

Red Squirrel (*Tamiasciurus hudsonicus*)

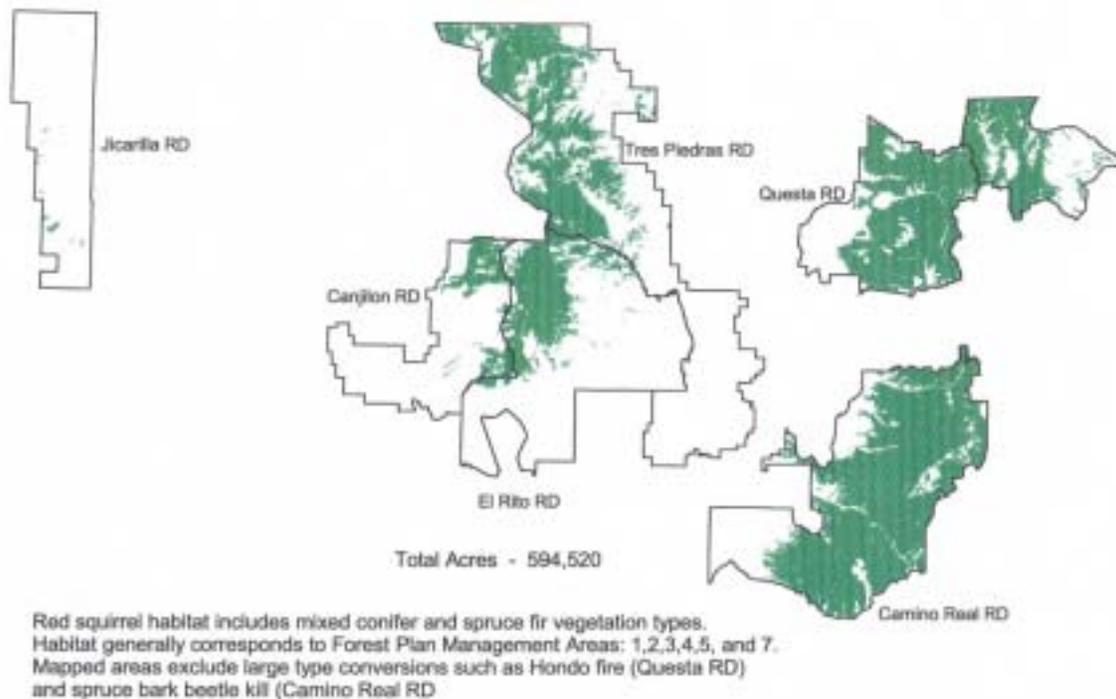
Indicator Species Habitat

Red squirrel principally utilizes the mixed conifer forest type. The species is an indicator for the presence of mixed conifer (USDA 1986a, p.97). Red squirrels require mature coniferous trees as a source of cones and seed (Degraaf and Rudis 1986). The best cone production occurs in 200- to 300-year old Douglas-fir 40- to 300-year old white fir (*Abies concolor*), and 150- to 200-year-old Engelmann spruce. The best seed-producing stands of blue spruce (*Picea pungens*) are 50 to 150 years old (Reynolds et al. 1992). The more diverse the tree species are the more likely that cone crop production will exist to sustain red squirrel populations. They are predominantly found in areas with greater than 60 percent canopy closure. In extensive areas of montane forest, this species may be found in ponderosa pine forests where transition occurs with mixed conifer. In smaller mountain ranges, it is restricted to stands of mixed conifer or spruce-fir forests. Red squirrels utilize large diameter trees for nests that are located on big branches near the trunk of the tree. They may also use mistletoe formations in Douglas fir.

Food caches (middens) are of paramount importance to red squirrels (Reynolds et al. 1992). Without these middens, winter starvation is inevitable (Smith 1968, Kemp and Keith 1970). A large centrally located (primary) midden is the most prominent feature of red squirrel territories. These primary middens, along with several secondary middens, provide the energy requirements of a single squirrel for half of the year (Rusch and Reeder 1978, Gurnell 1984, Patton and Vahle 1986). Cache sites are in moist, shaded areas. At cache sites, groups of mature trees and shading from additional understory and overstory vegetation maintain the humidity necessary to prevent the cones from opening. Vahle and Patton (1983) found the 90 percent of 141 cache sites had canopy cover greater than 60 percent, and received additional shading from surround uneven-aged groups of trees.

Within certain habitats, the red squirrel is commonly used as prey by the northern goshawk (Reynolds et al. 1992). In the Jemez Mountains of northern New Mexico, the red squirrel comprised 5.6 percent of 36 prey deliveries to seven goshawk nests and 17.5 percent of 63 pellets analyzed from eight goshawk nests (Kennedy 1991).

On the Carson National Forest, this species is commonly observed throughout the mixed conifer and spruce-fir habitat type. Characteristic mounds or middens confirm red squirrels presence and are found throughout red squirrel habitat on the Forest. Red squirrel clippings, cone felling and stripping are also a usual sign of occurrence. As displayed on a map of the Carson National Forest (next page), the “potential” habitat for the red squirrel is well distributed across the Forest. Note that the acres on this map are based on terrestrial ecosystem unit data and not on the recently available vegetation cover type data. This map will be replaced as soon as the vegetation cover layer maps are available.



Map 1. Red Squirrel Potential Habitat Distribution on the Carson National Forest (USDA 1987)

Management Activities or Natural Events That May Affect Habitat

Negative: Logging activities in mature stands, catastrophic wildfire.

Positive: Thinning smaller diameter trees to release and promote larger trees.

Plans, Regulations and Guidelines Supporting, Maintaining or Improving Habitat

- *Carson National Forest Land and Resource Management Plan, Forest-wide Prescriptions for Wildlife and Fish (1986) are described,*

By creating a diversity of stand conditions and providing juxtaposition of stands over time and space, suitable habitat components of Abert and red squirrels will be maintained over time. During the intensive reconnaissance phase of integrated stand management, State and Federal biologists should identify those stands where squirrel activity is especially high and recommend deferment of cutting during the entry (USDA 1986c, p. Wildlife & Fish – 10).

The desired conditions for Management Areas 3, 5 and 7 are identified as quality habitat for red squirrel (USDA 1986c, p. 3. MC<40% - 1, p. 5. MC/PP >40% - 1, 7. Unsuitable - 1).

- *Record of Decision for Amendment of Forest Plans (USDA 1996) provides guidelines relative to the management of both Mexican spotted owl and northern goshawk habitat.*

Standards and guidelines for ecosystem management in Mexican spotted owl habitat (mixed conifer on the Carson NF) include:

Manage to ensure sustained level of owl nest/roost habitat where appropriate while providing a diversity of stand conditions across the landscape to ensure habitat for a diversity of prey species.

Attempt to mimic natural disturbance patterns by incorporating patterns by incorporating natural variation, such as irregular tree spacing and various patch sizes, into management prescriptions.

Emphasize uneven-aged management systems. However, both even-aged and uneven-aged systems may be used where appropriate to provide variation in existing stand structure and species diversity. Existing stand conditions will determine which system is appropriate.

Save all trees greater than 24 inches DBH.

Retain substantive amounts of key habitat components:

Snags 18 inches in diameter and larger.

Down logs over 12 inches midpoint diameter.

...implement forest plan old growth standards and guidelines to maintain and promote development of owl habitat. (USDA 1996, pp. 89 & 90)

Standards for ecosystem management in northern goshawk habitat include:

Manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape.

Sustain a mosaic of vegetation densities (overstory and understory), age classes and species composition across the landscape. Provide foods and cover for goshawk prey (USDA 1996, p. 91).

Standards and guidelines for old growth include:

Until the forest plan is revised, allocate no less than 20 percent of each forested ecosystem management area to old growth...(see USDA 1996, Minimum Criteria for Structural Attributes Used to Determine Old Growth table, p. 96).

Strive to create and sustain as much old growth compositional, structural, and functional flow as possible over time at multiple area scales. Seek to develop or retain old growth function on at least 20 percent of the naturally forested area by forest type in any landscape.

- *Management Recommendations for the Northern Goshawk in the Southwestern United States (Reynolds et al. 1992) describe the red squirrel as an important prey species for the goshawk and habitat management recommendations include:*
 - o *Mixed-species and spruce-fir specialist*
 - *Closed canopy VSS 4, VSS 5, and VSS 6*
 - o *Nesting*
 - *Closed canopy VSS 4, VSS 5, and VSS 6*
 - *Nests are close to middens*
 - *Nest sites have high canopy cover and the best sites are mesic*
 - o *Foraging (considered a food specialist)*
 - *VSS 5 and VSS 6 (infrequent use of VSS 4)*
 - *Middens have high canopy cover and are mesic, preserving cones*

- High canopy cover provides mesic conditions for greater fungi production
- o Other important habitat attributes
 - Snags (>18 inches DBH) and downed logs (16-20 inches diameter) very important; smaller woody debris less important
 - High canopy cover provides escape cover for squirrels
 - Large mature cone-bearing trees, abundant fungi, and multistoried stands with many plant species in all forest layers constitute superior squirrel habitat
 - Medium to large forest openings degrade the mesic microclimate in adjacent forests, and thereby reduce the quality of red squirrel habitat (Reynolds et. al 1992).

Habitat Condition And Trend On The Carson National Forest

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 also 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 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.

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. Appendix A explains in more detail how habitat trend is determined.

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.

Table 1. Red Squirrel Suitable Habitat Acres: Change from Wildfire, Logging, and Tree Growth 1986-2002

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 (+ 1%)	Remaining Acres of Abert's Squirrel Habitat
D1, D2, D6 ¹	121,463	68,864	0	7,357	7,357	698	62,196
D3	1,943	933	0	0	0	9	942
D4	173,383	111,171	80	4,072	4,152	1,112	108,131
D7	145,055	36,638	2,500	1,362	3,862	366	33,142
Total	441,844	217,606	2,580	12,791	15,371	2,176	204,411

From 1986 to 2002, red squirrel habitat of interlocking canopies in mixed conifer and spruce-fir is estimated to have increased from 169,400 to 204,411 acres or an upward trend of about 20 percent.

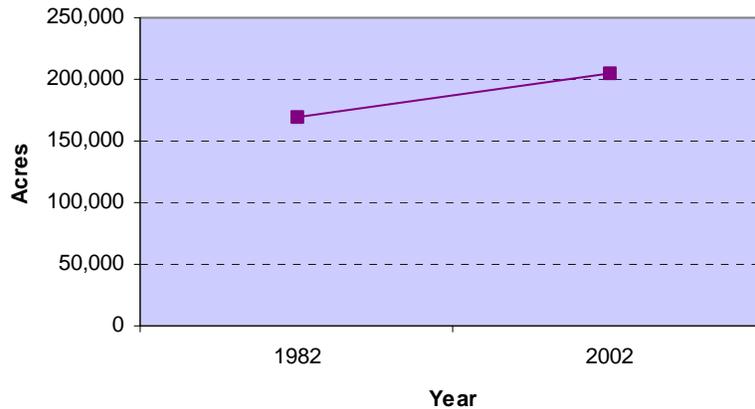


Figure 1. Changes in Red Squirrel Suitable Habitat on the Carson National Forest from 1986 to 2002.

Forest Management Activities

In southwestern mixed conifer forests, size, density and grouping of coniferous trees are the most important overstory components of red squirrel habitat. In the right combinations, these factors provide squirrels with optimum conditions for food procurement, nesting cover and food caching sites (Vahle et al. 1983). Vahle and others (1983, 1986) and Patton (1983) recommended maintenance of areas with closely spaced groups of trees of different ages and sizes for red squirrel habitat. Conifers larger than 15 inches diameter at breast height (DBH) are necessary for cone production; at least three or four large trees per acre are needed. For Douglas-fir, 200- to 300- year-old trees are the best cone producers (Hermann and Lavender 1990). In addition, one or more large tree components (>20 inches DBH), consisting of snags, fallen logs, and live trees, are necessary for primary middens. Closed canopies (basal areas \geq 200 square feet per acre) are also important for maintaining mesic conditions for middens and suitable cover for nesting. To

¹ D1 = Canjilon, D2 = El Rito, D3 = Jicarilla, D4 = Camino Real, D6 = Tres Piedras, D7 = Questa

provide adequate conifer seed for food, 3 to 4 large (≥ 18 inches DBH) trees are needed per acre (Vahle 1978).

Red squirrel populations depend on cone production and reproductive sites. Cone production varies by year, depending on available moisture or harvest activities that may open the canopy. Harvest activities can have mixed results regarding cone production. In a managed forest, method of overstory removal significantly influences red squirrel habitat. Harvesting will generally stimulate cone production in the spruce-fir, but excessive canopy opening can create a drier condition that reduces the amount of cone production. The group selection method provides undisturbed groups of all-aged trees and promotes habitats favored for red squirrel cache sites. Squirrels prefer groups that are mostly dense and contain large conifers, snags and downed logs (Vahle et al. 1983). Reynolds and others (1992) listed specific management recommendations for red squirrels in the Southwest in conjunction with maintenance of northern goshawk prey base (see previous section). Cone production may be influenced by spring freezing, and to some degree by wind throw, which can be locally significant.

The maintenance of many mature coniferous forest types is often dependent on fire. Ponderosa pine, Douglas-fir, lodgepole pine, whitebark pine, and spruces are either dependent on stand replacing fires for regeneration or on low-severity fires for maintenance. Even though severe fire is immediately destructive of red squirrel habitat, the long-term maintenance of most coniferous forests is dependent on fire (Kozlowski 1974).

The dominant mid-seral conditions on the Carson primarily relate to cumulative effects of historical heavy logging, primarily railroad logging in the early 20th century, and long-term fire suppression. Overstory removal prescriptions also contributed to the trend towards smaller diameter stands. Over the past 15-20 years, most of the vegetation treatments in red squirrel habitat have shifted away from sawtimber and more towards wildlife habitat improvement.

Vegetation treatments since 1986 have been consistent with the Forest Plan, creating small openings and retaining large cone producing trees for red squirrel foraging opportunities. Although timber harvest has dropped dramatically (97%) across the majority of the Carson National Forest in the past decade, a common practice throughout the period of the Forest Plan (1986), with regard to harvest activities, was to locate and avoid patches around squirrel middens (see Forest Plan direction in previous section). The untreated stands continue to provide and maintain a closed canopy for fungi production and mesic conditions. **As a result the current habitat condition for this species is relatively good, with an upward trend.**

Current management practices on the Forest place more emphasis on thinning and prescribed burning, increasing the desired habitat in mixed conifer. Prescribed fire controls dense reproduction and improves prey base populations. Thinning in mixed conifer stands that are not maturing into large diameter trees reduce inter-tree competition for moisture, nutrients and light and stimulate growth of residual trees. In addition, dense stands of trees are prone to catastrophic wildfire, which could completely remove red squirrel habitat, affecting local populations. By thinning dense stands, the risk of a catastrophic wildfire is reduced.

The figure below shows that between 1986 (when the Carson Forest Plan was implemented) and 2000, approximately four percent of the “potential” red squirrel habitat has been actively managed for timber production.

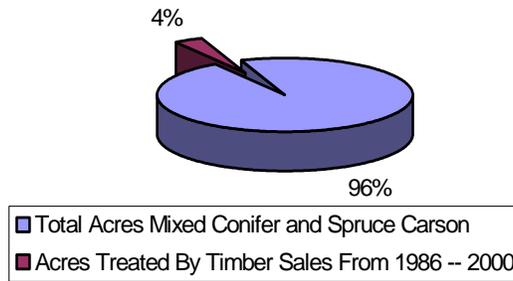


Figure 2. Proportion of Mixed Conifer and Spruce-fir Treated in Timber Sales on the Carson National Forest From 1986 to 2000 (RMRIS DB, Activity Records)

Standards and guidelines incorporated in the Carson Forest Plan through the 1996 Region-wide amendment of forest plans (USDA 1996) restrict management activities within the mixed conifer. Standards and guidelines include:

- *No timber harvesting (except for fire risk abatement) in mixed conifer on slopes greater than 40 percent.*
- *Within Mexican spotted owl restricted habitat (mixed conifer), 25 percent of the oldest and/or best nest/roost habitat (threshold) must not go below threshold values.*
- *Unless 20 percent of an ecosystem management area has been allocated to old growth, any mixed conifer stands must not be treated in a manner that would take the stand out of meeting old growth criteria (USDA 1996).*

Since 1995, the Carson National Forest has focused on thinning from below, with little or no timber activity in the mixed conifer. The graph below shows that of the four percent potential red squirrel habitat that has been treated through timber sales since 1986, 62 percent of the habitat has shifted from late² to early seral conditions.

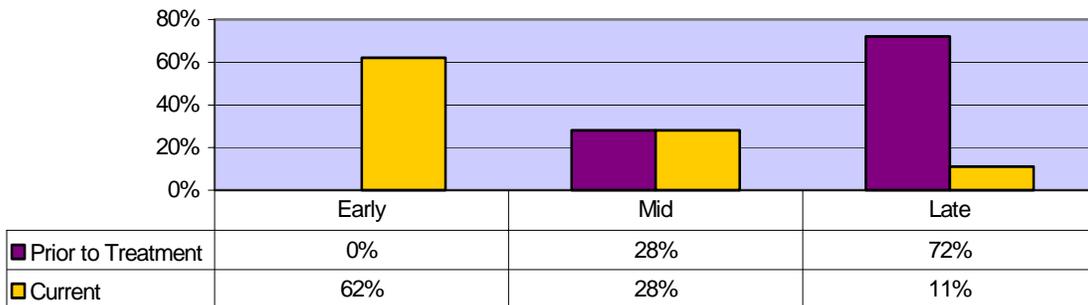


Figure 3. Changes in Forested Seral Conditions in Timber Sale Areas on the Carson National Forest from 1986 to 2000.

In addition, over 254,000 acres of wilderness areas (Wilderness Act 1964), wild and scenic river areas (Wild and Scenic Rivers Act 1968), roadless areas (USDA 1986c, 20. Semi-primitive-2), slopes > 40 percent (USDA 1986c, 5. MC/PP >40% - 2 and Timber - 12) and special management areas (USDA 1986c, 19. Special Areas - 2) on the Carson National Forest that have management direction through the Forest Plan or federal laws that exclude harvesting.

² Late seral stage includes stands that are not old growth.

that some degree of correlation can be made. When populations are increasing, the popularity of the squirrel hunting is likely to be more appealing.

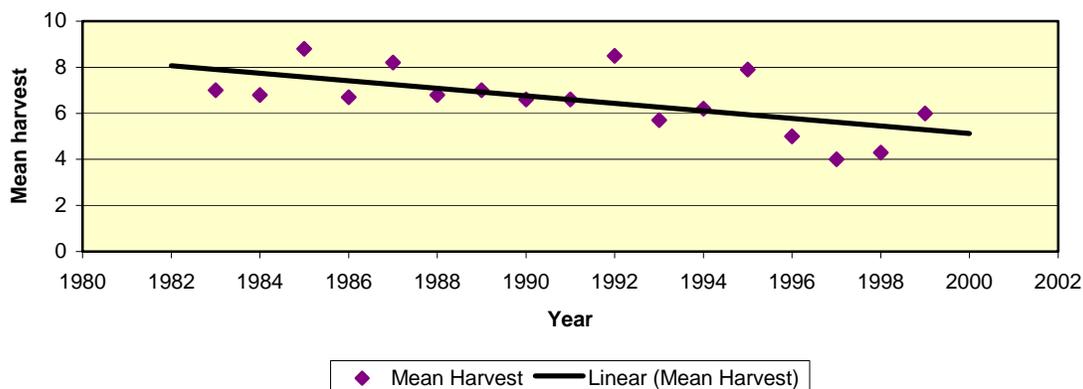


Figure 4. Mean Harvest Red Squirrel for New Mexico (NMDGF 2001)

Many studies, reviewed by Klenner and Krebs (1991), indicated that red squirrel population density varies with cone crops. Rusch and Reeder (1978) reported that summer populations fluctuated between 67 and 151 red squirrels per 2,500 acres in mixed habitats. The number of cones required to sustain a single red squirrel for a year ranges from 42,000 to 131,000, thus 9 to 25 large, mature cone-producing trees per territory are necessary (Smith 1968, Rusch and Reeder 1978, Gurnell 1984, Patton and Vahle 1986). On the Carson National Forest, very few acres of red squirrel habitat (mixed conifer and spruce-fir) have been harvested since 1995 or are planned for future harvest. Thinning and prescribed burning will only improve conditions for growing large, mature cone-producing trees.

Frequent observations and the extensive distribution and abundance of mixed conifer and spruce-fir forest are indicative the species continues to survive and reproduce successfully across the Forest. Ninety-six percent of the squirrel’s habitat on the Forest is not being impacted by management activities.

Red squirrel habitat on the Carson National Forest is in good condition and is in an upward trend. Taking into account the condition and trend of the squirrel’s habitat on the Forest, existing data and field observations, **the Carson is supporting stable populations of red squirrel and viable populations are being sustained.** Older seral stages of trees found throughout the Forest are being maintained and/or increased, improving habitat diversity, as well as old growth, that red squirrels depend on.

The nature of projects over the last decade has generally shifted timber harvest away from overstory and shelterwood final removals to thinning from below and group selections. Future implementation of prescribed burning and thinning will only continue to improve the squirrel’s habitat. Subsequently, implementation of these forest activities would have an insignificant effect on the viability of squirrel populations. Catastrophic wildfire in the mixed conifer would threaten local red squirrel populations; however current emphasis on reducing fuels in mixed will reduce the risk.

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