Appendix -- Determining Habitat Trends

INTRODUCTION

The following are assessments of habitat trends of Management Indicator Species (MIS). The basis for determining trend is a comparison of estimated MIS habitats at the time of preparing the Forest Plan (USDAc 1986) to the present. The methods used to determine current habitats had to be developed to approximate similarity to the degree possible to the 1986 Forest Plan Environmental Impact Statement (USDAa 1986). In some cases the estimated acres of MIS habitats are base on certain parameters of habitat quality. The rationale and methods are described for each MIS or group.

Management indicator species are a subset of all animal and plant species in a planning area selected for planning and management purposes. Management indicator species are defined in the Carson Forest Plan as, "[t]hose species selected in the planning process to monitor the effects of planned management activities on viable populations of all wildlife and fish species, including those species that are socially or economically important" (USDA 1986c, Glossary p. 301). MIS are selected to represent several categories, such as commonly hunted or fished species, non-game and threatened and endangered species.

The 1986 Carson Forest Plan (USDA 1986a, p. 97) designates specific MIS with habitats that could best be used to analyze effects of site-specific proposals on the Carson National Forest. These species are:

MIS	Habitat
Hairy woodpecker	snag
Turkey	old growth pine
White-tailed ptarmigan	alpine tundra, subalpine deciduous shrub
Plain titmouse	pinon-juniper canopies
Brewer's sparrow	sagebrush
Abert's squirrel	interlocking canopies
Red squirrel	mixed conifer
Elk	general forest
Bighorn sheep	alpine, subalpine tundra mountain meadow grassland
Resident trout	perennial stream, riparian
Aquatic macro-invertebrates	perennial stream, riparian

MIS are selected to monitor the effects of planned management activities on populations of fish and wildlife species. Monitoring MIS habitats and determining how habitat trends relate to population trends can help identify what impacts management activities have on wildlife and their habitats on the Carson National Forest. For species that are related to forested habitats, the actual tree data was examined to help determine suitable habitat and how to design the queries to best approximate acres of habitats as addressed in the Forest Plan EIS. Selected portions of each species' write-up will be incorporated into the MIS Assessment to provide a summary of the habitat trend on the Carson National Forest.

BREWER'S SPARROW – HABITAT TREND ANALYSIS

Forest Plan Environmental Impact Statement (EIS) identifies sagebrush as the habitat type for this species (USDA 1986a, p. 97). At the time the Forest Plan was implemented, 52,600 acres of Brewer's sparrow habitat were identified for the Forest. It was expected that habitat would remain relatively consistent along with populations. Based on the current Geographic Information System (GIS) vegetation data layer, there is now a total of 81,752 acres of sagebrush. **Habitat trend for Brewer's sparrow on the Carson National Forest is up by about 55 percent or 29,152 acres.**

This is mainly due to the large areas of revegetation treatments, which converted both piñon and juniper and sagebrush to grasslands in the 1960's. A total of 83,142 acres of these treatments (Management Area 11 in the Forest Plan) were not included in either the sagebrush or piñon/juniper habitats at that time. Many of the acres of both conversion types have gradually transitioned from grasslands to sagebrush, which accounts for the significant upward trend in habitat. Some of sites are shifting from sagebrush back to piñon-juniper. Others have been maintained by prescribed burning and are not expected to shift from grasslands to sagebrush.

It should be noted that many acres in the Forest Plan EIS identified as piñon-juniper habitat acres have a very strong sagebrush component. For example, sagebrush may actually be the dominant species in an area, but piñon-juniper may be present in sufficient abundance to provide the structural difference necessary to classify the site as piñon-juniper. No set criteria are provided for observers to breakout this particular transitional portion of the community. However, areas are often broken out based on the most structurally or visually influencing species. The Brewer's sparrow may occupy as much as two or three times the acres of monoculture sagebrush habitat present.

As of 2005, the numbers supporting this trend (above chart) have not changed from the 2003 Forest-wide MIS Assessment (USDA 2003b); however the amount habitat loss on the Jicarilla Ranger District was not entirely considered. The removal of sagebrush for gas extraction (road construction and well pad development) has increased over the past 2-3 years.

Project Level Effects Analysis

With regard to individual project effects analysis, the overall forest trend in habitats should be referenced against the acres classified as sagebrush. However the transitional sites mentioned above are likely to contain excellent habitat characteristics and be occupied by the species. A distinction should be drawn between the two and identified in the analysis. Such habitats should be addressed at a site-specific level including projected effects of bark beetle mortality.

JUNIPER TITMOUSE – HABITAT TREND ANALYSIS

Forest Plan EIS identifies piñon-juniper as the habitat type for this species. The key feature used in the EIS to track plain titmouse habitat was "piñon-juniper canopies" (USDA 1986a, p. 97). At the time the Forest Plan was implemented, 364,900 acres of plain titmouse habitat were determined for the Forest. However, the difference between 364,900 acres in the Forest Plan and the 355,409 identified in the vegetation cover data (USDA 2003a) is due to a variation in habitat typing. Since that time stands have grown, some have been harvested, wildfires and disease have changed the landscape to a limited degree and data to estimate conditions and cover types has also improved or changed in methods.

Several factors are used to determine habitat trend. Management activities (primarily timber sales) and wildfire have reduced certain habitats to unsuitable conditions. High intensity wildfire and certain harvest prescriptions such as overstory removal, seed cuts and shelterwood harvests are examples of areas that are deducted from the total acres of titmouse habitat. Total stand acres are not deducted. Only the actual acres treated that are estimated to result in acres becoming unsuitable are subtracted. Suitable stands (2,620 ac) that had experienced wildfire or prescribed fire were removed from titmouse habitat. Suitable habitat lost to fuelwood cutting (4,060 ac) was also deducted.

The following table uses the Carson Forest Vegetation cover type mapping to determine acres of habitat. Adjustments are made based wildfire and fuelwood harvesting including various forms of type conversion in this habitat type.

Titmouse Suitable Habitat Acres: Change from Wildfire, Fuelwood Cutting, and Tree Growth 1986-2005

Ranger District	Total PJ Acres in 2002	Habitat Acres Reduced by Wildfire & Rx Burning	Habitat Acres Reduced by Fuelwood Cutting	Total Acres Reduced	Remaining Acres of Titmouse Habitat
D1, D2, D6[19]	204,328	20	1,500	1,520	202,808
D3	87,301	500	2,550	3,050	84,251
D4	41,444	100	300	400	41,044
D7	22,336	2,100	100	2,200	20,136
Total	**355,409**	**2,720**	**4,450**	**7,170**	**348,239**

The above table does not include an ingrowth factor, since this habitat grows very slowly and is not likely to be significant enough to consider. Also fuelwood harvest, as with logging practices, changed during the period of the Forest Plan. Removal of older, larger trees for fuelwood was a fairly common practice in the 1980's. Thus the assumption the Forest Plan EIS makes that fuelwood harvesting would result in a downward trend habitat. This was in part reversed by the early 1990's to maintain the larger trees and remove the crowding in the understory. The latter treatment would not affect the suitability of habitat for the juniper titmouse. The numbers above are estimated to reflect that trend. The table still reflects any harvest that would have removed or resulted in unoccupied habitat.

In this case, the trend in acres of habitat shows a decrease in acres from 364,900 to 348,729. However, it should be noted that the difference between 364,900 acres in the Forest Plan and the 355,409 identified in the vegetation cover data (see table) is due to a variation in habitat typing. There are often variations especially in the piñon-juniper sagebrush communities. For example, sagebrush may be the dominant species in an area but scattered piñon and juniper may actually provide the structural difference necessary to influence species diversity. There are no set criteria for observers to break out this particular transitional portion of the community.

[19] D1 = Canjilon, D2 = El Rito, D3 = Jicarilla, D4 = Camino Real, D6 = Tres Piedras, D7 = Questa

The trend in habitat acres shows a decrease from 355,409 to 348,239. This is a downward trend of an estimated 7,170 acres, or about two percent of available juniper titmouse habitat on the Carson National Forest since 1986.

Project level effects analysis

With regard to individual project effects analysis, there is no distinction as to quality of habitat in the Forest Plan EIS. It is likely that in the neighborhood of 15 to 20 percent of this habitat forest-wide provides poor to marginal habitat conditions. These stands are sparse and on low productivity sites with small trees. On the other hand, some transitional sites likely to be typed out as ponderosa may contain excellent habitat characteristics that are occupied and not included in these numbers. Along with the forest-wide habitat trend (which compares back to the Forest Plan EIS), such habitat factors should be addressed at a site-specific level, including projected effects of bark beetle mortality and the results of change due to the project.

ABERT'S SQUIRREL – HABITAT TREND ANALYSIS

There are two levels that need to be considered when looking at the ponderosa pine habitats across the Forest. First is the overall ponderosa pine habitat. This is important to help place the subset of interlocking canopies identified in the Forest Plan EIS in perspective. Although there are 301,297 total acres of ponderosa (based on current stand data cover types), the Forest Plan EIS identifies a subset of 53,220 acres of occupied Abert's squirrel habitat in the ponderosa pine. In 1986, when the Forest Plan was adopted, the key feature used to identify quality habitat was "interlocking canopies" (USDA 1986a, p. 97). Since that time, stands have grown, some have been harvested or burned, and data to estimate conditions has improved. Although there is important data forest-wide, the subset of interlocking canopies is the primary feature by which habitat trend for Abert's squirrel is tracked.

Several factors are used to determine habitat trend. Management activities (primarily timber sales) and wildfire have reduced certain habitats to unsuitable conditions. High intensity wildfire and certain harvest prescriptions such as overstory removal, seed cuts and shelterwood harvests are examples of areas that are deducted from the total acres of interlocking canopies. Total stand acres are not deducted. Only the actual acres treated that are estimated to result in acres becoming unsuitable are subtracted. The process to estimate current acres of interlocking canopies involve numerous steps which include:

- *Select the stands from the RMRIS database and export to Arc View.*
- *Select the ponderosa pine vegetation cover type.*
- *Determine suitable Abert's Squirrel habitat by:*

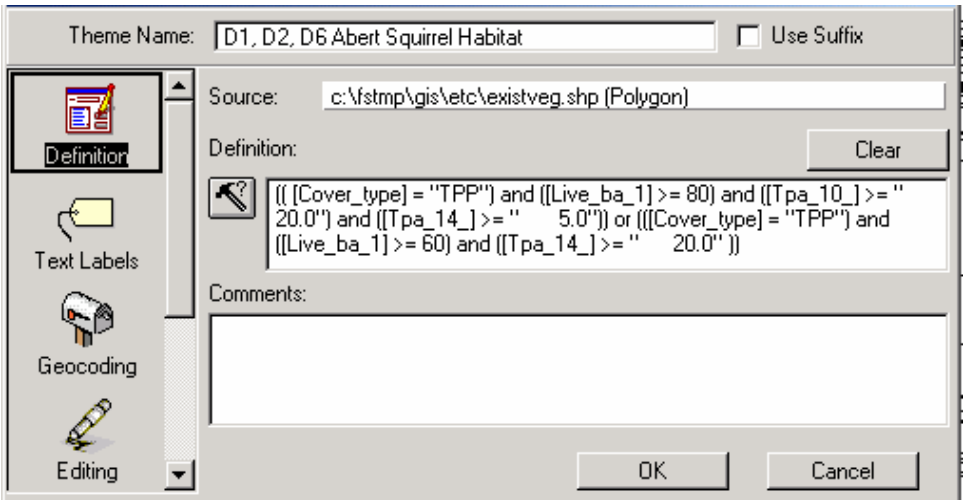
  Selecting Ponderosa Pine stands with stand exam data.

  Creating fields with tree size information that includes trees per acre >10", >14", >16", >18" and >20" diameter at breast height (DBH).

  The tree size distribution data was reviewed to help select the query criteria for suitable habitat.
- *A query was developed that basically selects for Vegetation Structural Stage (VSS) 4 through 6. It was also designed to include number of high end VSS 3 stands with a strong component of larger trees that would provide suitable habitat with interlocking canopies. It is important to note that the distribution of tree size data was used instead of just a VSS query, as VSS data was not available on all the stands with stand exams*

and the actual size class distribution was likely to improve stand selection for suitable habitat.

Query 1



- *The Forest was also divided into four separate areas with contiguous boundaries to evaluate stand data. These include: 1) Jicarilla (D3); 2) Camino Real (D4) 3) Questa (D7); 4) El Rito (D2), Canjilon (D1) and Tres Piedras (D6) Ranger Districts. This was done as habitats are more similar within these groups and the percentage of stands with exams will vary between these areas. Evaluating them separately prior to extrapolation and then totaling will increase reliability of the acreage estimates.*
- *The suitable habitat acres for each area were then factored by the acres of ponderosa pine without exams to get the estimated suitable habitat acres.*
- *These acres were then multiplied by the percentage estimated to have interlocking canopies.*
- *Then the high intensity fire acres were estimated along with the sale areas that reduce habitat values and subtracted.*

We also looked at the possibility of an adjustment in case the areas with stand exams may have been conducted on higher priority stands. After evaluation, it did not appear that this was the case and no adjustment was necessary.

Acreage Summary

Formula: $\frac{\text{Acres PP with stand exams}}{\text{Total acres PP}} = X\%$

$\frac{1}{x}$ = multiple factor

Total suitable Abert's squirrel habitat = multiple factor x acres of suitable squirrel habitat with stand exams.

Estimated Abert's Squirrel Habitat on the Carson National Forest in 2002

District	Total PP Acres	PP Stand Exam Acres	% of PP Acres with Stand Exams	Multiplier	Stand Exam Acres Meeting Squirrel Habitat Query Criteria	Gross Stand Acres of Squirrel Habitat	Net Acres of Squirrel Habitat
D1, D2, D6[20]	176,966	62,922	0.36	2.81	25,228	70,953	**35,476**
D3	33,905	0	0.00	-	-	13,458	**6,729**
D4	50,005	13,453	0.27	3.72	9,329	34,676	**17,338**
D7	40,421	28,363	0.70	1.43	7,018	10,002	**5,001**
						Total	**64,544**

The Jicarilla Ranger District has no stand exam data. However, it does have suitable habitat and huntable populations of Abert's squirrel. This population has largely developed after the Forest Plan implementation (1986). Field biologist observations indicate that Abert's squirrel occurs in most locations where ponderosa pine occurs. The distribution of Abert's squirrel is district-wide. A forest-wide ratio of average suitable habitat to total ponderosa pine acres from the remainder of the Forest is used to estimate suitable acres of habitat for the Jicarilla Ranger District.

Given the criteria for stand selection the average basal area (BA) across the forest will average around 110 in suitable habitats. The following are the average basal areas by unit area.

Area	Avg. Basal Area
D1, D2, D6	108
D4	114
D7	111
D3	unavailable

Using the Regional conversion chart (unpublished), the crown cover will average just over 75 percent. It is estimated that interlocking canopies that allow for arboreal movement by squirrels will average at least 50 percent of each of the stands identified as suitable habitat.

Since the Forest Plan was first implemented, ponderosa pine stands have progressed toward more suitable habitat as a result of forest succession. A conservative estimate of stands moving into suitability from forest succession is five percent (see table below).

However, management activities (timber sales) and wildfire have reduced certain habitats to unsuitable. High intensity wildfire and certain harvest prescriptions such as overstory removal, seed cuts and shelter wood harvests are example of areas that are deducted from the total acres of interlocking canopies. Total stand acres are not deducted. Only the actual acres treated that are estimated to result in acres becoming unsuitable are subtracted.

The following chart is a summary table of adjustments to suitable acres of Abert's squirrel habitat during the life of the Forest Plan.

[20] D1 = Canjilon, D2 = El Rito, D3 = Jicarilla, D4 = Camino Real, D6 = Tres Piedras, D7 = Questa

Abert's Squirrel Suitable Habitat Acres: Change from Wildfire, Logging and Tree Growth 1986-2005

Ranger District	Total PP Acres	Estimated Acres of Habitat in 2002	Habitat Acres Reduced by Wildfire	Habitat Acres Reduced by Logging	Total Acres Reduced	Total Acres of Ingrowth (+ 5%)	Remaining Acres of Abert's Squirrel Habitat
D1, D2, D6	176,966	35,476	371	2,410	2,781	2,106	34,801
D3	33,905	6,729	22	0	22	399	7,106
D4	50,005	17,338	110	194	304	1029	18,063
D7	40,421	5,001	1,474	0	1,474	297	3,824
Total	**301,297**	**64,544**	**1,977**	**2,604**	**4,581**	**3,831**	**63,794**

The habitat trend for Abert's squirrel from 1986 to 2005 is estimated to have increased from 53,220 to 63,794 acres of interlocking canopies or an upward trend of almost 20 percent.

HAIRY WOODPECKER – HABITAT TREND ANALYSIS

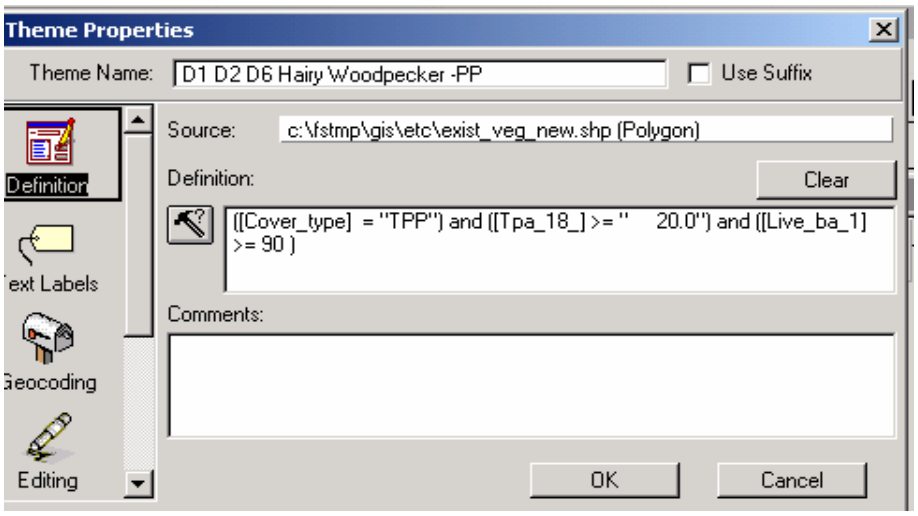
The key feature used in the Carson Plan EIS to identify quality hairy woodpecker habitat was "snags". There are two levels that need to be considered when looking at hairy woodpecker habitat across the Forest. First is the overall ponderosa pine and mixed conifer habitat. This is important to help place the subset of quality habitat in perspective. Although there are approximately 637,488 total acres of ponderosa and mixed conifer (based on current stand data cover types), the Forest Plan EIS identifies a subset of 106,880 acres of occupied hairy woodpecker habitat in the ponderosa pine and mixed conifer. According to the Forest Plan EIS, hairy woodpeckers will utilize mature and old growth stands of pine, fir and aspen (USDA 1986a, p. 97). Since 1986, stands have grown, some have been harvested or burned and data to estimate conditions has improved. Although there is important data forest-wide, the subset of snags is the primary feature by which habitat trend for hairy woodpecker is tracked.

Several factors are used to determine habitat trend. To determine a trend from the baseline in the Forest Plan EIS, the RMRIS database was used to select stands that mimic the general approach used to arrive at the original acre figure. Cover types were selected from the RMRIS database and exported to Arc View. Although mature stands were considered, the following queries were run to reflect stands with the highest potential for old growth and large snag availability.

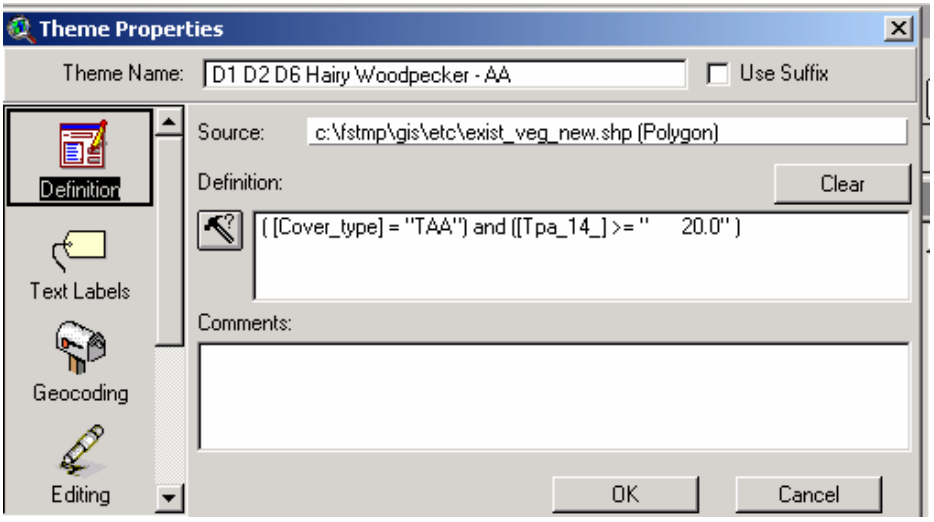
Management activities (primarily timber sales) and wildfire have reduced certain habitats to unsuitable conditions. High intensity wildfire and certain harvest prescriptions such as overstory removal, seed cuts and shelterwood harvests are examples of areas that are deducted from the total acres of quality hairy woodpecker habitat. Total stand acres are not deducted. Only the actual acres treated that are estimated to result in acres becoming unsuitable are subtracted.

Hairy Woodpecker Queries

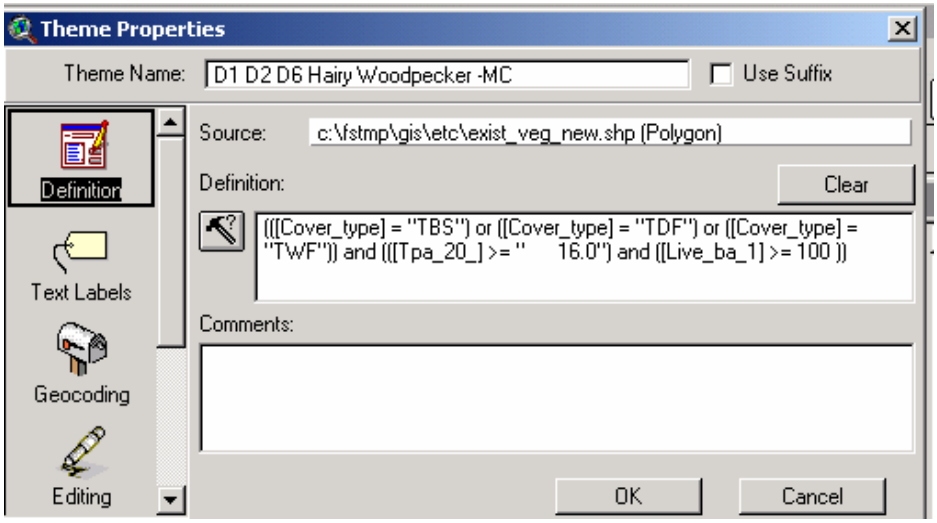
Query 1



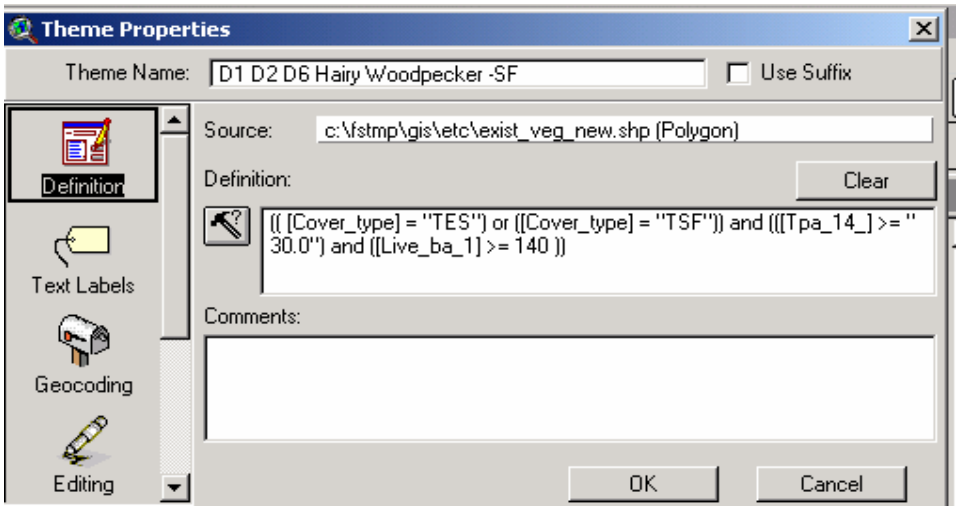
Query 2



Query 3



Query 4



Hairy Woodpecker Habitat in Ponderosa Pine

District	Total PP Acres	PP Stand Exam Acres	% of PP Acres With Stand Exams	Multiplier	PP Stand Exam Acres Meeting Hairy Woodpecker Habitat Query Criteria	Gross Stand Acres of PP Woodpecker Habitat	Total PP Acres In MA 17 & 20	% of PP Acres in MA 17 & 20	10% Acre Adjustment to Reflect Higher % of Habitat in Wilderness	Net Acres of PP Hairy Woodpecker Habitat
D1, D2, D6	176,966	62,922	0.36	2.81	472	1,327	799	0.5	80	1,407
D3	33,905	0	0.00	0.00	0	282	0	0.0	0	282
D4	50,005	13,453	0.27	3.72	241	896	1,173	2.3	117	1,013
D7	40,421	28,363	0.70	1.43	0	0	1,691	4.2	169	169
Total	301,297	104,738	0.35	2.88		2,505	3,663			2,871

Hairy Woodpecker Habitat in Mixed Conifer

District	Total MC Acres	MC Stand Exam Acres	% of MC Acres With Stand Exams	Multiplier	MC Stand Exam Acres Meeting Hairy Woodpecker Habitat Query Criteria	Gross Stand Acres of MC Woodpecker Habitat	Total MC Acres In MA 17 & 20	% of MC Acres in MA 17 & 20	10% Acre Adjustment to Reflect Higher % of Habitat in Wilderness	Net Acres of MC Hairy Woodpecker Habitat
D1, D2, D6	71,993	28,690	0.40	2.51	1,535	3,852	1,351	1.9	135	3,987
D3	1,943	0	0.00	0.00	0	59	0	0.0	0	59
D4	100,385	22,879	0.23	4.39	751	3,295	18,705	18.6	1871	5,166
D7	66,124	5,023	0.08	13.16	11	145	21,668	32.8	2167	2,312
Total	240,445	56,592	0.24	4.25		7,351	41,724			11,524

Hairy Woodpecker Habitat in Spruce-Fir

District	Total SF Acres	SF Stand Exam Acres	% of SF Acres With Stand Exams	Multiplier	SF Stand Exam Acres Meeting Hairy Woodpecker Habitat Query Criteria	Gross Stand Acres of SF Hairy Woodpecker Habitat	Total SF Acres In MA 17 & 20	% of SF Acres in MA 17 & 20	10% Acre Adjustment to Reflect Higher % of Habitat in Wilderness	Net Acres of SF Hairy Woodpecker Habitat
D1, D2, D6	49,470	3,189	0.06	15.51	733	11,371	17,954	36.3	1,795	13,166
D3	0	0	0.00	0.00	0	0	0	0.0	0	0
D4	72,998	6,326	0.09	11.54	2,831	32,668	29,791	40.8	2,979	35,647
D7	78,931	3,887	0.05	20.31	768	15,595	44,146	55.9	4,415	20,010
Total	201,399	13,402	0.07	15.03		59,634	91,891			68,823

Hairy Woodpecker Habitat in Aspen

District	Total AA Acres	AA Stand Exam Acres	% of AA Acres With Stand Exams	Multiplier	AA Stand Exam Acres Meeting Hairy Woodpecker Habitat Query Criteria	Gross Stand Acres of AA Woodpecker Habitat	Total AA Acres In MA 17 & 20	% of SF Acres in MA 17 & 20	10% Acre Adjustment To Reflect Higher % of Habitat in Wilderness	Net Acres of AA Hairy Woodpecker Habitat
D1, D2, D6	43,997	12,310	0.28	3.57	3,943	14,093	4,872	11.1	487	14,580
D3	0	0	0.00	0.00	0	0	0	0.0	0	0
D4	30,918	4,835	0.16	6.39	1,777	11,363	8,311	26.9	831	12,194
D7	21,192	1,026	0.05	20.65	68	1,405	13,052	61.6	1305	2,710
Total	96,107	18,171	0.19	5.29		26,860	26,235			29,484

Total Hairy Woodpecker Habitat

District	Total Acres	Gross Stand Acres of Woodpecker Habitat	Net Acres of Hairy Woodpecker Habitat
D1, D2, D6	342,426	30,643	33,140
D3	35,848	341	341
D4	254,306	48,222	54,020
D7	206,668	17,145	25,201
Forest Total	839,248	96,351	112,702

Hairy Woodpecker Suitable Habitat Acres: Change from Wildfire, Logging and Tree Growth 1986-2005

Ranger District	Total Acres	Estimated Acres of Habitat in 2002	Habitat Acres Reduced by Wildfire	Habitat Acres Reduced by Logging	Total Acres Reduced	Total Acres of Ingrowth (+ 1%)	Remaining Acres of Hairy Woodpecker Habitat
D1, D2, D6	342,426	33,140	0	579	579	331	32,892
D3	35,848	341	0	0	0	3	344
D4	254,306	54,020	0	305	305	540	54,255
D7	206,668	25,200	500	0	500	252	24,952
Total	839,248	112,701	500	884	1,384	1,127	112,444

Suitable stands (500 ac) that had experienced high intensity fire were removed from the woodpecker habitat. Suitable habitat lost to timber harvest (884 ac) was also deducted. Also taken into account was forest succession, where ponderosa pine and mixed conifer stands have progressed towards more quality habitat since 1986. Only one percent ingrowth rate was used as the dense nature of many of the stands result in significant competition and stagnation in those stands that are most likely to progress to old growth. To compound this situation, timber sale projects included the allocation old growth stands that did not meet old growth standards, but were the closest and/or the best stands within the project area. Although old growth allocation does not necessarily preclude forest management activities, allocated stands are usually set aside from these practices. These stands should probably have been the highest priority stands to thin from below and move or set on track towards actually progressing to a biological representation of old growth more rapidly.

The following is a summary of the acres logged through timber sales that were used in the calculations to determine the acres reduced. Those acres are reflected in the previous summary table.

Logging in Hairy Woodpecker Habitat in Areas with Stand Exams

District	Sale Name	Location/Site	Acres
D1	Ranas	1000650019	54
D1	Ranas	1000650001	42
D2	Felipito	2001210018	45

District	Sale Name	Location/Site	Acres
D2	Felipito	2001210031	30
D6	Little Tusas	6002030004	28
D1, D2, D6 Total			**199**
D4	Ojo Aspen	4042500017	33
D4	Ojos Ryan	4025400035	2
D4 Total			**35**
Forest Total			**234**

Logging in Hairy Woodpecker Habitat in Areas without Stand Exams

District	Sale Name	Estimated Acres
D2	Lonesome	50
D2	Pasture	100
D6	Banco Julian	100
D6	Broke Off	50
D6	Oso	80
D1, D2, D6 Total		**380**
D4	Alamitos	25
D4	Dropout	25
D4	Duran	10
D4	Osha	20
D4	Pichacho	20
D4	Quemado	20
D4	Warm Springs	150
D4 Total		270
Forest Total		**650**

Total Estimated Reductions in Hairy Woodpecker Habitat from Logging

District	Estimated Acres
D1, D2, D6	579
D3	0
D4	305
D7	0
Forest Total	**884**

Of the 884 acres, 234 were known from stand exams. However, it is thought that sales that did not have stand exams had acres that may have qualified as old growth that were also affected. The additional acres were based on professional estimates by sale area. Most of which occurred during the early years of the Forest Plan as most sales after 1990 avoided old growth stands.

From 1986 to 2005, the estimated habitat trend for hairy woodpecker on the Carson National Forest is from 106,880 acres to 112,444 acres of habitat, or an upward trend of 5

percent. It should be noted that these numbers reflect acres of the best condition habitats and are most comparable to the acres estimated at the time of the Forest Plan.

Project level effects analysis

With regard to individual project effects analysis, the overall Forest trend should be referenced along with a reference to snag availability within the project area. The trend analysis focused on old growth and not just on mature stands. This is partially due to the fact that "mature" stands may or may not contain quality snags, which was the intent of the Forest Plan, and "mature" can vary, making assessments much more ill-defined and difficult. Effects on overall Forest trend can be more easily assessed when considering old growth habitats. Again, there will be thousands of additional acres in various conditions and cover types that contain numerous snags that may be utilized by the hairy woodpecker.

RED SQUIRREL – HABITAT TREND ANALYSIS

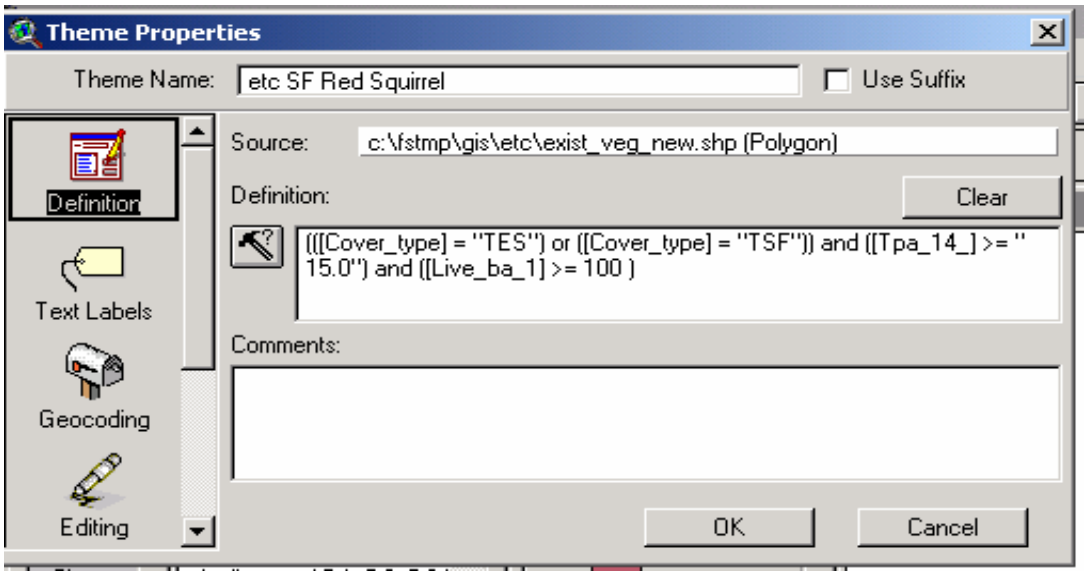
The Forest Plan EIS states red squirrel will utilize the mixed conifer habitat type (USDA 1986a, p. 97). No key habitat component was identified. However, the Forest Plan EIS estimates quality red squirrel habitat at 169,400 acres, which is only about half of the total mixed conifer on the Forest. This disparity seems to indicate that habitat quality parameters were the objective. The Forest Plan directs providing quality habitat in the mixed conifer and includes Engelmann spruce "in a wide variety of mixtures". The red squirrel is also known to utilize the spruce-fir habitat type. Some of the higher densities of squirrels are in this cover type. In the Southwest, Engelmann spruce or a mixture of spruce and Douglas-fir are the most important and commonly inhabited forest types for the red squirrel (Vahle 1978).

To determine a habitat trend from the baseline, the RMRIS database was used to select stands that, to the degree possible, arrive at the quality habitat objective. The cover types were selected from the RMRIS database and exported to Arc View. Then the following queries were run to reflect stands with the highest potential for the habitat attributes necessary for red squirrel occupancy.

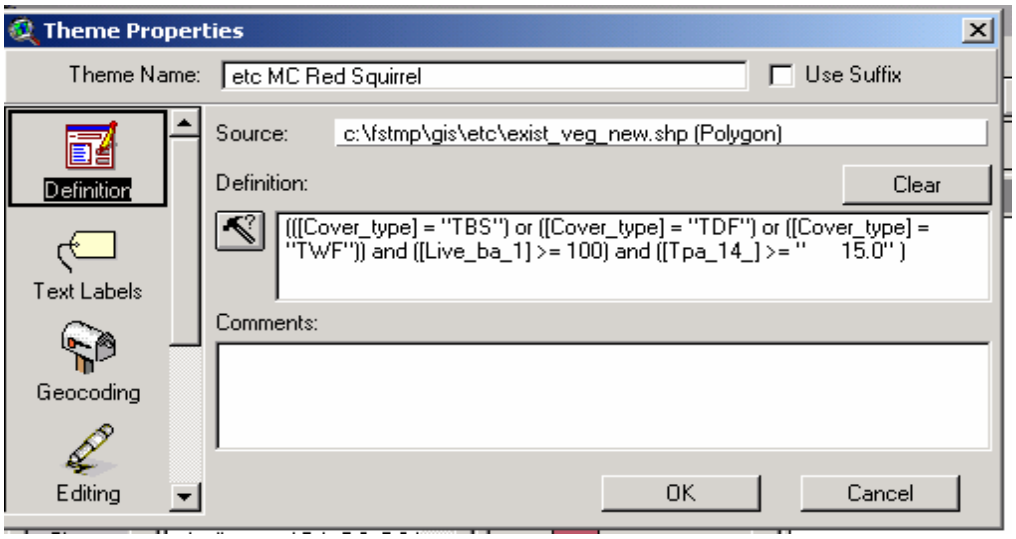
Red Squirrel Queries

To support the species, mature stands of mixed conifer and spruce-fir are important for adequate cone production, nest sites and canopy density. Queries were designed with these considerations in mind. They focus on mature or large tree components and a minimum basal area to provide adequate canopy closure.

Query 1



Query 2



Several factors are used to determine habitat trend. Management activities (primarily timber sales) and wildfire have reduced certain habitats to unsuitable conditions. High intensity wildfire and certain harvest prescriptions such as overstory removal, seed cuts and shelterwood harvests are examples of areas that are deducted from the total acres of quality mixed conifer and spruce-fir habitat. Total stand acres are not deducted. Only the actual acres treated that are estimated to result in acres becoming unsuitable are subtracted.

Suitable stands (2,580 ac) that had experienced high intensity fire were removed from squirrel habitat. In addition, suitable habitat lost to timber harvest (12,791 ac) was deducted. Also taken into account is forest succession, where mixed conifer and spruce-fir stands have progressed towards more quality habitat since 1986. A conservative estimate of stands moving to suitability is one percent of the overall mixed conifer and spruce-fir on the Forest.

In the following tables the total acres of habitat by cover type are identified from the GIS vegetation layer. The percentage with stand exams were totaled and then compared against the percentage meeting the habitat quality criteria and then extrapolated to estimate the total acres of red squirrel habitat.

Red Squirrel Habitat in Mixed Conifer

District	Total MC Acres	MC Stand Exam Acres	% of MC Acres With Stand Exams	Multiplier	MC Stand Exam Acres Meeting Red Squirrel Habitat Query Criteria	Gross Acres of MC Red Squirrel Habitat
D1 D2 D6	71,993	28,690	0.40	2.51	14,764	37,048
D3	1,943	0	0.00	0.00	0	933
D4	100,385	22,879	0.23	4.39	14,649	64,275
D7	66,124	5,023	0.08	13.16	1,000	13,164
Total	240,445	56,592	0.24		30,413	**115,420**

Red Squirrel Habitat in Spruce-Fir

District	Total SF Acres	SF Stand Exam Acres	% of SF Acres With Stand Exams	Multiplier	SF Stand Exam Acres Meeting Red Squirrel Habitat Query Criteria	Gross Acres of SF Red Squirrel Habitat
D1 D2 D6	49,470	3,189	0.06	15.51	2,051	31,817
D3	0	0	0.00	0.00	0	0
D4	72,998	6,326	0.09	11.54	4,064	46,896
D7	78,931	3,887	0.05	20.31	1,156	23,474
Totals	201,399	13,402	0.07		7,271	**102,187**

Total Red Squirrel Habitat

District	Total Acres	Stand Exam Acres Meeting Red Squirrel Habitat Query Criteria	Gross Acres of Red Squirrel Habitat
D1, D2, D6	121,436	16,815	68,864
D3	1,943	0	933
Total D4	173,383	18,713	111,171
Total D7	145,055	2,156	36,638
Forest Total	441,844	37,684	217,606

Red Squirrel Suitable Habitat Acres: Change from Wildfire, Logging and Tree Growth 1986-2005

Ranger District	Total MC and SF Acres	Estimated Acres of Habitat in 2002	Habitat Acres Reduced by Wildfire	Habitat Acres Reduced by Logging	Total Acres Reduced	Total Acres of Ingrowth thru 2005	Remaining Acres of Red Squirrel Habitat

Ranger District	Total MC and SF Acres	Estimated Acres of Habitat in 2002	Habitat Acres Reduced by Wildfire	Habitat Acres Reduced by Logging	Total Acres Reduced	Total Acres of Ingrowth thru 2005	Remaining Acres of Red Squirrel Habitat
D1, D2, D6[21]	121,463	68,864	0	7,357	7,357	818	62,318
D3	1,943	933	0	0	0	10	943
D4	173,383	111,171	80	4,072	4,152	1,320	108,339
D7	145,055	36,638	2,500	1,362	3,862	434	33,210
Total	**441,844**	**217,606**	**2,580**	**12,791**	**15,371**	**2,582**	**204,873**

There were a number of considerations that we examined, but decided not to use as modifiers to the acre calculations. One consideration was a deduction for those lower elevation mixed conifer stands that may have enough ponderosa pine to discourage red squirrel use. In conjunction, there are a few stands that are the highest elevation spruce-fir stands that may also not be as desirable. By examining the data, it could not be determined how much, if any, of a percent deduction should made. On the other hand, standards were set fairly high for quality habitat, and it is likely some acres of habitat are not reflected in the totals. For example, there are only a hand full of stands that meet the 14-inch lower limit and do not have a number of trees that are 16 to 18 inches and larger in the stand.

From 1986 to 2005, red squirrel habitat of interlocking canopies in mixed conifer and spruce-fir is estimated to have increased from 169,400 to 204,873 acres or an upward trend of about 20 percent. It is assumed that some of the increase is due to improved database and GIS capabilities not available at the time the Forest Plan was developed. However, the Forest Plan EIS (page 97) states, “a relatively consistent habitat is expected.” It was thought that Forest habitat would be sustained at a projected rate of timber harvest. The actual rate of harvest has been substantially less than the projected for about a decade. This may also be a factor.

ROCKY MOUNTAIN ELK – HABITAT TREND ANALYSIS

The Forest Plan EIS identifies 1,362,760 acres as occupied habitat for elk on the Carson National Forest (USDA 1986a, p.97). The EIS projected an improvement in elk habitat conditions as the number of structural improvements (e.g., water developments) and nonstructural improvements (e.g. aspen regeneration) increased on the Forest (USDA 1986a, pp. 98 & 152).

In reviewing the management areas identified in the Forest Plan, sagebrush is not included in the acres of occupied elk habitat (USDA 1986c). Elk are currently utilizing the majority of the sagebrush habitat type on the Carson National Forest. Elk are extensively using the piñon-juniper woodlands intermixed with sagebrush, and in doing so, are also dispersing into the adjacent sagebrush habitat type.

The current vegetation cover type data shows 81,752 acres of sagebrush on the Forest, with the majority being on the Tres Piedras Ranger District. The District Biologist estimates that elk regularly use at least 75 percent of this cover type for several months to year-round. In addition, elk use virtually all of the sagebrush on the Jicarilla Ranger District (~6,500 acres). Forest-wide, it is estimated that elk habitat on the Carson National Forest has increased by 61,314 acres

[21] D1 = Canjilon, D2 = El Rito, D3 = Jicarilla, D4 = Camino Real, D6 = Tres Piedras, D7 = Questa

(75% of total sagebrush habitat). Forest-wide, it is estimated that elk habitat on the Carson National Forest has increased by 61,314 acres (75% of total sagebrush habitat). **The trend for Rocky Mountain elk habitat from 1986 to 2005 is estimated to have increased from 1,362,760 to 1,424,074 acres or upward by almost 4 percent.**

TURKEY – HABITAT TREND ANALYSIS

There are two levels that need to be considered when looking at the ponderosa pine habitats across the Forest. First is the overall ponderosa pine habitat. This is important to help place the subset of old growth identified in the Forest Plan EIS in perspective. Although there are 301,297 total acres of ponderosa (based on current stand data cover types), the Forest Plan EIS identifies a subset of 117,300 acres of occupied turkey habitat. According to the Forest Plan EIS, wild turkey utilize old growth stands of pine, but focus on roost tree availability as a key component or habitat group (USDA 1986a, p. 97). Although definitions for old growth have changed somewhat since 1986, there was and still is significantly less than 117,300 acres of old growth ponderosa pine.

By going back to the Analysis of the Management Situation document (USDA 1984, p. H-2) used in preparation of the Forest Plan, it was discovered that acres of turkey habitat were also taken from several “analysis areas” including aspen and mixed conifer. Since that time, stands have grown, some have been harvested, and some have experienced wildfire.

Methods for analyzing data to estimate habitat availability have also improved. Although there is important forest-wide data, the subset of roost trees is the primary feature by which habitat trend for Merriam’s turkey is tracked. Queries were designed to replicate to the degree possible the intent of the Forest Plan by identifying stands with a high likelihood of providing roost trees or roost tree groups.

Several factors are used to determine habitat trend. Management activities (primarily timber sales) and wildfire have reduced certain habitats to unsuitable conditions. High intensity wildfire and certain harvest prescriptions such as overstory removal, seed cuts and shelterwood harvests are examples of areas that are deducted from the total acres of turkey habitat. Total stand acres are not deducted. Only the actual acres treated that are estimated to result in acres becoming unsuitable are subtracted.

Suitable stands (4,000 ac) that had experienced high intensity fire were removed from turkey habitat. Suitable habitat lost to timber harvest (9,733 ac) was also deducted. Also taken into account is forest succession, where ponderosa pine stands have progressed towards more quality habitat since 1986. A conservative estimate of stands moving to suitability is one percent of the overall ponderosa pine on the Forest.

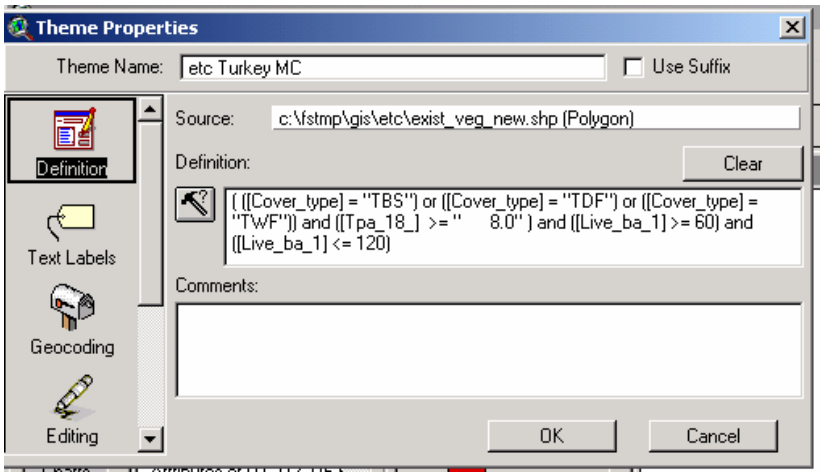
To determine a trend from the baseline, the RMRIS database was used to select stands that mimic to the degree possible the general approach used to arrive at the original acre figure. The cover types were selected from the RMRIS database and exported to Arc View. Then the following queries were run to reflect stands with the highest potential for the habitat attributes necessary or identified for turkeys.

Turkey Queries

Given that roost tree availability was the primary consideration used to determine habitat during Forest Plan development, queries were designed with that consideration in mind. In addition, both an upper and lower basal area was used in the mixed conifer, since it is likely that

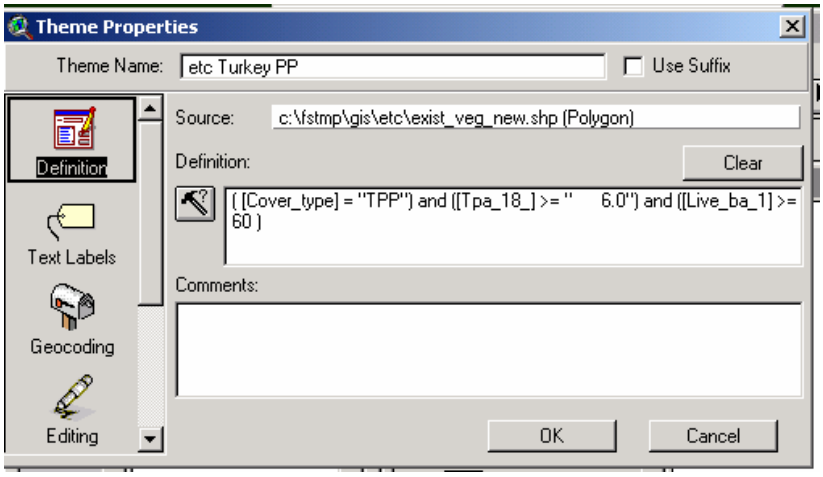
extremely dense stands are not preferable to the species, but adequate cover in conjunction with roost tree availability was important.

Query 1

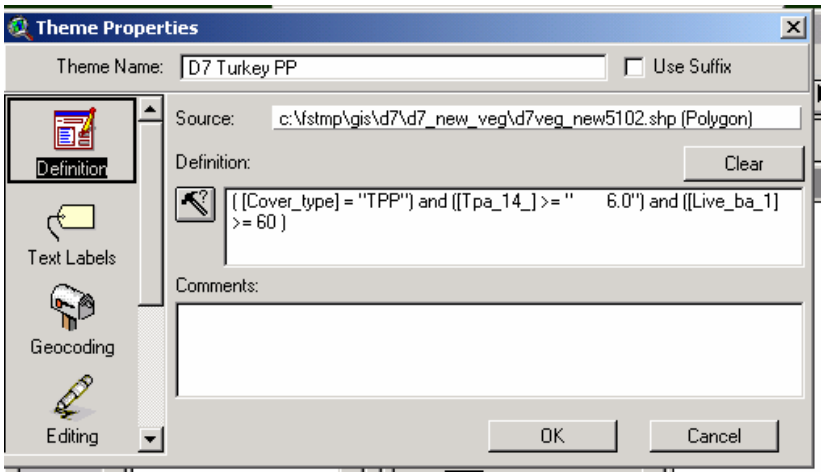


It is also likely that a few more large trees per acre may be required to provide an adequate roost tree or roost tree group in the mixed conifer. In the ponderosa pine the upper limit on the basal area was not considered as critical as the presence of enough large trees to provide for a roost tree or roost tree group per stand. The nature of the stands would not result in such a tight understory, which would inhibit movement, reduce forage and cause avoidance by turkeys.

Query 2



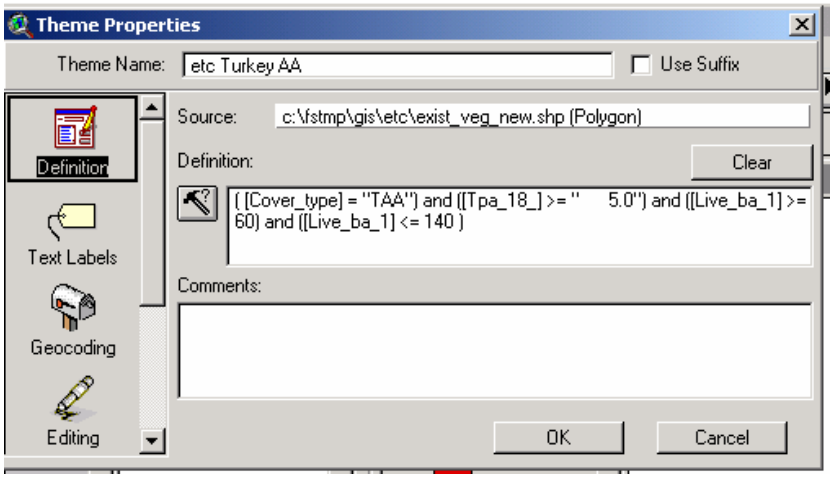
Query 3



The standards chosen for queries may appear to be more than required for turkey roost tree availability. However, one factor considered was that not all larger trees have turkey roost tree characteristics. In addition, we used a slightly less stringent standard for the Questa Ranger District. This reflects the smaller diameter classes on the Valle Vidal. This area does support turkeys and has a number of trees with turkey roost characteristics, but are just not as tall or have as large a diameter.

An upper limit on the basal area was also used in the aspen. This is primarily to eliminate stands that have a dense mixed conifer understory through forest succession, but might still type out as aspen. Also the more open grown stands provide for a slight increase in mixed species and more lateral branching that might be used for roosting along with the open understory necessary for foraging.

Query 4



The following three tables reflect the acreage calculations by cover type (ponderosa pine, mixed conifer and aspen) for wild turkey.

Turkey Habitat in Ponderosa Pine

District	Total PP Acres	PP Stand Exam Acres	% of PP Acres With Stand Exams	Multiplier	PP Stand Exam Acres Meeting Turkey Habitat Query Criteria	Gross Acres of PP Turkey Habitat
D1, D2, D6	176,966	62,922	0.36	2.81	21,441	60,302
D3	33,905	0	0.00	0.00	0	11,886
D4	50,005	13,453	0.27	3.72	5,956	22,139
D7	40,421	28,363	0.70	1.43	7,926	11,296
Total	301,297	104,738	0.35			**105,622**

Turkey Habitat in Mixed Conifer

District	Total MC Acres	MC Stand Exam Acres	% of MC Stands With Stand Exams	Multiplier	MC Stand Exam Acres Meeting Turkey Habitat Query Criteria	Gross Acres of MC Turkey Habitat
D1, D2, D6	71,993	28,690	0.40	2.51	2,903	7,285
D3	1,943	0	0.00	0.00	0	131
D4	100,385	22,879	0.23	4.39	1,505	6,603
D7	66,124	5,023	0.08	13.16	165	2,172
Total	240,445	56,592	0.24			**16,191**

Turkey Habitat in Aspen

District	Total AA Acres	AA Stand Exam Acres	% Of AA Acres With Stand Exams	Multiplier	AA Stand Exam Acres Meeting Turkey Habitat Query Criteria	Gross Acres of AA Turkey Habitat
D1, D2, D6	43,642	12,310	0.28	3.55	1,191	4,222
D3	0	0	0.00	0.00	0	0
D4	30,912	4,835	0.16	6.39	458	2,928
D7	21,192	1,026	0.05	20.65	0	2,033
Total	95,746	18,171	0.19			**9,183**

Total Turkey Habitat

District	Total Acres	Gross Acres of Turkey Habitat
Total D1, D2, D6	292,601	71,809
Total D3	35,848	12,016
Total D4	181,302	31,670
Total D7	127,737	15,500
Forest Total	**637,488**	**130,995**

Ranger District	Total MC, PP & AA Acres	Estimated Acres of Turkey Habitat in 2002	Habitat Acres Reduced by Wildfire	Habitat Acres Reduced by Logging	Total Acres Reduced	Total Acres of Ingrowth (+ 1%)	Remaining Acres of Turkey Habitat
D1, D2, D6	298,792	71,809	1,000	7,338	8,338	852	64,323
D3	35,848	12,016	0	0	0	142	12,158
D4	193,069	31,670	0	2,117	2,117	376	29,929
D7	131,752	15,500	3,000	278	3,278	184	12,406
Total	659,461	130,995	4,000	9,733	13,733	1,554	118,816

Turkey habitat from 1986 to 2005 is estimated to have increased from 117,300 to 118,572 acres or a slight upward trend of about 1 percent.

Project level effects analysis

When doing effects analysis at a project level, it should be kept in mind that the roost availability is only one of numerous habitat components that are necessary for stable turkey populations. Weak links in the composition of habitats should be determined. For example, the lack of roosting sites may be reduced by logging or fire, but if there are still adequate roost sites, the conversion of a portion of these acres to foraging areas may actually improve overall habitat condition. If roost sites are actually the weak link or limiting factor locally, then the trend in available habitat becomes more important.

Another consideration is acres of habitat forest-wide are also calculated by stand. If the stand is burned over by wildfire, those acres are deducted. This may in fact be beneficial for turkeys as

long as there is adequate roost tree habitat and the other required habitat components occur within about a half-mile.

ROCKY MOUNTAIN BIGHORN SHEEP – HABITAT TREND ANALYSIS

In New Mexico, suitable range for bighorn sheep is relatively limited. It is believed that bighorn once occupied alpine ranges in most of New Mexico, implying that the Pecos, Latir Peak, Wheeler Peak and Gold Hill areas of the Carson National Forest are historic ranges. The westside of the Carson NF lacks the high elevation, rugged habitat of cliffs, crags and rocky areas required to support a viable population of bighorn sheep.

The Forest Plan EIS identifies 20,430 acres of occupied bighorn sheep habitat on the Carson National Forest (USDA 1986a, p. 97). Based on Terrestrial Ecosystem Survey data, Map 1 displays only the alpine tundra portion (~ 10,100 acres) of bighorn habitat (USDA 1987). The Forest Plan EIS includes other adjacent alpine habitats; therefore the acres in Map 1 cannot be used in a habitat trend analysis. The core portions of bighorn habitat, however, can be located using Map 1, until a new map depicting a more accurate range of the species can be made available and incorporated into this document.

The Forest Plan EIS considered the bighorn herd in the Pecos Wilderness to be unstable and that a downward trend was expected (primarily due to lungworm-pneumonia disease) (USDA 1986a, p. 98). Conversely, populations have done very well on the Forest and several relocations have been successful.

Livestock grazing has been the only management activity that has significantly changed potential bighorn habitat during the period of the Forest Plan. The removal of domestic sheep from the Latir Peak range has without doubt increased the habitat quality, but it is not certain if the acres identified in the Forest Plan included this area. Actual occupied habitats should be remapped and key or critical areas identified for this species.

Currently, reproduction is high and mortality of young has not been significant. If this trend stays consistent the actual occupied range may gradually increase although there are natural limits.

Habitat conditions in the Pecos Wilderness are fair and stable, while the Wheeler Peak Wilderness, Columbine-Hondo Wilderness Study Area and the Latir Peak Wilderness are generally good and stable. There are a few locations where utilization is heavy, but these are isolated. The limiting factor for the bighorn is severe winter conditions when quality and quantity of forage can fluctuate significantly. Recent Forest Service management trends places more emphasis on thinning conifer encroachment and prescribed burning in transitory range, thus improving the quality of bighorn sheep habitat. **The habitat trend for Rocky Mountain bighorn on the Carson National Forest is estimated to be stable or slightly increasing.**

WHITE-TAILED PTARMIGAN – HABITAT TREND ANALYSIS

White-tailed ptarmigan is associated with the alpine tundra and subalpine deciduous shrub. The Carson Forest Plan EIS identifies 6,400 acres of occupied habitat (USDA 1986a, p. 97). It also states that habitats are marginal compared to areas further north in Colorado, and that localized extinctions of populations could occur when densities are low.

No management actions have changed since the time of the Forest Plan to cause a change in the number of acres of available habitat on the Carson National Forest. The Terrestrial Ecosystem Survey data layer identifies that there are 10,106 acres of alpine tundra on the

Forest (USDA 1987). This does not mean there is any change in the trend of available habitat, but is a result of a variation in habitat mapping. Incidental observations show that portions of these habitats are still occupied. The most recent reports (photo verified) were in the Pecos Wilderness in 2002. **The overall habitat trend for the white-tailed ptarmigan on the Carson National Forest is stable.**

RESIDENT TROUT AND MACROINVERTEBRATES – HABITAT TREND ANALYSIS AND OTHER MONITORING DATA

Resident trout include all species of salmonids on the Carson including native and non-native species. Both resident trout and macroinvertebrates were based on the total length of stream miles or available habitat and were estimated at 400 miles. The Forest Plan EIS identifies 400 miles of occupied habitat. The total number of stream miles has not changed since the Plan was prepared. However, the data processing and GIS capabilities have resulted in a refinement of the actual occupied habitat to approximately 444.26 miles. **Habitat trend for both resident trout and aquatic macroinvertebrates on the Carson National Forest is stable.**

Even though the trend in habitat is stable, habitat monitoring has also led to a much more precise breakdown of occupied habitats between Rio Grande cutthroat (Forest Service Sensitive) and other non-natives such as brook trout, brown trout and rainbow trout. The following table is a summary of both native and non-natives by stream miles by watershed on the Carson National Forest.

Stream Miles for Native and Non-Native Trout Species on the Carson National Forest

Stream Name	Miles			
	Restoration Potential	RGCT Only	Non-Native Only	RGCT & Non-Native
Rio de los Piños (13010005050)[22]				
Rio de los Piños	3.25		3.35	
Lobo Creek	1.76		1.76	
Diablo Creek	2.58		2.58	
Escondido Creek	1.27		1.27	
Beaver Creek	4.79		4.79	
Cruces Creek	2.53		2.53	
Tanques creek		1.96		
Rio Nutrias	3.87	2.49	3.87	0
Rio San Antonio	15.63		15.63	
Lagunitas Creek	5.2		5.2	
Canada Tio Grande	5.09	4.46	5.09	1.34
Total	45.97	8.91	46.07	1.34
El Rito Creek (13020102090)				
Canada Chacon		2.31		
Hachita Canyon		2.14		
Salvador Canyon		1.65		
Gurule Canyon		1.83		
El Rito Creek		8.23	4.48	
Total	0	16.16	4.48	0
Canjilon Creek (13020102060)				
Canjilon Creek		5.83		
Total	0	5.83	0	0
Rio Tusas/ Vallecitos (13020102080)				
Jaroso Creek		1.56		
Total	0	1.56	0	0
Rio Costilla (13020101010)				
La Cueva Canyon		2.27		
Comanche Creek		9.93		
Vidal Creek		5.03		
Chuck Wagon Creek		2.47		

[22] Watershed Hydrologic Unit Code

Stream Name	Miles			
	Restoration Potential	RGCT Only	Non-Native Only	RGCT & Non-Native
Gold Creek		3.12		
La Belle Creek		2.79		
Grassy Creek		3.06		
Holman Creek		2.99		
Spring Wagon Creek		2.96		
Little Costilla Creek		4.74		
Powder House Creek		4.64		
Rio Costilla	5.17	5.17		5.17
Total	5.17	49.17	0	5.17
Vermejo (11080001010)				
Leandro Creek		2.5		
Total	0	2.5	0	0
Ponil (11080002010)				
North Ponil Creek	3.4	2.67	0.89	3.4
McCrystal Creel		4.79		
Total	3.4	7.46	0	0
Red River (13020101040)				
Bitter Creek		4.64		
Jiron Creek		2		
Cabresto Creek	7.75	7.9	8.9	5.34
Lake Fork Creek	2.56	2.83	2.35	1.71
Deer Creek		1.19		
Place Fork Creek		3.56		
Willow Fork Creek		1.97		
Columbine Creek		4.99		
West Fork Creek	1.74		1.74	
Middle Fork Creek	1.27		1.27	
Sawmill Creek	1.17		1.17	
East Fork Creek	2.68		2.68	
Red River	18.28		18.28	
Pioneer Creek		5.01	5.01	
Total	35.45	34.09	41.4	7.05
Rio Hondo (13020101050)				
San Cristobal Creek		5.18		

Stream Name	Miles			
	Restoration Potential	RGCT Only	Non-Native Only	RGCT & Non-Native
Yerba Canyon		2.91		
Manzanita Canyon		2.61		
Italianos Canyon		2.25		
Gavilan Canyon		1.96		
South Fork Rio Hondo		4.4		
Rio Hondo	9.74	3.65	6.54	3.65
Total	9.74	22.96	6.54	3.65
Rio Grande del Rancho (13020101060)				
Rio Fernando		3.18	1.93	
Valle Largo		0.67	0.88	0.76
Osha Pass		0.86	1.09	1.11
Tienditas Creek		2.84	1.86	1.03
Rio Chiquito	15.6		15.6	
Palociento Creek		2.46		
Frijoles Creek	1.52	0.7	1.52	1.36
Rito de la Olla	11.93	2.1	11.25	0.68
Rio Grande del Rancho	11.81		11.81	
Jarosa Canyon		1.55		
Saloz Canyon		1.36		
Totals	40.86	15.72	45.94	4.94
Rio Pueblo (13020101070)				
Sardinas Canyon	1.37	1.75	0.54	1
Rito La Pressa	2.96	2.49	1.27	1.5
Policarpio Canyon		2.25	0.21	0
Arellano Canyon	1.54		1.54	
La Junta Canyon	5.36		5.36	
Duran Creek	1.74	1.26	0	1.48
La Cueva Canyon		3.21		
Osha Canyon		4.6		
Comales Canyon		3.65		
Cordova Canyon		1.81		
Agua Piedra Creek	0.81	2.88	0	0.81
Rito Angostura		5.66		
Alamito Creek	4.62	4.62	4.62	0

Stream Name	Miles			
	Restoration Potential	RGCT Only	Non-Native Only	RGCT & Non-Native
Raton Canyon	1.46		1.46	
Rio Pueblo	5.46		5.46	
Indian Canyon		1.7		
Jicarita Creek		2.26		
East Fork Rio Santa Barbara	0.41	2.45	0	0.41
Middle Fork Rio Santa Barbara	3.62	3.13	0	3.62
West Fork Rio Santa Barbara	4.31	0.86	0	4.31
Rio Santa Barbara	5.37	0	1.09	4.03
Rio Chiquito	5.84		5.84	
Rio San Leonardo		3.54	3.54	
Total	44.87	48.12	30.93	17.16
Sabastian Martin (13020101090)				
La Jara Canyon		1.68	0	3.52
Rio De Truchas		1.53	0	3.69
Total	0	3.21	0	7.21
Upper Mora (11080004010)				
West Fork Luna Creek		2.29		
East Fork Luna Creek	2.76	0.74	0	2.76
Total	2.76	3.03	0	2.76
Coyote (11080004020)				
Jarosa Creek		0.9		
Total	0	0.9	0	0
Grand Total	*188.22*	*219.62*	*175.36*	*49.28*

Note: The first column or “Restoration Potential” is contained in the other column numbers: 219.62 + 175.36 + 49.28 = 444.26 miles.

General Assemblages of Aquatic Macroinvertebrates on the Carson National Forest

Station	Date	Sample ID	Total Abundance	EPT Abundance	# of Families	Dominant Family	Dominant Family Abundance	Dominant Family % Contribution
COMANCHE01	06/08/1998	108762	1054	688	14	Leptohyphidae	326	30.93
COMANCHE01	09/26/1982	112790	519	144	12	Elmidae	168	32.37
COMANCHE02	06/30/1998	108763	2398	2000	16	Heptageniidae	1072	44.70
COMANCHE03	06/30/1998	108764	2319	1642	15	Heptageniidae	649	27.99
COMANCHE04	07/02/1998	108765	2301	1735	17	Heptageniidae	821	35.68
COMANCHE05	07/10/1998	108766	1487	1223	13	Leptohyphidae	568	38.20
COMANCHE05	09/26/1982	112791	1500	906	13	Hydropsychidae	501	33.40
COMANCHE06	07/10/1998	108767	2294	1892	19	Lepidostomatidae	961	41.89
COMANCHE07	07/10/1998	108768	2333	2057	13	Lepidostomatidae	796	34.12
COMANCHE08	06/08/1998	108769	2652	1326	17	Chironomidae	1039	39.18
COMANCHE08	09/24/1982	112792	771	555	14	Glossosomatidae	225	29.18
COMANCHE20	06/09/2001	116366	620	358	12	Chironomidae	129	20.81
COMANCHE21	06/19/2001	115209	2544	2072	18	Heptageniidae	701	27.56
COMANCHE22	06/19/2001	115210	4579	2169	16	Chironomidae	1914	41.80
CWAGON-01	09/15/1998	108758	541	301	15	more than one	161	29.76
CWAGON-01	09/26/1982	112793	276	90	9	Chironomidae	9	19.57
ELRITO-A	07/16/2001	115199	2728	1914	9	Lepidostomatidae	1018	37.32
ELRITO-B	07/16/2001	115200	1208	885	10	Lepidostomatidae	427	35.35
ELRITO-C	07/16/2001	115201	2295	1427	15	Lepidostomatidae	983	42.83
ELRITO-D	07/16/2001	115202	1781	1409	9	Lepidostomatidae	871	48.91
ELRITO-E	08/03/2001	115203	294	204	15	Helicopsychidae	75	25.51
ELRITO-F	08/03/2001	115204	767	584	17	Heptageniidae	158	20.60
ELRITO-G	08/03/2001	115205	240	90	14	Chironomidae	72	30.00
FERNANDZ01	07/10/1998	108760	1118	452	14	Chironomidae	351	31.40
FERNANDZ01	09/26/1982	112794	405	144	8	Elmidae	195	48.15
LITTCOST01	07/31/1998	108759	215	100	11	Elmidae	82	38.14
LITTCOST01	09/26/1982	112795	612	198	12	Simuliidae	174	28.43
POT-01	09/04/2001	116363	1308	566	13	Chironomidae	627	47.94
POT-02	9/04/2001	0116364	935	624	16	Chironomidae	237	25.35
POT-03	09/06/2001	116365	1254	724	19	Chironomidae	323	25.76
POWDER-01	06/26/1997	103966	190	168	10	Heptageniidae	86	45.26
POWDER-01	09/11/1997	103967	179	68	14	Elmidae	79	44.13
POWDER-01	07/15/1998	108774	2312	523	15	Simuliidae	1068	46.19
POWDER-01	09/10/199	108775	566	258	12	Elmidae	240	42.40
POWDER-01	09/24/1982	112797	180	165	12	Baetidae	51	28.33
POWDER-01	08/24/1999	115206	409	269	9	Heptageniidae	211	51.59
POWDER-02	09/11/1997	103968	276	154	17	Elmidae	72	26.09
POWDER-02	09/08/1997	103970	656	276	20	Elmidae	294	44.82
POWDER-02	07/15/1998	108772	430	165	14	Elmidae	183	42.56

Station	Date	Sample ID	Total Abundance	EPT Abundance	# of Families	Dominant Family	Dominant Family Abundance	Dominant Family % Contribution
POWDER-02	09/10/1998	108773	867	401	13	Elmidae	315	36.33
POWDER-02	08/24/1999	115207	602	373	12	Heptageniidae	297	49.34
POWDER-03	09/11/1997	103969	441	158	15	Elmidae	158	35.83
POWDER-03	09/08/1997	103971	538	183	15	Elmidae	258	47.96
POWDER-03	07/15/1998	108770	1233	373	16	Chironomidae	430	34.87
POWDER-03	09/10/1998	108771	1072	487	16	Elmidae	441	41.14
POWDER-03	08/24/1999	115208	391	229	10	Heptageniidae	161	41.18
RRBELOW	07/17/1998	106628	369	237	5	Brachycentridae	190	51.49
RRDEBRIS	08/08/2000	112605	43	39	4	Ephemerellidae	25	58.14
RRDOWNMINE	07/16/2000	112606	681	462	10	Brachycentridae	254	37.30
RRDOWNMINE	08/08/2000	112607	581	520	10	Brachycentridae	344	59.21
RRDOWNMINE	09/23/2000	112608	340	305	9	Brachycentridae	151	44.41
RRTOWN	07/17/1998	106629	151	129	7	Brachycentridae	90	59.60
RRUPMINE	07/16/2000	112609	896	814	8	Brachycentridae	333	37.17
RRUPMINE	07/16/2000	112610	262	208	8	Baetidae	86	32.82
RRUPMINE	09/23/2000	112611	509	412	11	Baetidae	172	33.79
TIOGRAN-01	07/26/2001	115211	1115	634	15	Heptageniidae	495	44.39
TIOGRAN-02	07/26/2001	115212	491	312	11	Heptageniidae	168	34.22
TIOGRAN-03	07/26/2001	115213	710	552	15	Heptageniidae	419	59.01
VIDAL01	06/08/1998	108761	3074	1333	19	Chironomidae	921	29.96
Mean			**1066**	**656**	**13**		**401**	**37.62**

Abundance data is number per meter squared for quantitative samples and number per sample for qualitative samples.
NC = Not calculated. * = unable to calculate. EPT = totals for the insect orders