to biophysical settings conceptualized in the Interagency Fire Regime Condition Class Guidebook (v1.2, 2005), PNVTs combine potential vegetation and historic fire regime to form ecosystem classes useful for landscape assessment. PNVT mapping is used as a coarse delineation of major ecosystems and key analysis strata for planning in R3. On the other hand, existing vegetation are expressions of current conditions as represented in the R3 Mid-Scale Existing Vegetation Map by dominance, size (tree and shrub dominance types), and canopy cover class (tree and shrub dominance types).

Potential and existing mapping are intersected to: 1) build additional thematic detail and 2) to leverage the greater accuracy that may exist in one map product or the other. By combining, for instance, the "semi-desert grassland" PNVT with "grass mix" from the Mid-Scale data, one can spatially identify areas of semi-desert grassland that are actually grass-dominated, as opposed to areas that shrub- or tree-dominated, or sparsely vegetated, that have different habitat features and may have different wildlife associations. In the development of Mid-Scale data many dominance types were grouped into map units to improve map accuracy, albeit at the expense of precision. "Grass mix" is one such map unit. Though the unit itself is very general, when intersected with PNVT mapping the precision lost in grouping can be partially recovered. And the TEUI data that PNVT mapping is built from is highly accurate, particularly at the coarse thematic level of PNVT, not to mention TEUI represents the base-level map scale of 1:24,000 (vs. 1:100,000 in Mid-Scale mapping).

The Mid-Scale map was spatially joined with a PNVT map adding a layer of definition to the vegetation. A map of riparian areas on the Santa Fe was also merged into the Mid-Scale/PNVT map. Tables 1, 2, and 3 list the options used in querying the map to identify MIS habitats.

Table 1

PNVT HABITAT TYPES
Colorado Plateau / Great Basin
Cottonwood Willow Riparian Forest
Gambel Oak Shrubland
Juniper Grassland
Limber-Bristlecone Pine
Mixed Conifer -- Frequent Fir
Mixed Conifer w/ Aspen
Montane / Subalpine Grassland
Montane Willow Riparian Forest
PJ Grassland
PJ Sagebrush
PJ Woodland (persistent)
Ponderosa Pine / Bunchgrass
Ponderosa Pine / Gambel Oak
Riparian Herbaceous
Riparian Narrowleaf Cottonwood / Shrub
Riparian Rio Grande Cottonwood / Shrub
Riparian Willow – Thinleaf Alder
Sagebrush Shrubland
Spruce-fir
Wetland / Cienega

Table 2

SIZE
Grass/Forb
Shrub, all heights
Sparsely vegetated
Tree, diameter 0 - 4.9 in
Tree, diameter 10 - 19.9 in
Tree, diameter 20+ in
Tree, diameter 5 - 9.9 in

Table 3

CANOPY COVER

Grass/Forb, Tree cc <10%, Shrub cc <10%
Shrub cc 10 - 29.9%
Shrub cc 30 - 59.9%
Shrub cc 60+%
Sparsely vegetated, <10% vegetative cover
Tree cc 10 - 29.9%
Tree cc 30 - 59.9%
Tree cc 60+%

DEVELOPMENT OF THE DESCRIPTIONS OF THE HABITATS USED BY EACH SPECIES

The development of the descriptions of the habitats utilize by each species started by using data from the original MIS document Santa Fe National Forest Management Indicator Species Assessment, May 2006 Update. The original information was supplemented by information from NatureServe, BISON-M, WESTWILD, regional databases and other recourses.

ROCKY MOUNTAIN ELK (*Cervis elaphus nelsoni*)

2006 Report

Rocky Mountain elk are primarily grazers and inhabit most forest types with good forage and cover. However, they were selected to represent mid elevation (generally less than 9000 feet elevation) grasslands, meadows, and forested areas. The Forest plan modeling predicted that elk were limited primarily by low winter forage availability with road densities having a negative effect on elk habitat. Activities or events that open closed canopy forests, maintain or create grassland or shrub land, or reduce road densities generally improve elk habitat. Hiding and thermal cover are not limiting factors on the Santa Fe NF. The following table shows vegetative communities that elk use on the Santa Fe NF.

Table 4
Vegetative Communities Associated With Elk
Douglas fir - White fir
Aspen
Mountain Grassland and Meadow
Coniferous Riparian
Ponderosa Pine
Gambel Oak Woodland
Deciduous Riparian
Pinyon-Juniper
Sage
Grama grassland

1/ A substantial amount of these communities is at elevations exceeding 9000’ and would not be assessed as elk habitat.

2/ The vegetative communities within the Caja del Rio, Glorieta Mesa, and the Anton Chico Grant areas are not managed for elk habitat.

Mid-Scale/PNVT Vegetation

Since in the 2006 information mentioned that 9000 feet was the elevation limit for elk, the GIS analysis was for habitat 9000 feet or less.

Table 5

Mid-Scale/PNVT Vegetative Communities	Acres
Colorado Plateau / Great Basin	47984
Cottonwood Willow Riparian Forest	170328
Gambel Oak Shrubland	543
Juniper Grassland	105868
Limber-Bristlecone Pine	1097
Mixed Conifer -- Frequent Fir	342314
Mixed Conifer w/ Aspen	1279
Montane / Subalpine Grassland	22605
Montane Willow Riparian Forest	5712
PJ Grassland	22213
PJ Sagebrush	31046
PJ Woodland (persistent)	196912
Ponderosa Pine / Bunchgrass	81779
Ponderosa Pine / Gambel Oak	155937
Riparian Herbaceous	20331
Riparian Narrowleaf Cottonwood / Shrub	9674
Riparian Rio Grande Cottonwood / Shrub	4777
Riparian Willow - Thinleaf Alder	1364
Sagebrush Shrubland	111709
Spruce-fir	46245
Wetland / Cienega	45463

There is a potential total of 1,425,341 acres of elk habitat. This total habitat includes wintering, summer, cover, and foraging habitat.

Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*)

2006 Report

Bighorn sheep serve as a management indicator for alpine meadow habitat. On the Santa Fe NF, Rocky Mountain bighorn sheep inhabit the highest alpine areas of the Sangre de Cristo Mountains within the Pecos Wilderness. This includes the cliffs, crags or other extremely rocky areas around the mountain peaks and open alpine meadow areas down to the edge areas of the spruce / fir type. The total range within the Pecos Wilderness encompasses approximately 17,500 acres, but they are generally found in the alpine areas between Pecos Baldy and Jicarita Peak. Within this area, approximately 5,006 acres

are alpine meadow habitat. Bighorn prefer precipitous terrain adjacent to suitable feeding sites of high mountain meadows with grasses, forbs and browse species. The Santa Fe Forest Plan estimated habitat capability for bighorn sheep habitat based on the health of alpine and meadow areas and effects of encroaching canopy closure. Habitat conditions in the Pecos Wilderness Area are generally fair to good, but the limiting factor is severe winter conditions where quality and quantity of forage can fluctuate significantly. Cattle grazing can and does occur, but typically cattle use is minimal in the alpine areas and non-existent on the steeper terrain. Since the entire bighorn habitat is within Wilderness, there have been and will be no projects or treatments affecting alpine meadow habitat.

BISON-M

Bighorn habitat requirements: Most bighorn winter range ecology studies have been associated with the Agropyron spicatum/Poa secunda, Festuca idahoensis/Agropyron spicatum, or the lower montane habitat types. During winter, bighorn that remained above treeline were confined to windswept ridges or southerly exposed slopes that received high insolation. On 245 acres, they were identified in 54 stands within 10 habitat types. They were identified in one habitat type (Carex spp./Potentilla diversifolia) comprising bighorn winter range in the Bear-tooth Mountains, Montana. Bighorn sheep were generally found above treeline on cliffs or windswept, snow-free slopes. Ewes and lambs remained separate from rams in winter. During June through August bighorn were observed in alpine regions 65% of the time. In September and October, bighorn were observed 61% of the time in krummholz or subalpine. During winter, all sheep were observed in alpine. During winter, bighorn that remained above treeline were confined to windswept ridges or southerly exposed slopes that received high insolation. Size and availability of suitable winter range is dependent on season, amount of snow, relative elevation of the winter range, and presence of suitable escape terrain. Bighorn are restricted to windswept, snow-free slopes above treeline, to southerly exposed slopes that receive high insolation and melt free of snow, or descend below permanent snow during winter. A researcher has recorded only 3 instances of sheep feeding more than 90 m from rock outcrops or cliffs. Two-thirds of the Montana bighorn observed in winter were within 150m of rock outcrops. Eighty-eight percent of all bighorn bands observed in the alpine were using steep, rolling terrain or cliffs.

TEAMS Enterprise Group

Big Horn sheep occupied habitat was calculated from maps created by Forest Service Teams Enterprise Group. This Group compiled Big Horn sheep occupied habitat for Arizona and New Mexico. Since the sheep on the Santa Fe occur on the Pecos Wilderness the sheep habitat in the wilderness that occurs on the forest was clipped to the forest. The total acres of habitat that occur on the Pecos are 17,524, but only 7,902 acres are on the forest.

Hairy Woodpecker (*Picoides villosus*)

2006 Report

Hairy woodpeckers serve as a management indicator for mature forest and woodland habitats (i.e. PP, MC, SF, Aspen, Oak woodland). They are also found in mature pinyon-juniper, but typically, Pinyon trees are not large enough to provide suitable snags for nesting. They are primarily insectivorous and feed on insects associated with snags and down logs. Consequently, snags and down logs are key components of hairy woodpecker habitat. Hairy woodpecker habitat quality was expected to increase over time as young stands of forest mature. Activities that reduce the older tree component typically reduce habitat capability. Activities or events that create snag habitat or that move forest areas to later

seral stages, benefit hairy woodpeckers. The species is a forest generalist, keying in on available snags and live aspen. Snags most often used for cavity nesting by hairy woodpeckers are 15+ inches diameter at breast height (with bark), and are more often in soft snags than hard (BISON-M 2004). Down logs are also important to support insect populations for foraging. Removal of large snags, future snags and down logs increases the probability of decreased population numbers of hairy woodpeckers. The Santa Fe Forest Plan modeling predicted that hairy woodpecker habitat quality would improve over time as young stands mature into diameter classes acceptable as cover. Nesting habitat was more limiting than feeding habitat. Table 6 shows the vegetative communities on the Santa Fe NF that hairy woodpeckers represent.

Table 6
Vegetative Communities Used by Hairy Woodpecker
Spruce-fir
Douglas fir - White fir
Aspen
Coniferous riparian
Ponderosa Pine
Oak woodland
Deciduous riparian
Bristlecone
PJ (persistent)

NATURESERVE

Hairy woodpeckers are associated with forests, open woodland, swamps, well-wooded towns and parks, open situations with scattered trees. Most abundant in mature woods with large old trees suitable for cavity nesting; also common in medium-aged forests; prefers woods with a dense canopy. Uses tree cavities for roosting and winter cover; may excavate new cavities in fall to be used for roosting. Hairy woodpecker sleeps singly in holes usually carved by males. In the eastern U.S., uses forest areas of 2-4 ha or larger, though a much larger area (maybe 12 ha) may be needed to support a viable breeding population; in Iowa the minimum width of riparian forest necessary to support a breeding population was 40 m. Overall, appears to be minimally impacted by forest fragmentation, though a few studies have reported a decline in numbers as forest patch size decreases; the presence of suitable cavity trees is a more important consideration.

Nests in hole dug mostly by male in live or dead tree or stub, 1.5-18 m (average 9 m) above ground. In most areas, favors dead or dying parts of live trees, especially where fungal heart rot has softened the heartwood. Snag (25 cm or more in DBH) density of 5/ha assumed optimal for reproduction (but may not be adequate for foraging). Nest tree DBH minimally 20 cm; averaged 27-28 cm in New England, 38 cm in Colorado, 41 cm in Virginia, 44 cm in California, and 92 cm in Oregon. Usually excavates new nest hole each year.

Table 7
Vegetative Community Associated With Hairy Woodpecker
Spruce-fir
Douglas fir - White fir
Aspen
Coniferous riparian
Ponderosa Pine
Oak woodland
Deciduous riparian
Bristlecone
PJ (persistent)

Mid-Scale/PNVT Vegetation

Table 8

HABTYPE	ACERS
Limber-Bristlecone Pine	6
Mixed Conifer -- Frequent Fir	29,584
Mixed Conifer w/ Aspen	74
PJ Woodland (persistent)	11,424
Ponderosa Pine / Bunchgrass	12,461
Ponderosa Pine / Gambel Oak	27,636
Spruce-fir	2,945

Mid-Scale vegetative types noted above were queried for tree size, diameter 10 - 19.9 in., and diameter 20+ in., canopy cover of 10 - 29.9%, resulting in the areas listed above, Table 8, and the total acreage of 84,130 acres.

MOURNING DOVE (*Zenaida macroura*)

2006 Report

Mourning dove serves as a management indicator of healthy mid and low elevation grasslands, woodlands, and ponderosa pine habitats. They can be found in higher elevation communities but are typically regarded as casual above 7000 feet elevation. They nest in a variety of habitats including shrub lands and forests. Fields used for feeding are often characterized by an abundance of small weed seeds and grain on relatively bare ground. Activities that improve the amount of feed available have a positive influence on mourning doves. The mourning dove is found across North America in many types of habitat, including most forest types. It is wide spread except in the Arctic and closed forests. It is abundant and increasing near 16 farms and suburbs and frequents backyard feeders, suburbs, and towns. They are common to abundant in most counties in New Mexico. Mourning dove habitat is abundant on the Santa Fe NF. The Santa Fe Forest Plan predicted that mourning dove habitat would improve through improving the ecological condition of low elevation grassland and by harvesting/thinning in woodland and ponderosa pine areas. For the Santa Fe NF, low elevation grassland equates to grama grassland. Mourning dove can be found in higher elevation communities such as Douglas Fir / White Fir and Spruce / Fir, but they were not chosen to represent these communities.

Table 9
Vegetative Communities Associated With Mourning Dove
Ponderosa Pine
Gambel Oak Woodland
Deciduous Riparian
Pinyon-Juniper
Sage
Grama grassland

For habitat to be favorable, abundant food and water must be available within 20-30 km. The habitats found on the Forest meet the feeding requirements for the mourning dove. Water developments and

treatments that open closed canopies to allow for increased herbaceous growth improve habitat for mourning dove. Most nesting occurs in lower elevation habitats. The abundance of nesting and cover opportunities on the Santa Fe contribute to maintaining viable populations of mourning dove.

Mid-Scale/PNVT Vegetation

Table 10

Mid-Scale/PNVT Vegetative Communities	Acres
Juniper Grassland	105868
PJ Grassland	22213
PJ Sagebrush	31046
PJ Woodland (persistent)	196912
Ponderosa Pine / Bunchgrass	81878
Ponderosa Pine / Gambel Oak	161769
Riparian Herbaceous	26000
Riparian Narrowleaf Cottonwood / Shrub	13415
Riparian Rio Grande Cottonwood / Shrub	4777
Riparian Willow - Thinleaf Alder	3584

The total potential Morning dove habitat on the Santa Fe is 647,460 acres.

Mexican spotted owl (*Strix occidentalis lucida*)

The determination of potential habitat for MSO was developed from a regional database of 1911 of MSO locations. Seventy seven locations were on the Santa Fe NF. These 77 MSO locations were used to identify MSO habitat as they would be divined by the Mid-Scale/PNVT map. Employing the spatial-join operation of GIS, the Mid-Scale/PNVT attributes were joined to the MSO data. Joining attributes allowed for summarizing the number of MSO habitat type. Table 10 lists the Mid-Scale/PNVT vegetation types the 77 MSO occur in.

Table 11

Mid-Scale Vegetation Types	MSO Locations	Selected for Modeling
Mixed Conifer -- Frequent Fir	33	*
Cottonwood Willow Riparian Forest	22	*
Ponderosa Pine / Gambel Oak	9	*
Spruce-Fir Forest	6	*
Montane / Subalpine Grassland	2	
Riparian Herbaceous	2	
Wetland / Cienega	2	
Riparian Narrowleaf Cottonwood / Shrub	1	

Table 12

Size	MSO Locations	Selected for Modeling
Shrub, all heights	1	
Sparsely vegetated	1	
Tree, diameter 10 - 19.9 in	63	*
Tree, diameter 5 - 9.9 in	12	

Table 13

Canopy Cover	MSO Locations	Selected for Modeling
Shrub cc 30 - 59.9%	1	
Sparsely vegetated, <10% vegetative cover	1	
Tree cc 10 - 29.9%	8	
Tree cc 30 - 59.9%	59	*
Tree cc 60+%	8	*

Mid-Scale/PNVT Vegetation

Table 14

Mid-Scale/PNVT Vegetative Communities	**Acres**
Cottonwood Willow Riparian Forest	148135
Mixed Conifer -- Frequent Fir	362520
Ponderosa Pine / Gambel Oak	78830
Spruce-fir	78326

The habitat values noted by * were used because they most closely matched the 1995 MSO Recovery Plan. Applying the selected (*) parameters from Tables 12, 13, and 14, resulted in identifying the habitat types and respective acres were MSO are most likely to occur, Table 12. There is a total of 667,811 acres were MSO could use.

PINYON JAY (*Gymnorhinus cyanocephalus*)

2006 REPORT

Pinyon jays can be found in a wide variety of vegetative communities, but they were selected to serve as a management indicator of healthy pinyon-juniper habitat. Pinyon jays nest mainly in stands of pinyon-juniper. It needs open woodlands for nesting and an adequate supply of seeds, especially nuts. They are gregarious and breed in colonies up to 150. They spend the winters in large flocks of 10's or 1000's moving in search of pinyon stands with a successful crop of pinyon nuts that are a primary food source along with other seeds, fruits and insects. The Forest Plan modeling predicted that pinyon jay habitat would improve by increasing foraging areas. Alternatives that favored a variety of mast producing plants found in early seral stage forests were best for pinyon jays. Stands of mature pinyon-juniper provide quality habitat for the pinyon jay on the Santa Fe National. Stand improvements to

grow large nut-producing pinyon trees and reduce the risk of crown fires in the pinyon-juniper type continues through managed fuelwood programs to thin dense stands. Prescribed fire is used to reduce woody debris after thinning. Beginning around 2002, much of the southwest has experienced severe mortality of pinyon stands. The Santa Fe National Forest is no exception. This die off was a result of severe drought conditions that weakened trees and made them susceptible to an infestation of pinyon bark beetle (pinyon ips). Aerial surveys by Forest Pest Management personnel indicate that more than 65,000 acres of pinyon stands on the Santa Fe NF have been affected. In some stands, pinyon mortality is 100%. Pinyon stands that were at lower elevations and that were very dense were affected the most. Even so, there remains over 300,000 acres of pinyon-juniper habitat.

NATURESERVE

Pinyon-juniper woodland, less frequently pine; in nonbreeding season, also occurs in scrub oak and sagebrush (AOU 1983). Pinyon jays nest in shrubs or trees (e.g., pine, oak, or juniper), about 1.5-9 m above ground.

Mid-Scale/PNVT Vegetation

Table 15

Mid-Scale/PNVT Vegetative Communities	Acres
PJ Grassland	22213
PJ Sagebrush	31046
PJ Woodland (persistent)	196912

Since all references note that the Pinyon jays are primarily associated with PJ the vegetative communities listed in Table 14 used to identify Pinyon jay potential habitat with a total of 250,170 acres.

MERRIAM'S TURKEY (*Meleagris gallopavo*)

2006 REPORT

Merriam's turkey uses a wide range of vegetative communities, but they were selected to serve as a management indicator of healthy, mature ponderosa pine habitat. Merriam's turkey utilizes ponderosa pine, a source of mast and its favorite roosting tree. Ponderosa pine is an essential component of its permanent habitat, while surface water is a range requirement. Turkeys prefer to roost in tall mature or over-mature ponderosa pines with relatively open crowns and large horizontal branches starting at 20 to 30 feet from the ground. Trees with a diameter at breast height (DBH) of over 14 inches are often used as roosts. These trees generally have excellent protection from the wind and are usually located in sites with an open ridge or rocky ledge nearby to provide ease in entering and exiting the roost site. Hens normally nest within ½ mile radius of water. A good, healthy understory provides cover and forage. Turkeys forage in grasslands, brush communities, deciduous tree-brush and in ponderosa pine. They eat grasses and grasshoppers in the summer. They eat acorns and mature ponderosa pine seeds in the fall. Tall grasses are eaten in the winter when the heavy snows come. Pinyon nut crops are the turkey's "corn" of the southwestern forest (BISON-M 2004).

WESTWILD HABITATS

WESTWILD listed the following vegetation types that were associated with Merriam's turkey, PP, PJ, AS, MC, and PO.

ARIZONA GAME AND FISH DEPARTMENT

Merriam's turkeys are found throughout the Western United States primarily in the ponderosa pine forests of Colorado, New Mexico, and northern Arizona. They have been transplanted into the pine forests of Utah, Idaho, Washington, Oregon, California, Montana, Wyoming, and South Dakota. The best populations of Merriam's, however, occur in the ponderosa pine forests north of the Gila River.

Matt Vasquez, 2005, Prepared for the Grand Mesa, Uncompahgre, and Gunnison National Forests

Ponderosa pine, Pinyon-Juniper, Gambel Oak, grassland/forbland areas within or adjacent to ponderosa pine, pinyon-juniper, Gambel oak or mixed forests with a ponderosa pine or aspen component, riparian, Aspen, cottonwood, Douglas-fir, Mixed conifer, mountain shrub.

Mid-Scale/PNVT Vegetation

Table 16

Mid-Scale/PNVT Vegetative Communities	Acres
Mixed Conifer -- Frequent Fir	392104
Mixed Conifer w/ Aspen	1196
PJ Grassland	97
PJ Sagebrush	7126
PJ Woodland (persistent)	78425
Ponderosa Pine / Bunchgrass	48500
Ponderosa Pine / Gambel Oak	106467

The acres of potential Merriam's turkey habitat listed in Table 16 resulted from refining the vegetative communities by limiting them to tree, diameters to 10 - 19.9 in and 20+ in and canopy cover of 10 – 29.9% and of 30 – 59.9%. The total potential habitat for the turkey is 633,916 acres.