2012 Breeding Raptor Survey, Bureau of Land Management, Taos Field Office Resource Area Final Report

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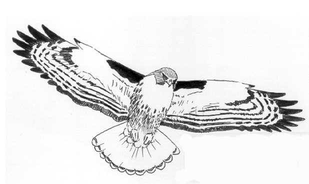

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EXECUTIVE SUMMARY

The Upper Rio Grande Gorge, Rio San Antonio Gorge, and Orilla Verde Recreation Area are important sites for breeding raptors in northern New Mexico and southern Colorado. In 2000, Hawks Aloft, Inc. was contracted to conduct distribution and productivity surveys of breeding raptors in the region. These surveys, although variable in survey area, effort, and species monitored, were continued from 2003 to 2007, 2010 (with a different contractor and protocol), and 2011 to 2012. This report summarizes results from 2012 and provides a review of results from previous survey years. Ten previously undocumented raptor nest sites were discovered, bringing the total number of documented sites to 102. A total of two occupied territories and sixteen active nest sites, representing seven raptor species, were documented in 2012. Of the active sites, reproductive success was determined at ten sites and reproductive failure was determined at five sites. A minimum of 13 chicks were fledged, resulting in an average productivity of 1.33 chicks per site. Productivity was highest for Ferruginous Hawk (1.50, n=2), Prairie Falcon (1.00, n=1) and Peregrine Falcon (1.50, n=2), and lowest for Red-tailed Hawk (0.67, n=3) and Golden Eagle (0.20, n=5). A variety of factors decrease the strength of productivity results for this study, and gauging the validity of inter-year comparisons is difficult. Surveys conducted from 2003-2007 and 2011 were most similar in methodology to 2012, and the number of successful sites in 2012 were similar to the 2003-2007 mean. Productivity at successful nest sites was relatively low in 2012, likely related to the drought conditions during the 2011-2012 water year.

INTRODUCTION

The Upper Rio Grande Gorge, Orilla Verde Recreation Area, and the Rio San Antonio Gorge are important areas for nesting raptors in north-central New Mexico, as well as migration corridors for many other raptor species. This relatively undeveloped area includes an abundance of cliff walls that provide an ideal nesting substrate for many raptor species including Golden Eagle (*Aquila chrysaetos*), Prairie Falcon (*Falco mexicanus*), Peregrine Falcon (*F. peregrinus*), Red-tailed Hawk (*Buteo jamaicensis*), and Great Horned Owl (*Bubo virginianus*). Over the past two decades, recreational use of the Upper Rio Grande Gorge and Orilla Verde Recreation Area has substantially increased. Activities such as boating, fishing, hiking, and cycling can potentially have adverse impacts on nesting raptors (Call 1978, New Mexico Avian Protection Working Group 2005, Watson and Dennis 1992). All raptor species and their nests are protected under the Migratory Bird Treaty Act of 1918. Bald Eagles (*Haliaeetus leucocephalus*) receive further legal protection by the Bald Eagle Protection Act of 1940. In 1962, the act was expanded to the Bald and Golden Eagle Protection Act of 1940, which extended legal protection to include the Golden Eagle (*Aquila chrysaetos*).

Prior to 2000, little information concerning the status of raptors in the Upper Rio Grande Gorge region was available, and official surveys had not occurred since the 1980s. In 2000, the Taos Field Office of the Bureau of Land Management (BLM) contracted Hawks Aloft, Inc. to conduct a survey of the breeding raptor population in the Upper Rio Grande Gorge. In 2003, this work was extended to include the Orilla Verde Recreation Area and the Rio San Antonio Gorge, and these surveys were continued through 2007. In 2009, only Golden Eagle sites in the Upper Rio Grande Gorge were monitored. Full surveys were reinstated in 2010, but were not conducted by Hawks Aloft, Inc., and a different protocol was followed. For the first time since 2007, Hawks Aloft conducted surveys for all raptor species in the full survey area in 2011 and continued full surveys in 2012. The primary purpose of this project is to document raptor distribution, productivity, and population trends in the project area in order to assist the BLM in the development of management decisions that may impact raptor populations. This report documents the results of 2012 breeding raptor surveys and also summarizes findings from past survey years.

STUDY AREA

Surveys were conducted in three areas in northern New Mexico and southern Colorado: the Upper Rio Grande Gorge, the Rio San Antonio Gorge, and the Orilla Verde Recreation Area (Figure 1). These sites occur in Taos and Rio Arriba counties, New Mexico, and in Conejos and Costilla counties, Colorado.

The Upper Rio Grande Gorge survey area covers approximately 66 kilometers of river from the John Dunn Bridge in New Mexico to the Lobatos Bridge in southern Colorado. The John Dunn Bridge is located approximately four kilometers west of the town of Arroyo Hondo, and the Lobatos Bridge crosses the Rio Grande approximately 13 kilometers north of the Colorado-New Mexico border. The Rio Grande begins to cut into the layered basalt of the Taos Plateau just south of the Lobatos Bridge where the Upper Gorge technically begins. The gorge is approximately 60 meters wide and 45 meters deep at the New Mexico-Colorado border. The gorge meanders south and gradually widens and deepens, reaching its maximum size at the Wild Rivers Area where it is approximately one kilometer across and 250 meters deep. Continuing south, the canyon narrows and becomes shallower again; at the John Dunn Bridge it is approximately 0.4 kilometers wide and 100 meters deep.

The Taos Plateau is flanked by the alluvial fans of the Sangre de Cristo Mountains to the east, and the Tusas Mountains to the west. The plateau is dotted with numerous cinder cones and a few widely scattered, large shield volcanoes. The elevation of the Taos Plateau along the canyon rim ranges from 2,072 meters at the John Dunn Bridge to about 2,316 meters in southern Colorado. Habitat on the Taos Plateau can be generally categorized as Great Basin desert shrub with big sagebrush (*Artemisia tridentata*) as the major shrub component. From the John Dunn Bridge north through the Wild Rivers Area, the east rim of the gorge is predominantly pinyon-juniper woodland, containing Colorado pinyon pine (*Pinus edulis*) and juniper (*Juniperus sp*.). Some of the larger side canyons contain mixed conifer woodland with ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*). The west rim is primarily juniper savanna and shrub/grassland habitat, with pinyon-juniper woodland becoming dominant along the Wild Rivers Area. Both the east and west rim from Sheep Crossing north to the Lobatos Bridge are mainly shrub/grassland and sparse shrub/grassland with scattered areas of juniper savanna. The bottom of the Rio Grande Gorge consists of riparian woodland, with areas of mixed conifer woodland occurring mainly in the southern portion of the survey area north through the Wild Rivers Area. This reach of the Rio Grande Gorge has large, widely scattered mature ponderosa pines along the canyon bottom in close proximity to the river. North of the Wild Rivers Area the canyon bottom narrows and few trees are found in this portion of the survey area.

The Orilla Verde Recreation Area begins just north of the town of Pilar, New Mexico and follows the Rio Grande north for approximately 10 kilometers to the point where county road No. 570 climbs to the west rim of the gorge. Riparian habitat here is relatively consistent with the upper gorge area. The east and west rims are also characterized as Great Basin desert shrub. The elevation ranges from 1,830 meters on the canyon bottom to 2,073 meters at the canyon rim. The width of the canyon is about one kilometer at the north end and widens to over a kilometer near Pilar.

The Rio San Antonio Gorge is located approximately 35 kilometers north of the town of Tres Piedras, New Mexico and five kilometers west of Highway 285. The headwaters of the Rio San Antonio originate approximately 25 kilometers west of San Antonio Mountain at the boundary line of the Tierra Amarilla Land Grant and the Carson National Forest. The study area covers approximately 10 kilometers of the Rio San Antonio Gorge, from just south of the town of Ortiz, Colorado, south to the northwestern flank of San Antonio Mountain (3,325 meters), one of several large shield volcanoes that rise above the Taos Plateau. The Rio San Antonio Gorge has been cut through the basaltic rock of the Taos Plateau, with the canyon depth ranging from approximately 15 meters to 46 meters, and its width ranging from approximately 75 meters to 150 meters. At the canyon rim, the elevation ranges from 2,438 meters at the northern end to 2,621 meters at the southern end. The Rio San Antonio Gorge is very similar in structure and associated habitats to the Rio Grande Gorge, with basalt canyon walls and vegetation characteristic of an inverted ecosystem.

METHODS

Surveys were conducted on foot and by vehicle using existing roads and tracks. Areas that had previously documented raptor nests and territories were visited first; additional areas were searched for undocumented sites as the season progressed. Canyon walls were scanned with binoculars and spotting scopes for active nests and raptor activity. In order to adequately cover the survey area, attempts were made to search each canyon wall for signs of raptor presence. In areas with easy access, this could be accomplished by scanning both sides from the canyon bottom, but in most areas, it was necessary to search visible cliff faces from the canyon rims. Where possible, surveys occurred on both canyon rims, but in several areas, such as the northern half of the upper Rio Grande Gorge and the Rio San Antonio Gorge, accessing one side of the canyon (in these instances, the west side) was difficult and time consuming due to the poor condition of the existing roads. As a result, some sections of the survey area were surveyed only from one side and coverage was less than ideal.

When undocumented nest sites were found, coordinates of the site or vantage point were recorded with GPS units, and information on nest type, substrate, height, and habitat were recorded. During all visits, species attendance, number and development stage of chicks, and behavioral data were collected and catalogued on field data forms. Active raptor nests were viewed from a distance of more than 100 yards to avoid disturbance to the nest (Fuller and Mosher 1987) and were monitored for a minimum of 15 minutes to accurately determine nesting status. All active nests were visited a minimum of three times throughout the breeding season. Visiting sites more often results in better estimates of productivity, and effort was made to visit active sites as often as resources allowed.

Nest status was determined to be "active" (occupied by a breeding pair) if an adult was observed in the incubating position, or nestlings were observed in the nest. Nest sites were considered to be "occupied territories" if adult or sub-adult birds were observed near the nest and/or displayed territorial behavior, and no evidence of breeding was observed. All nests determined to be active during the incubation or brooding periods received a minimum of two additional visits to determine the number of nestlings and the number of young fledged. Young still in the nest were considered fledged if they were 90% feathered and estimated to be within 1-2 weeks of leaving the nest. Active sites where chick fates could not be determined were assigned "unknown" productivity statuses. Nest sites were considered "failed" if an adult was observed in the incubating position and/or nestlings (estimated fledge date greater than 30 days) were visible during an initial visit, but no sign of adults or nesting activity could be detected during two subsequent visits with a minimum of 25 days spaced between visits. Nest success is calculated as the number of sites that fledge at least one chick divided by the number of sites with known fates, and productivity is calculated as the number of fledglings divided by the number of nests with known fate. The period of nest monitoring is not factored into success calculations (see Discussion).

RESULTS

Overview of Documented Sites

Ten previously undocumented raptor nest sites were discovered in 2012, bringing the total number of documented sites in the study area since 2000 to 102. This number includes sites with multiple proximate stick nests that were judged to be alternate nests for a single raptor pair. Of the 102 sites, two represent stick nests located outside of the primary gorges (a decrease from 5 stick nests reported in 2011); these sites include one Ferruginous Hawk (*Bueto regalis*) nest and one American Kestrel (*Falco sparverius*). Although not located in the focus survey area, these nests are situated along routes used to access other gorge sites and were included because of the ease with which they could be monitored.

Results of 2012 Surveys

Surveys for the 2012 survey season were initiated 12 March on and continued through 7 July with a total of 19 survey days. A total of two occupied territories and twenty active nest sites, representing seven raptor species, were documented in 2012 (Table 1). Reproductive success was determined at 15 of 16 active sites. Of the sixteen sites, five failed and ten sites with known fates were successful, fledging a minimum of thirteen nestlings, resulting in an average productivity of 1.30 chicks per site. Productivity was highest for Ferruginous Hawk (1.50, n=2), Prairie Falcon (1.00, n=1) and Peregrine Falcon (1.00, n=2), and lowest for Red-tailed Hawk (0.67, n=3) and Golden Eagle (0.20, n=5).

Overview of Results from All Survey Years

Of the 102 sites that have been identified since 2000, 29 have not been active or occupied during survey years. Four sites have never been active, but were designated as occupied territories on at least one occasion. Of the remaining 69 sites that have been active during at least one survey year, 31 were active during only one year, 14 during two years, seven during three years, seven during four years, five during five years, two during six years, one during seven years, one during eight years, and one during nine years. Of these, 14 were considered unknown fates (e.g. reproductive status could not be determined), 27 were determined to have failed, and 128 were considered successful. This results in an overall nest success rate of 0.83 for the survey area.

Productivity parameters for all raptor species by year are presented in Figure 2 and Table 2. Because monitoring period, effort, survey area, and protocol have varied among years, inter-year comparisons of productivity are difficult. For years when all raptor species were monitored, the number of active nests has ranged from 11-25 with a mean of 18.6. During this period, nest success has ranged from 0.67 to 1.00, with a mean of 0.83. Because the monitoring period, area surveyed and protocol followed were fairly constant, the years 2003- 2007 are most useful for inter-year comparisons. Total nest success rates were consistent during the 2003-2007 period. From 2003 to 2005 the number of occupied territories decreased while the number of active sites increased; the number of successful and failed sites remained fairly consistent for the following two years (2006 and 2007). Comparisons of productivity between recent survey years and the 2003 to 2007 period are not valid because of late start dates (2010 and 2011), insufficient survey effort and weak protocol adherence (2010), and different focal species and survey area (2009). Effort, survey area, species surveyed, and protocol adherence during the 2012 survey year matched the 2003 to 2007 period.

Results by Species

For all survey years, breeding attempts in the survey area have been documented for seven raptor species. Reported activity and productivity statuses by species during all survey years are presented in Table 3. The highest numbers of active nests were documented for Golden Eagle (54) and Red-tailed Hawk (47). Although these findings indicate that Golden Eagle is the most common breeding raptor in the study site, it should be noted that only sites utilized by this species were monitored in 2009; if data from that year were removed the number of Red-tailed Hawk sites is similar to Golden Eagle sites (47 vs. 51). Slightly less numerous over the survey period were Prairie Falcon sites (39), followed by Peregrine Falcon sites (13) and Great Horned Owl sites (5). Only three active nests sites have been documented for American Kestrel. Ferruginous Hawk sites were monitored in 2007 and 2011-2012 and, although reported during these years, the nests were located outside of the survey area. Because ideal Ferruginous Hawk nesting habitat is located on grasslands adjacent to but not within the gorges where surveys are concentrated, it is likely that the species was excluded from monitoring during many survey years and more nests were likely present than the three sites (although never active, site 71 is a nest characteristic of the species) that were monitored during 2007 and 2011-2012.

For species with at least ten site-years where fate was determined, nest success has been highest for Prairie Falcon (0.89) and slightly lower for Red Tailed Hawk (0.83) followed by Golden Eagle (0.79). For species with higher sample sizes, the ratio of occupied territories to active nest sites is higher for Prairie Falcon (0.33) and Peregrine Falcon (0.23) and lower for Golden Eagle (0.20) and Red-tailed Hawk (0.15). The number of active nest sites by species and year are presented in Table 4 and Figure 3, and the number of occupied territories by species and year are presented in Table 5 and Figure 4. Differences among years in survey area, protocol, and species monitored make comparisons difficult, but in several cases, years with higher numbers of active sites (relative to other years with similar survey effort) show lower numbers of occupied territories during the same year. Table 6 and Figure 5 present the cumulative number of occupied territories and active nest sites by species and year. The summation of these parameters provides an estimate of the total number of raptor sites with attending individuals each year.

Results by Survey Area

For all survey years, productivity parameters for the Upper Rio Grande Gorge, Orilla Verde Recreation Area, and the Rio San Antonio Gorge are presented in Table 7. Eighty-one percent of documented occupied territories and 76% of active sites occurred in the much larger Upper Rio Grande Gorge section of the study site. Nest success was highest in the Rio San Antonio Gorge (0.96) followed by Orilla Verde (0.91) and was lowest in the Upper Rio Grande Gorge area (0.79).

DISCUSSION

Factors Affecting Survey Findings

Determining reproductive success in breeding raptors is dependent on accurately estimating the fledging success of chicks. Intensive monitoring allows observers to better estimate early stage chronological events (i.e. laying and hatching dates), which can assist with the timing of future visits to maximize the probability of determining nest success. For example, if the hatch date at a nest is accurately determined, the fledge date can be estimated by adding the average chick-rearing period for the species to the hatch date. This allows observers to time their final monitoring visit to within a few days of the expected fledge date. If fully feathered chicks are visible during this visit, the probability of a successful fledge is high. However, if an early stage chronology date is not estimated accurately, the timing of later visits is more difficult and observers may find an empty nest where it is impossible to determine with confidence whether the chick fledged or died. These unknown fates lower the sample size of sites used in success analyses, and can lead to an underestimation of nest failure. The number of unknown fates reported from this project is low; yet, in many years, the monitoring schedule involved a limited number of visits. This indicates that observers may have tended to categorize sites as failed or successful without adequate evidence.

Perhaps most significantly, the time span of monitoring is important when measuring breeding success. Nest failure is a function of time, where decreased monitoring periods result in a corresponding decrease in observed losses (Mayfield 1961, Ricklefs 1969). For this reason, the success of each development stage (i.e. laying, hatching, fledging) should not be calculated for sites where the previous stage was not observed. For example, sites discovered with chicks already present should not be used in estimating fledging success because if that site was empty at the time of discovery, there would be no way of knowing whether a nesting attempt occurred. Moreover, the span of nest observation has not been factored into calculations of success for this project, and reported rates are likely higher than true outcomes.

Results from this study reliably document the species composition and distribution of breeding raptors in the study area. However, for reasons discussed above, productivity results are less reliable, and inter-year comparisons should be viewed with these factors in mind. In summary, it should be stressed that:

- Productivity parameters are likely inaccurate when sites were not visited with adequate effort during the appropriate periods. Gauging monitoring adequacy for past years is difficult and, therefore, the validity of inter-year comparisons is difficult to gauge. Modifying survey protocol to ensure adequate monitoring effort, however, would require resources that are unlikely to become allocated to this project.
- Numbers of successful sites may be inflated because of the tendency of observers to overestimate the age of nestlings. Even if nestling age is accurately estimated, chicks that are at least 90% feathered could remain at the nest site for one to two weeks (depending on species) before fledging. Although the probability of successful fledging increases with development, the possibility of chick mortality remains. For sites where fledglings are not observed and success is based on nestling stage before disappearance (which is the case for the majority of site-years), results should be viewed as the maximum possible number of successful sites.
- On many occasions during the course of this project, fledglings were observed and considered associated with sites where nestlings were not previously detected. Assuming that the fledglings were attributed to the correct nest site, these birds should be included

in the overall count of successful sites. However, because they represent sites that did not have a chance to fail (because they were not discovered until already successful), they should not realistically be included in measurements of nest success or productivity. When estimating the success rate of a development stage (i.e. laying, hatching, fledging), sites discovered after the earliest evidence of that chronology event should be excluded from analysis. True measures of nest success and productivity should only be calculated for sites that were monitored from the egg laying period until the conclusion, but this has not been the case for this study, and all reported success rates should be viewed as maximums that could be much higher than the true rates for raptors in the study area.

Discussion of Survey Results

Although the number and quality of nesting sites may limit the number of raptors that breed in the survey area, the abundance of cliff faces leads us to believe that other factors are likely more important in influencing the number and success of breeding raptors. Prey abundance and weather are often the most significant factors affecting raptor-breeding success (Steenhof et al. 1997, Smith and Murphy 1979, Bates and Moretti 1994). Jackrabbits (*Lepus* spp.), cottontails (*Sylvilagus* spp.), ground squirrels (*Spermophilus* spp.), and possibly prairie dogs (*Cynomys* spp.) likely comprise the vast majority of the prey taken during the breeding season by the three most common raptor species (Golden Eagle, Red-tailed Hawk, Prairie Falcon) in the survey area. Black-tailed jackrabbits (*L. californicus*) and cottontails have been documented as the primary prey species for Golden Eagles in Great Basin Desert Shrub habitats (Kochert et al. 2002). At the eagle nest sites we have been able to access and visually inspect during previous years, we have found cottontail rabbits to be the only identifiable prey. For Red-tailed Hawks, Gatto et al.

(2005) reported that *Sylvilagus* rabbits were the most common prey item taken on the Kaibab Plateau, Arizona, and Smith and Murphy (1973) reported that jackrabbits were nearly the exclusive prey item taken in the Great Basin Desert region of Utah. Ground squirrels are the dominant prey item taken by Prairie Falcons during the breeding season throughout most of their range (Steenhof 1998). All of these mammals appear numerous in the survey area, but likely vary in abundance among years. Future study of small mammal populations would likely lead to a better understanding of the factors affecting raptor abundance and breeding success in the survey area.

Raptor productivity in 2012 may have been impacted by the drought conditions that prevailed throughout the breeding season and previous winter. According to the National Oceanographic and Atmospheric Administration (NOAA) weather service, the water year (October 2011 to September 2012), which encompassed the 2012 raptor breeding season, was the 23rd driest on record. The precipitation average for the state was 77% of normal, and rates in the survey area ranged between 40-120% of normal. While the state experienced more precipitation during the 2012 water year than 2011 water year, the last two water years combined (October 2010 through September 2012) were the driest consecutive water years on record for New Mexico according to the NOAA National Climatic Data Center (NCDC). The prolonged drought may have lasting effects on nesting success of raptors. Reproductive success of many diurnal raptor species is closely tied to the abundance of prey (Smith and Murphy 1979, Smith et al. 1981, Korpimäki 1984). Weather, particularly precipitation, can directly affect nesting success of some birds of prey (Olsen and Olsen 1989, Kostrzewa and Kostrzewa 1990, 1991), and indirectly affect success by interacting with prey availability (Steenhof et al. 1997). Drought conditions may result in reduced plant growth, which can reduce populations of raptor prey species (Newton 1979, Olsen and Olsen 1989).

The lack of survey standardization among years creates difficulties with inter-year productivity comparisons. The strongest component of this project is the multi-year dataset that tracks the distribution and species composition of breeding raptors in the survey area. Additionally, for years with early start dates (2000, 2003-2007, 2012), the total number of active sites and occupied territories provides strong population estimates for raptor species utilizing the survey area. Limited survey effort may cause confusion when categorizing sites as active or occupied territories; for purposes of tracking population changes, the summation of the two classifications (referred to here as “total sites”), as presented in Table 6 and Figure 5, may provide the strongest means of inter-year comparison. During this period, two of the three most common species, Red-tailed Hawk and Prairie Falcon, show a drop in total sites and active sites from 2000 to 2003 (despite the increased survey area in the latter year) followed by an increase or stabilization between subsequent years. This trend correlates with precipitation levels during the period. Weather stations in Cerro and Tres Piedras, New Mexico, which are located close to the eastern and western edges of the study area, reported especially low precipitation in 2002, followed by an increase to near normal levels in the following years. The drop in active and total raptor sites from 2000 to 2003, followed by a gradual increase as precipitation levels returned to normal, is likely linked to this climatic trend. The lower number of sites in 2011 and 2012 compared to the previous post-drought period (2005-2007) may be largely attributable to the extreme drought conditions. The relatively high number of successful sites in 2012, however, does not support this explanation. While drought conditions may reduce the density of available prey in the area it also likely reduces the percent and height of vegetation coverage (Steenhof et al. 1999). The high number of successful sites in 2012 may be linked to increased foraging efficiency associated with short and sparse vegetation coverage making prey more accessible.

The higher rate of occupied territories to active sites noted for the two large falcon species compared to Red-tailed Hawk and Golden Eagle for all survey years could be due to the location of the nests. Because falcons do not build nests, but use scrapes in horizontal slots on the canyon walls, unlike the stick nests of hawks and eagles, often are impossible to verify when birds are not present. The observer may not determine the exact location of the nest, thus the area is considered an active territory but may actually be an active nest site.

All raptor species are susceptible to human disturbance during the breeding season, but of the species that breed in the study area, Golden Eagle and Ferruginous Hawk are likely the most sensitive. This sensitivity is most pronounced during the incubation and early nestling periods when the potential for nest abandonment is the highest (Fyfe and Olendorff 1976, Watson and Dennis 1992, Olendorff 1993). Human activity that occurs in close proximity to active nest sites has the potential to adversely affect nest success. The Golden Eagle nest sites that are potentially the most susceptible to human disturbance (e.g. low cliff height, close proximity to river, roads, and trails, narrow gorge width) are sites 8-13, 17, 18, 22, 43, 51, and 52. Ferruginous Hawk nests, which are often highly visible because of their large size and location in isolated junipers, also are at risk of disturbance. This may be especially true at site 61, which is located less than 200 yards from Highway 285 and is visible from the road. If recreational use of the study area continues to increase, the need for effective nest protection measures during the breeding season will become more critical.

The number of active Golden Eagle sites has varied among survey years (from 3 to 9), but average annual productivity was reported as at least 1.0 for all survey years since 2004;

however in 2012, Golden Eagle productivity departed from the long-term average. In 2012, Golden Eagle productivity was significantly lower (0.20) than in previous years which reduced the average across all years to 0.79. In 2012, we documented five active Golden Eagle nest sites with clear evidence of nest starts but four of the five nests failed during the survey season. Numerous factors could be driving the increased number of nest failures among Golden Eagles in the study area; however, the prolonged drought is likely the most significant driver. Lack of precipitation can directly affect the nesting success of many raptor (Olsen and Olsen 1989, Kostrzewa and Kostrzewa 1990, 1991) and Golden Eagles seem to be particularly sensitive to drought conditions (Bahat and Mendelssohn 1996). A long-term study of breeding pairs of Golden Eagles in the Israeli deserts (Judean and Negev) indicated that rainfall during the year prior to the current nesting year was the most significant climatic factor that affects the total number of Golden Eagle fledglings (Bahat and Mendelssohn 1996). It is likely that drought reduces prey densities, which could be a physiological stressor to female Golden Eagles potentially resulting in fewer eggs laid and/or a higher rate of nest failures (Bahat and Mendelssohn 1996).

Average nest success for Red-tailed Hawks in the survey area is lower than the productivity rate in 2011 (0.67 vs. 1.25); however, in 2011 no nest failures were documented which could inflate the productivity estimate for 2011. Although nesting success is relatively high compared to other nesting species, there is evidence that the breeding Red-tailed Hawk population in the study area has declined. A one-year study in the Upper Rio Grande Gorge by Ponton (1980) documented 12 active Red-tailed Hawk nests. Since Hawks Aloft began monitoring in 2000, the number of active Red-tailed Hawk nests documented in that section of the survey area has ranged from three to seven. Although our knowledge of populations prior to

2000 is based on only one survey year, it seems possible that fewer Red-tailed Hawks have nested in the Upper Rio Grande Gorge during the past decade than during earlier periods.

Productivity rates for Prairie Falcons have noticeably decreased since 2011. Overall, the number of active sites and occupied territories has ranged from four to seven during survey years; however, in 2012 we documented only one active site and one occupied territory. At the Snake River Birds of Prey Area (SRBPA) near Boise, Idaho, the amount of cliff area present per 10 km stretch of survey route explained 91% of the variation in nesting density (Steenhof et al. 1999). This suggests that the number of breeding Prairie Falcons is limited by the availability of nest sites. Because the Rio Grande Gorge has a similar cliff structure and surrounding habitat to that of the SRBPA, we initially expected to find a similar correlation in nesting density relative to the amount of cliff area. However, on the upper Rio Grande Gorge, Prairie Falcons nest in higher densities in the northern portion of the survey area (over 80% of sites are located in the Rio San Antonio Gorge and northern quarter of the Upper Rio Grande Gorge), where the cliff area is substantially lower than in the southern portion. Overall, the Upper Rio Grande Gorge appears to contain a myriad of potential nest sites. Many of these sites showed signs of previous use, such as thick accumulations of old whitewash indicating that these sites were once heavily used, and that the Prairie Falcon populations may have been larger in the past. We believe that nesting Prairie Falcons in the Rio Grande Gorge are most likely limited by prey availability, and not by a lack of suitable nest sites. Average productivity in the survey area, when including 2012 productivity rates, appears to be lower than the median replacement standard of 2.0 calculated by Runde (1987) as necessary for population maintenance.

Among species with at least ten site-years of known fates, nest success is lowest for Peregrine Falcons. Since 2000, we have documented a total of thirteen breeding attempts by the species, resulting in an average nest success rate of 0.62. Prior to 2012, nest success was reported at 0.37 and productivity at 0.63. The multi-year productivity rate certainly falls below the estimated recruitment standard of at least 1.45 young per nest site required to maintain a stable population (Johnson 1999). Although the much lower breeding success of Peregrine Falcons compared to Golden Eagles, Red-tailed Hawks, and Prairie Falcons could be influenced by many factors, it seems likely that diet is the most significant. Peregrine Falcons prey primarily on birds, while the other three most common raptor species prey primarily on small and medium-sized mammals. Investigations of Peregrine Falcon prey items and populations in the survey area merit further study.

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Table 1: Productivity parameters by species for 2012, BLM Taos raptor survey area. Productivity is the number of chicks fledged divided by the number of sites with known fates.

Species	Occupied Territory	Active	Known Fate	Failed	Successful	Fledged	Productivity
American Kestrel	1	1	0	0	0	0	0.00
Ferruginous Hawk	0	2	2	0	2	3	1.50
Golden Eagle	0	5	5	4	1	1	0.20
Great Horned Owl	0	2	2	0	2	3	1.50
Peregrine Falcon	0	2	2	0	2	2	1.00
Prairie Falcon	1	1	1	0	1	1	1.00
Red-tailed Hawk	1	3	3	1	2	2	0.67
Total	2	16	15	5	10	13	0.87

Table 2: Productivity parameters for all raptor species by year, BLM Taos raptor survey area. Nest success is the number of nests that fledged at least one chick (e.g., successful) divided by the number of sites with known fates.

Year	Start	Occupied Territory	Active	Known Fate	Successful	Failed	Nest Success
2012	12-Mar	3	19	17	12	5	0.71
2011	1-Jun	2	17	16	16	0	1.00
2010[1]	15-Jun	4	11	5	5	0	1.00
2009[2]	24-Apr	3	3	3	2	1	0.67
2007	15-Mar	2	25	22	18	4	0.82
2006	12-Mar	6	21	21	17	4	0.81
2005	24-Mar	4	24	24	18	6	0.75
2004	19-Mar	5	18	17	14	3	0.82
2003	28-Mar	6	13	12	8	4	0.67
2000[3]	24-Mar	2	18	18	18	0	1.00
Total		34	169	155	128	27	0.83

[1] surveys were not conducted by Hawks Aloft, Inc. and different protocol were followed
[2] only Golden Eagle sites in the Upper Rio Grande Gorge were monitored
[3] only the Upper Rio Grande Gorge was surveyed

Table 3: Productivity parameters by species for all survey years, BLM Taos raptor survey area. Nest success is the number of nests that fledged at least one chick (e.g. successful) divided by the number of sites with known fates.

Species	Occupied Territory	Active	Known Fate	Failed	Successful	Nest Success
American Kestrel	2	3	1	0	1	1.00
Ferruginous Hawk	0	4	4	0	4	1.00
Golden Eagle	11	54	52	11	41	0.79
Great Horned Owl	1	5	4	0	4	1.00
Peregrine Falcon	3	13	13	5	8	0.62
Prairie Falcon	13	39	37	4	33	0.89
Red-tailed Hawk	7	47	42	7	35	0.83
Total	37	165	153	27	126	0.82

Table 4: Number of active nest sites reported by species, per year, BLM Taos raptor survey area. The following codes are used: AMKE (American Kestrel), FEHA (Ferruginous Hawk), GOEA (Golden Eagle), GHOW (Great Horned Owl), PEFA (Peregrine Falcon), PRFA (Prairie Falcon), and RTHA (Red-tailed Hawk).

Species	2012	2011[1]	2010[2]	2009[3]	2007	2006	2005	2004	2003	2000[4]
AMKE	1	0	1	-	0	0	0	1	1	0
FEHA	2	1	0	-	1	0	0	0	0	0
GOEA	5	4	3	3	8	8	8	6	3	6
GHOW	2	0	1	-	0	0	2	0	0	0
PEFA	2	2	0	-	2	0	3	2	2	0
PRFA	1	5	2	-	6	6	5	4	3	7
RTHA	3	5	4	-	8	7	6	5	4	5
Total	16	17	11	3	25	21	24	18	13	18

[1] delayed start date likely resulted in a low count of active sites
[2] surveys not conducted by Hawks Aloft and different protocol were followed; delayed start date
[3] only Golden Eagle sites in the Upper Rio Grande Gorge were monitored
[4] only the Upper Rio Grande Gorge was surveyed

Table 5: Number of occupied territories reported by species, per year, BLM Taos raptor survey area. The following codes are used: AMKE (American Kestrel), FEHA (Ferruginous Hawk), GOEA (Golden Eagle), GHOW (Great Horned Owl), PEFA (Peregrine Falcon), PRFA (Prairie Falcon), and RTHA (Red-tailed Hawk).

Species	2012	2011[1]	2010[2]	2009[3]	2007	2006	2005	2004	2003	2000[4]
AMKE	1	0	0	-	0	1	0	0	0	0
FEHA	0	0	0	-	0	0	0	0	0	0
GOEA	0	0	0	3	1	1	0	2	4	1
GHOW	0	0	0	-	0	1	0	0	0	0
PEFA	0	0	1	-	0	1	0	1	0	0
PRFA	1	1	3	-	1	1	2	2	1	0
RTHA	1	1	0	-	0	1	2	0	1	1
Total	3	2	4	3	2	6	4	5	6	2

[1] delayed start date likely resulted in a low count of occupied territories
[2] surveys not conducted by Hawks Aloft and different protocol were followed; delayed start date
[3] only Golden Eagle sites in the Upper Rio Grande Gorge were monitored
[4] only the Upper Rio Grande Gorge was surveyed

Table 6: Total number of occupied territories and active nest sites reported by species, per year, BLM Taos raptor survey area. The following codes are used: AMKE (American Kestrel), FEHA (Ferruginous Hawk), GOEA (Golden Eagle), GHOW (Great Horned Owl), PEFA (Peregrine Falcon), PRFA (Prairie Falcon), and RTHA (Red-tailed Hawk).

Species	2012	2011[1]	2010[2]	2009[3]	2007	2006	2005	2004	2003	2000[4]
AMKE	2	0	1	-	0	1	0	1	1	0
FEHA	2	1	0	-	1	0	0	0	0	0
GOEA	5	4	3	6	9	9	8	8	7	7
GHOW	2	0	1	-	0	1	2	0	0	0
PEFA	2	2	1	-	2	1	3	3	2	0
PRFA	2	6	5	-	7	7	7	6	4	7
RTHA	4	6	4	-	8	8	8	5	5	6
Total	19	19	15	6	27	27	28	23	19	20

[1] delayed start date likely resulted in a low count of active sites and occupied territories
[2] surveys not conducted by Hawks Aloft and different protocol were followed; delayed start date
[3] only Golden Eagle sites in the Upper Rio Grande Gorge were monitored
[4] only the Upper Rio Grande Gorge was surveyed

Table 7: Productivity parameters for all raptor species by survey area for all survey years, BLM Taos raptor survey area. Nest success is the number of nests that fledged at least one chick (e.g. successful) divided by the number of sites with known fates.

Area	Occupied Territory	Active	Known Fate	Failed	Successful	Nest Success
Upper Rio Grande	30	126	117	25	92	0.79
Orilla Verde	3	12	11	1	10	0.91
San Antonio	4	29	27	1	26	0.96
Total	37	167	155	27	128	0.83

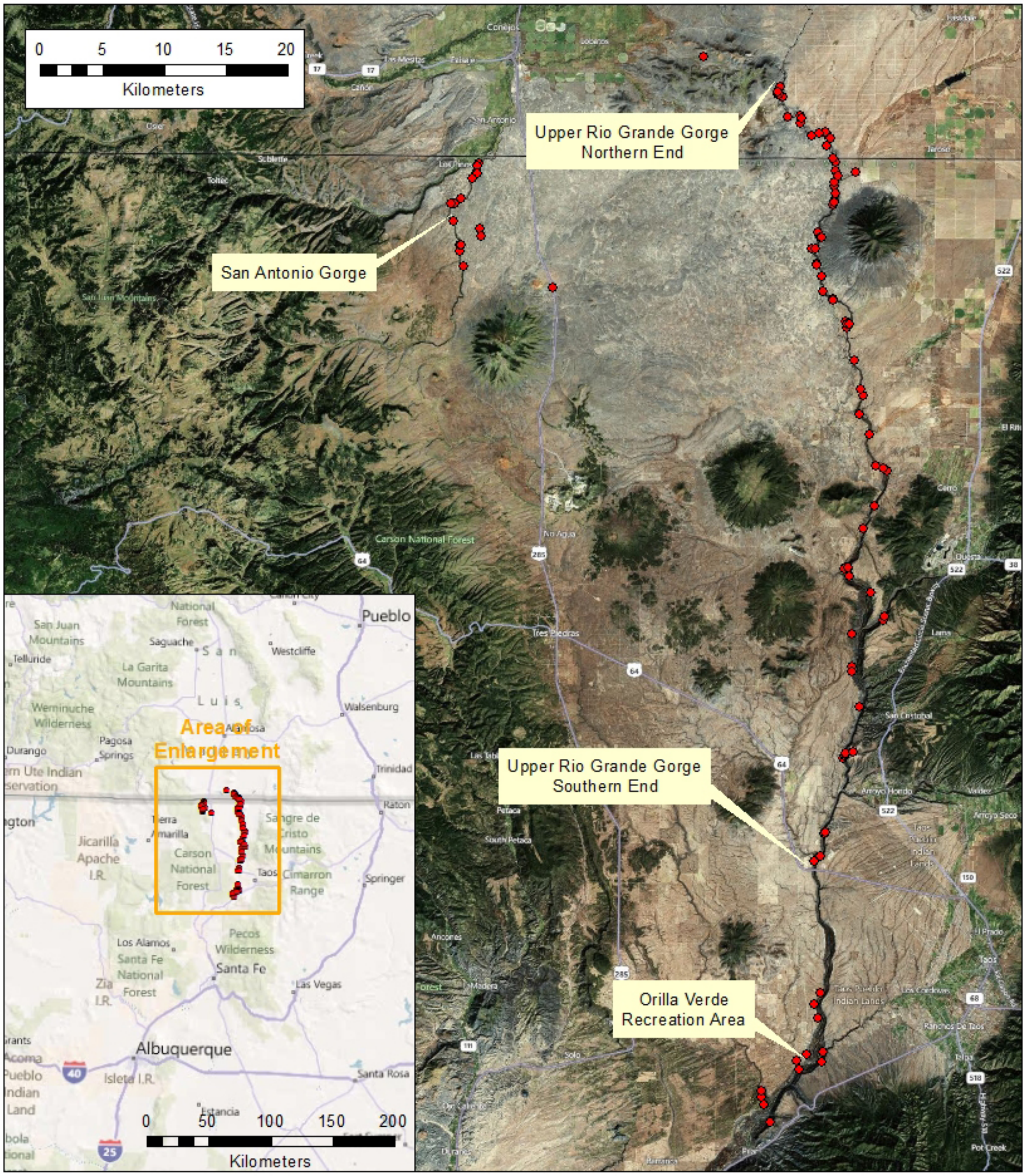

Figure 1: Overview of the 2012 BLM Taos breeding raptor survey area, Taos and Rio Arriba Counties, NM and Costilla and Conejos Counties, CO.

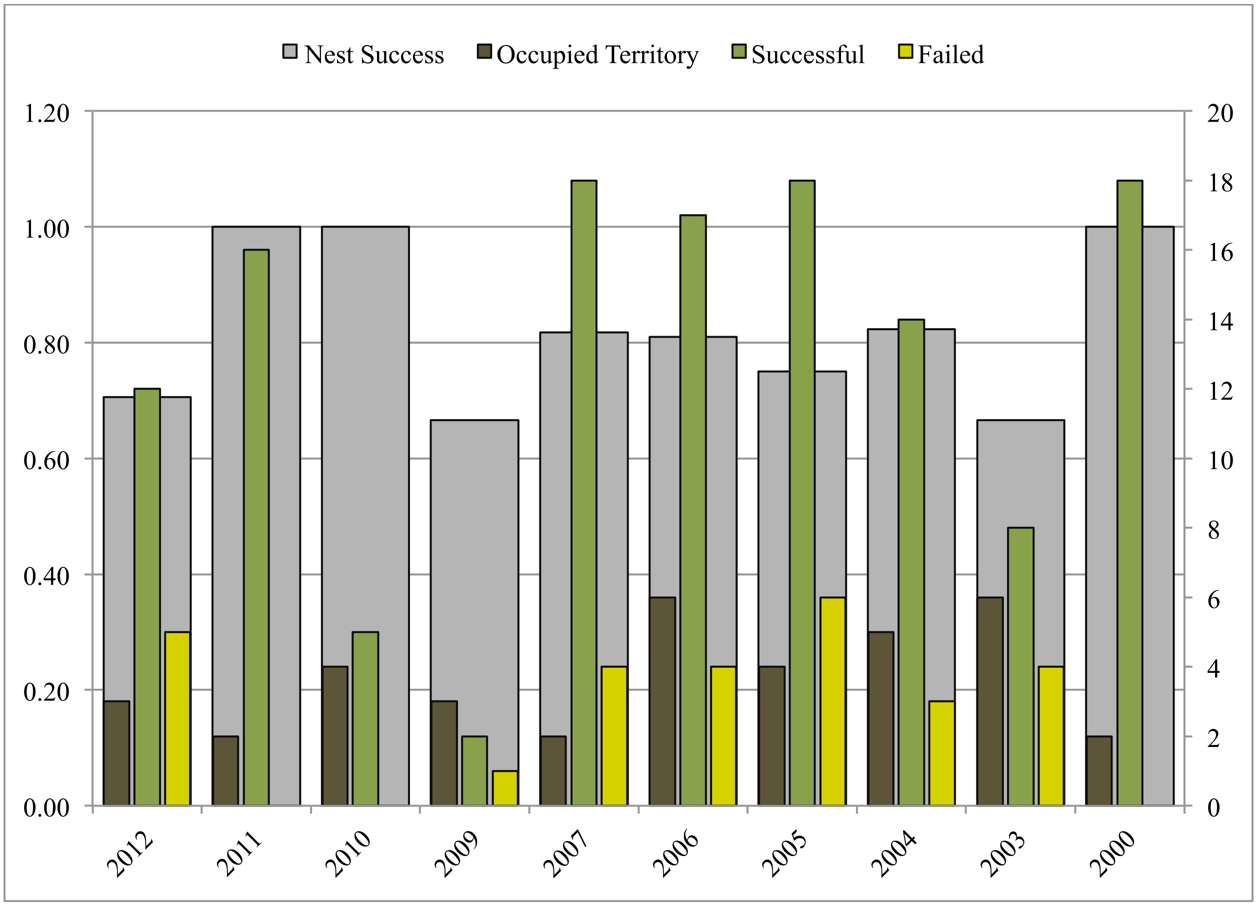

Figure 2: Raptor productivity parameters, by year, BLM Taos raptor study area. The right axis refers to numbers of occupied territories and sites that failed or were successful (fledged at least one chick). The left axis refers to nest success (the number of successful nests divided by the number of nests with known fates. In 2000 and 2009, surveys were not conducted at the Rio San Antonio Gorge or the Orilla Verde Recreation Area; only Golden Eagle sites were monitored in 2009. Late start dates in 2010 and 2011 bias results towards success.

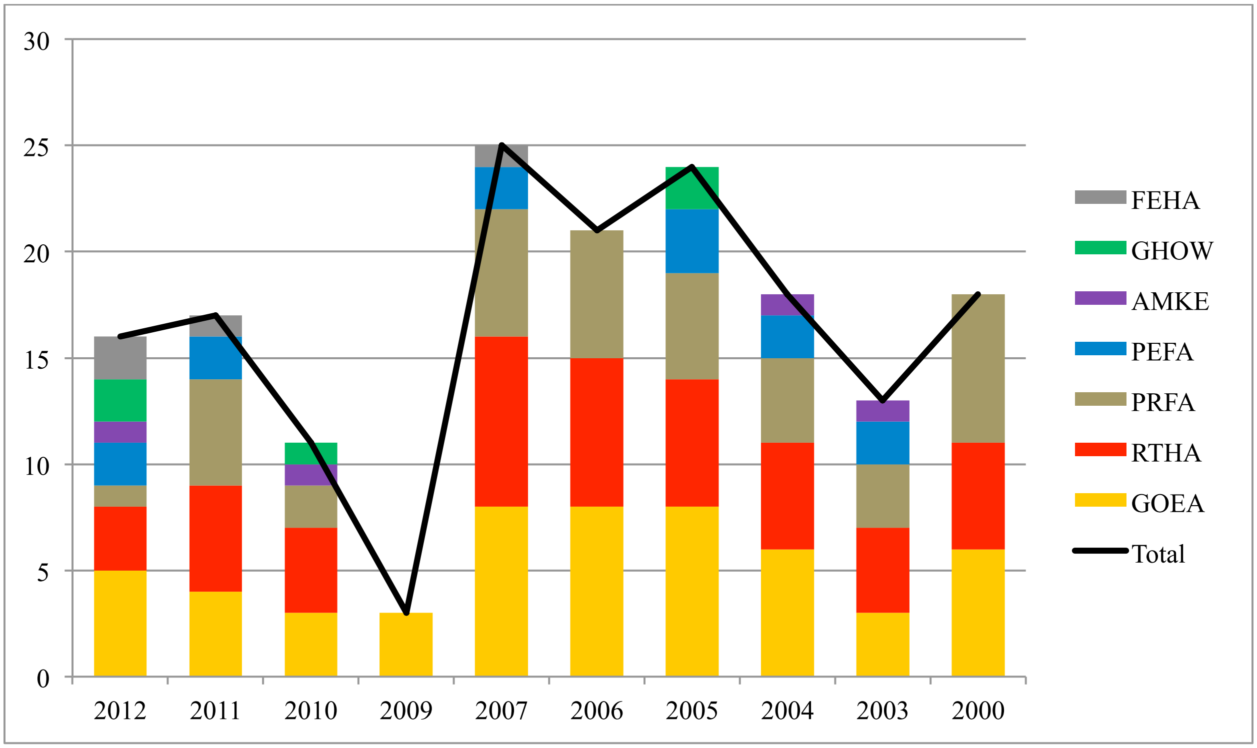

Figure 3: Number of active nest sites reported by species, per year, BLM Taos raptor survey area. The following codes are used: AMKE (American Kestrel), FEHA (Ferruginous Hawk), GOEA (Golden Eagle), GHOW (Great Horned Owl), PEFA (Peregrine Falcon), PRFA (Prairie Falcon), and RTHA (Red-tailed Hawk). Survey area, protocol, and species monitored varied among years.

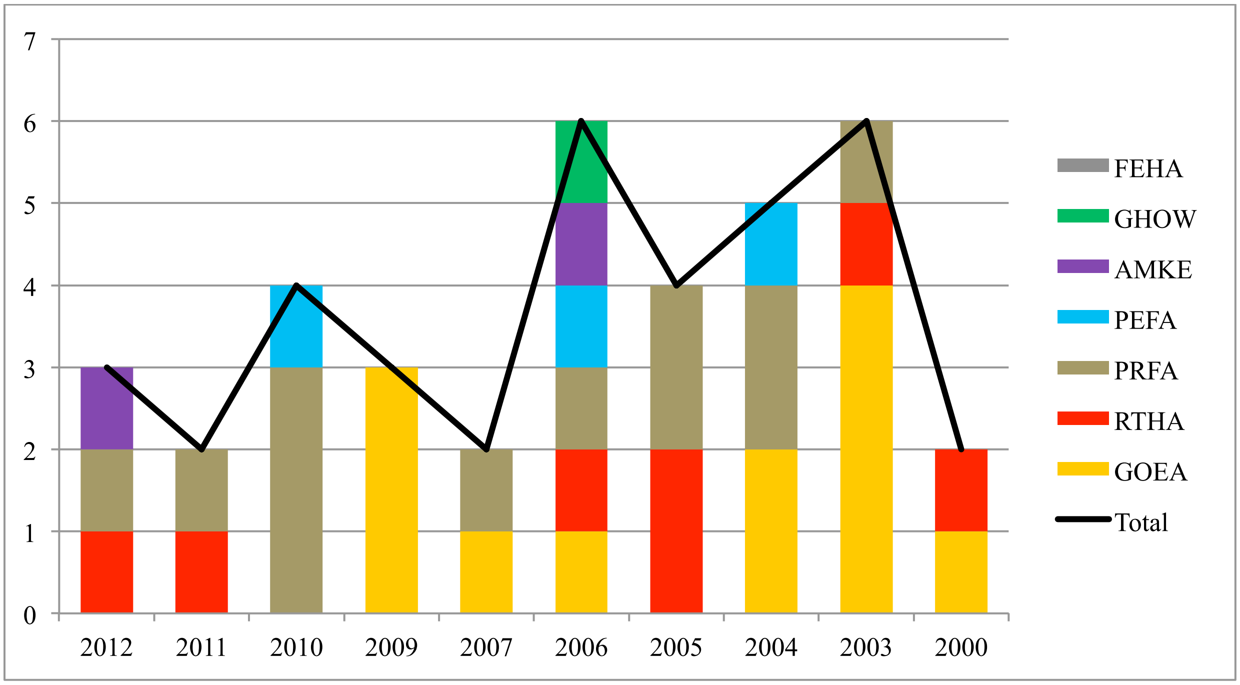

Figure 4: Number of occupied territories reported by species, per year, BLM Taos raptor survey area. The following codes are used: AMKE (American Kestrel), FEHA (Ferruginous Hawk), GOEA (Golden Eagle), GHOW (Great Horned Owl), PEFA (Peregrine Falcon), PRFA (Prairie Falcon), and RTHA (Red-tailed Hawk). Survey area, protocol, and species monitored varied among years.

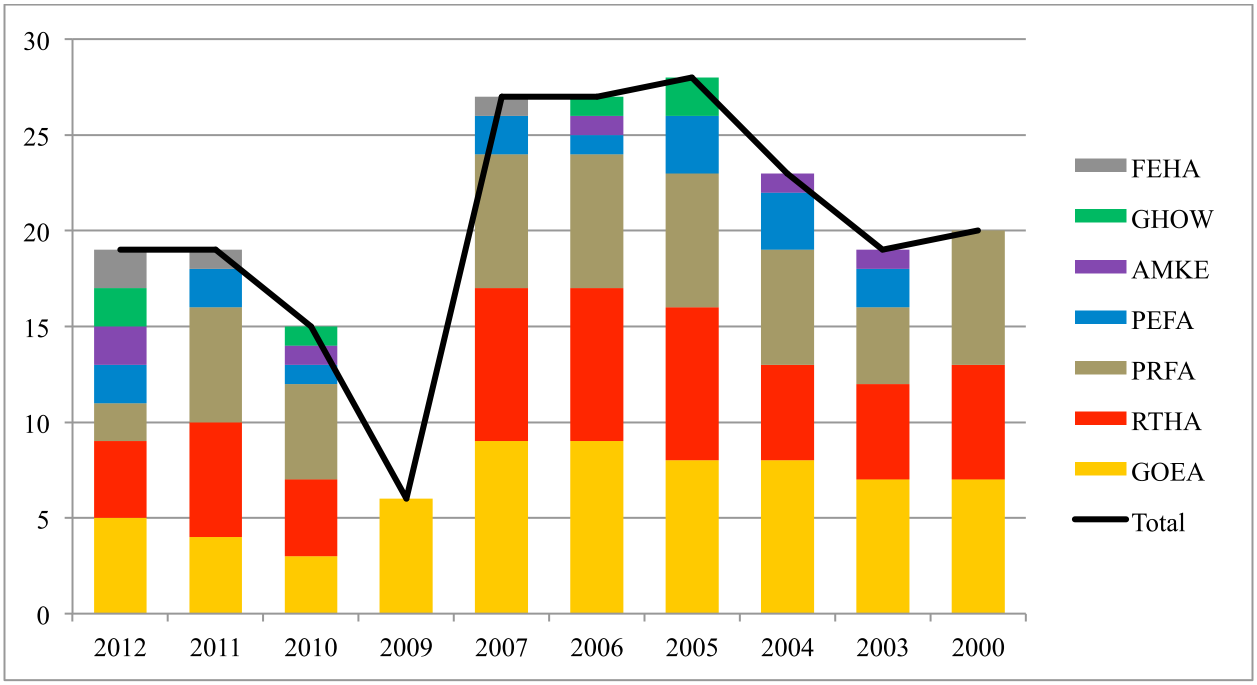

Figure 5: Total number of occupied territories and active nest sites reported by species, per year, BLM Taos raptor survey area. The following codes are used: AMKE (American Kestrel), FEHA (Ferruginous Hawk), GOEA (Golden Eagle), GHOW (Great Horned Owl), PEFA (Peregrine Falcon), PRFA (Prairie Falcon), and RTHA (Red-tailed Hawk). Survey area, protocol, and species monitored varied among years.