GOLDEN EAGLE MONITORING AT CARBON MOUNTAIN:
FINAL SUMMARY REPORT FOR THE 2003-07 BREEDING SEASONS
U.S. BUREAU OF RECLAMATION, WESTERN COLORADO AREA OFFICE
ANIMAS-LA PLATA PROJECT, DURANGO, COLORADO

Prepared for:

U.S. Bureau of Reclamation
Western Colorado Area Office Southern Division
835 East Second Avenue
Durango, CO 81301

Prepared by:

Ecosphere Environmental Services
2243 Main Avenue, Suite 4
Durango, CO 81301

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INTRODUCTION

The Animas–La Plata (ALP) Project is designed to provide water for municipal and industrial uses in the Four Corners region of Colorado and New Mexico (Bureau of Reclamation 1980, 1992, 2000). The U.S. Department of the Interior Bureau of Reclamation (Reclamation) is constructing Ridges Basin Dam and Reservoir, located southwest of Durango, La Plata County, Colorado, as integral components of the ALP Project. Construction activities for the ALP Project began in 2002.

Ridges Basin is directly adjacent to Carbon Mountain, a known nesting site for a pair of golden eagles (*Aquila chrysaetos*). Golden eagles are common throughout the western U.S. and are typically found near open spaces, such as Ridges Basin, that provide hunting habitat. Territories are often adjacent to cliffs, because they provide suitable nesting sites (Andrews and Righter 1992, Kochert et al. 2002). Throughout their range, golden eagles are considered a short- to medium-distance partial migrant; however, many eagles breeding south of 55° N Latitude do not migrate, and pairs maintain territories year-round (Kochert et al. 2002). Pairs often build and maintain more than one nest within their territory, and may switch nest sites from year to year (Kochert et al. 2002). A pair of golden eagles has occupied the Carbon Mountain territory year-round since at least the mid 1990s (Harmata 1996, Harmata and Flath 1997), and there are currently three nests located on the western face of Carbon Mountain.

Golden eagles are protected under federal laws including the Migratory Bird Treaty Act (16 USC 703-71L) and the Bald and Golden Eagle Protection Act (16 USC I.S.C. 668a-668b) of 1940, as amended. The Migratory Bird Treaty Act (MBTA) provides that "it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not." The Bald and Golden Eagle Protection Act (BGEPA) also prohibits, except under certain specified conditions, "the taking, possession and commerce of golden eagles."

During the past five years (2003–2007), Reclamation has contracted Ecosphere Environmental Services (Ecosphere) to monitor the pair of golden eagles at Carbon Mountain during the breeding season. The purpose of these monitoring efforts was to assess the effects, if any, of the ALP Project construction within Ridges Basin on the nesting success of the eagles, and to prevent "take" under the MBTA and BGEPA. The BGEPA defines "take" as any action which would "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb bald or golden eagles (16 U.S.C. 668a-d). "Disturb" is further defined in the federal register to mean any action which agitates or bothers a bald or golden eagle to such a degree that it causes injury, decrease in productivity or nest abandonment (50 C.F.R. 22.3).

The eagles did not nest at any of the three historic nest sites on Carbon Mountain in 2003; however, the female was not seen in the vicinity of Carbon Mountain for approximately 3 months, from mid-March to mid-June (Ecosphere 2003). Ecosphere biologists searched for alternate nest sites, but were unsuccessful. It is unclear whether or not a nest attempt had taken place because the eagles were never observed with fledglings. Between 2004 and 2006 the golden eagles nested in two of the three the historic nest sites on Carbon Mountain and

successfully reared and fledged two young in both 2004 and 2005 and one young in 2006 (Ecosphere 2004, 2005, 2006).

Reclamation again contracted Ecosphere to monitor the pair of golden eagles at Carbon Mountain during the 2007 breeding season. Because the eagles had been successful the previous three years, the level of monitoring effort was scaled back considerably from that of 2003–06. This report primarily provides a summary of golden eagle activities during the 2007 breeding season, but also includes a brief overall discussion of productivity during the last 4 years.

The golden eagle breeding cycle can be divided into several distinct phases including, courtship and nest building, incubation, nestling and fledgling. A summary of activities typically occurring during each of these phases is described below.

COURTSHIP AND NEST BUILDING

Golden eagles perform a variety of behaviors during courtship. Migratory eagles begin pair formation upon return to the breeding grounds in late winter or early spring; however, residents, such as the Carbon Mountain eagles, remain on the nesting territory year-round. Pre-nesting activities consist of territory defense, courtship aerial displays, nest building and/or maintenance, and copulation (Kochert et al. 2002). Male and female golden eagles defend and maintain territory boundaries by exhibiting undulating flight displays or high soaring flight (Harmata 1982, Marzluff et al. 1997, Watson 1997).

During undulating flight, the eagles perform a series of dives and upward swoops, often stalling briefly at the top before plunging downward again (Ellis 1979). Undulating flight may also be associated with courtship behavior (Bahat 1989 in Kochert et al. 2002). Other aerial displays associated with courtship include mutual soaring, circling, chases and dives, mock attacks, and tandem aerial display (rolling and foot touching) (Ross 1941 in Kochert et al. 2002).

Nest building and maintenance may occur year-round by resident eagles; but peak activity is usually between late-January to early-March (Watson 1997). Copulation may also occur year-round, but is most frequent prior to egg-laying (Palmer 1988). Copulation may be followed by courtship aerial displays or extended periods of perching together (Harmata 1982).

INCUBATION

The incubation phase ranges from 41 to 45 days for golden eagles, with an average of 42.4 days (Kochert et al. 2002). The female begins incubation after the first egg is laid (Wheeler 2003); however, females may sit on the nest in the incubation posture before laying (Ellis 1979).

Clutch size normally ranges from 1 to 3 eggs (DeGroot 1928, Ray 1928 and Gordon 1955, all in Kochert et al. 2002), with eggs laid at 3 to 4 day intervals (Wheeler 2003). Females do the majority of the incubating; although, males will relieve females for short bouts to allow them to forage (Collopy 1984). Males may deliver food to incubating females; however, females may be forced to forage if males are inattentive (Collopy 1984).

NESTLING

The nestling phase includes the time from hatching until the young first leave the nest (fledge). The duration of the nestling period varies but may range from 45 to 81 days (USGS unpubl. data in Kochert et al. 2002, Gordon 1955 in Kochert et al. 2002); however, eaglets do not usually achieve self-sustained flight until greater than 64 days of age (Brown and Amadon 1968, Palmer 1988). Hatching is asynchronous (Watson 1997). Eaglets are covered with white downy feathers upon hatching, but will slowly develop into juvenile plumage during the nestling period.

For the first approximately 20 days after hatching, the young are dependent on adults to regulate body temperature; therefore, the parents (usually the female) will spend much of their time brooding and shading the young (Watson 1997). Both the male and female will also bring food to the young in the nest (Ellis 1979, Collopy 1984) and perform nest sanitation.

FLEDGLING

The fledgling phase begins when nestlings first leave the nest and extends until independence, at which time the adults may display territoriality towards their young. Although there have been documented cases of eaglets fledging as early as 45 days (USGS unpublished data in Kochert et al. 2002); on average, young are generally old enough to sustain flight at the time of fledging. In an Idaho study, Collopy (1984) reported that all golden eagle nestlings fledged between 66 and 75 days (n = 10 nests). O'Toole et al. (1999) reported the mean golden eagle fledgling age as 10.1 weeks (71 days) in North Dakota.

Fledglings remain with their parents for 1–6 months after fledging (Kochert et al. 2002). Departure from the nest may include falling, jumping, walking or flying, often followed by an uncontrolled landing (Camenzind 1969 in Kochert et al. 2002). Early-on fledglings are still learning to fly, because of their inexperience and incomplete muscle and feather development. During this time they are still dependent on the adults for food.

Throughout the early fledgling period, the young eagles will spend time perched outside the nest and will make occasional short unsteady flights to nearby perches, sometimes landing on the ground, while they wait for the adults to bring them food. As they learn to fly with more confidence, the juveniles will take longer flights, farther from the nest (O'Toole et al. 1999), often following one or both adults.

Even as the young eagles become stronger and more proficient fliers, they remain in their natal territories while they learn to hunt, sometimes making their initial kill as early as 30 days after fledging (Walker 1987 and Bahat 1992, in Kochert et al. 2002). The adult eagles will remain in relative close proximity of the juveniles, feeding them and guarding them from predators until they learn to hunt for themselves.

METHODOLOGY

Time spent monitoring the golden eagles at Carbon Mountain was decreased considerably in 2007 compared to that of 2003–2006. During the previous three breeding seasons (2004–06), the eagles had been successful using either historic nest B or C (Figure 1). Reclamation therefore proposed a reduced monitoring effort for 2007 that was dependent on the eagles utilizing nest B or C. Reclamation's monitoring plan for 2007 involved initial ground visits to be conducted in March to determine nesting status and nest occupancy. If the eagles were found to occupy historic nest A (closest to dam construction; Figure 1), monitoring would generally follow the methodology from the previous two years (2005–06). If the eagles occupied either historic nest B or C, monitoring would be scaled back to include the following:

- Aerial surveys to confirm nest occupancy and/or hatching success.
- Periodic, short ground visits to determine approximate hatching and fledging date and apparent nest success.

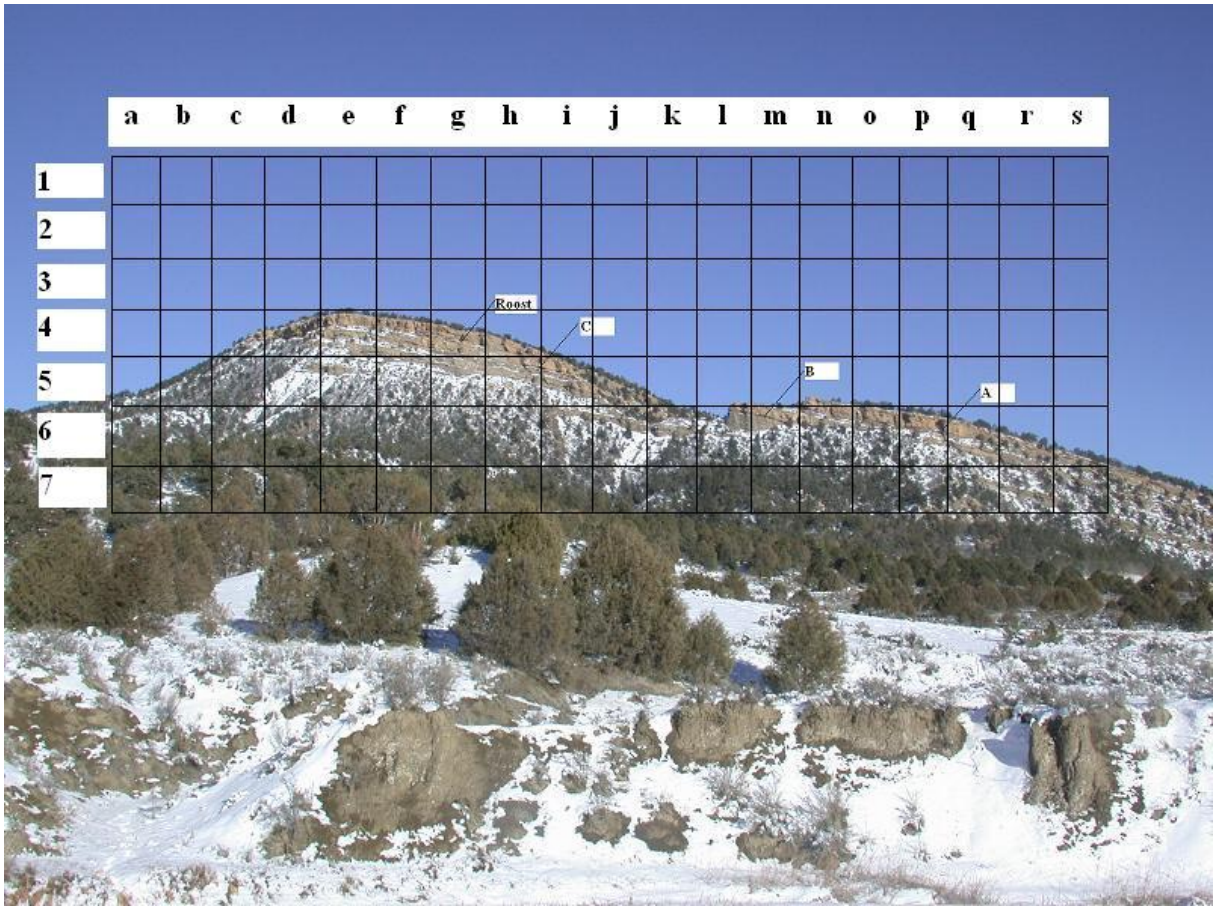

Figure 1. Grid system used to document golden eagle perch, roost, and nest sites on Carbon Mountain. Letters A, B, and C represent historic nest locations.

In 2007, Ecosphere biologists monitored the eagles from a fixed location, the retention pond along the main haul road within the ALP construction area (Figure 2). This observation point was close enough to view and document the eagles' activities, but far enough away (>0.5 miles) to minimize disturbance associated with human presence. Observers stayed in or near their vehicles, using a 20–80X spotting scope to view the eagles. Binoculars were also used, particularly when the birds were in flight and difficult to follow using the spotting scope. Gender was determined when both adults were present and the size difference was apparent.

During each monitoring period, observers recorded the daily activities of the eagles, such as perching, soaring, hunting and eating. Perches and nest locations were recorded using a grid system overlaid onto a digital image of Carbon Mountain (Figure 1). Throughout the monitoring effort, we also documented specific behaviors related to each phase of the breeding cycle, including: courtship behavior (e.g. copulation, nest building/refurbishing), territorial displays (e.g. undulating flight, aerial chases) and nesting activities (e.g. incubation, brooding).

Every effort was made to locate both the male and female eagles during each monitoring period. We recorded the exact times and durations of each behavior exhibited by the eagles, including the times that each left and returned to Carbon Mountain and the surrounding area. Interactions between the breeding pair and other golden eagles, bald eagles, and other bird species were also documented. We recorded observable responses (or lack thereof) of eagles to construction activities, particularly those associated with loud noise. Similarly, their observable responses (or lack thereof) to non-project related human activities, such as small aircraft and helicopter fly-bys or vehicles in the area were also recorded.

RESULTS

In 2007, we spent a total of 18.5 hours monitoring the nesting activities of the Carbon Mountain eagles. Per Reclamation's scaled back monitoring approach, an initial 4-hour ground visit to Carbon Mountain was conducted on 2 March to determine nest occupancy and status. Observations of the eagles and the three historic nests on 2 March indicated that egg-laying and incubation had not yet been initiated; however, we did observe the eagles copulating. Because the level of nest monitoring in 2007 was dependant on which of the three historic nest was occupied, Ecosphere biologists conducted additional 2–3 hour ground visits to Carbon Mountain periodically to determine nest occupancy. These ground visits occurred on 9, 16, and 29 March.

At no time during these visits did we observe either the female or male eagle sitting on a nest. Thus, it appeared that egg-laying had not been initiated by 29 March. However, the female was observed perched at historic nest B on both 9 and 16 March; and, on 29 March, fresh greenery was observed for the first time in the nest. No nest building/refurbishing activities was observed by either adult eagle during monitoring visits in March. The male was observed performing undulating flight, which is sometimes used as courtship a display, on both 9 and 16 March.

A rotor-wing aerial survey of the three historic eagle nests on Carbon Mountain was conducted on 30 March, in conjunction with aerial monitoring of regional golden eagle nests to determine nest occupancy within a 10-mile radius of Ridges Basin (Appendix A). During the aerial survey,

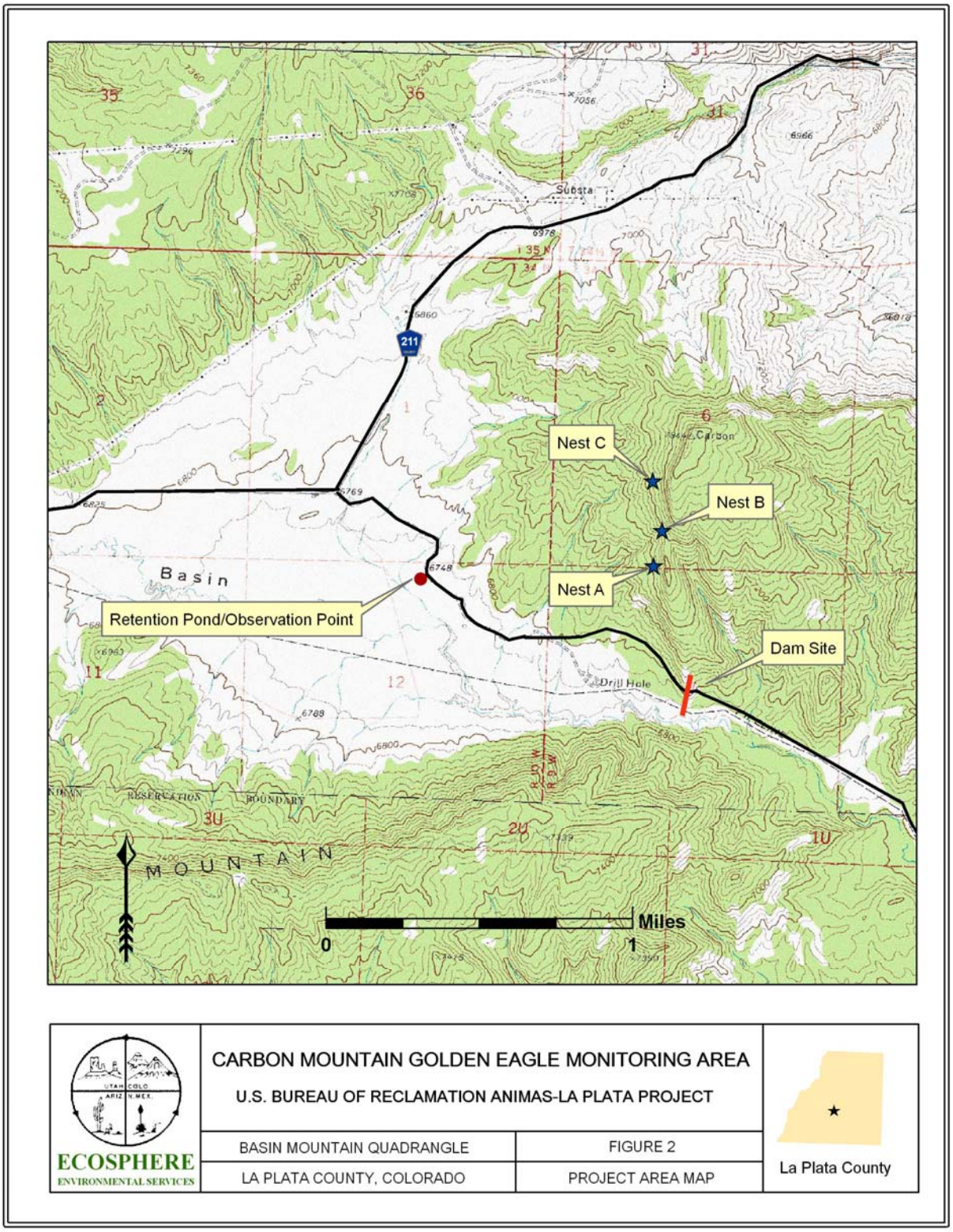

Figure 2. Project area map, showing dam site, retention pond (observation point), and historic nests A, B, and C.

we closely observed fresh greenery in nest B; however, there were no eggs nor an incubating adult in the nest.

Ground visits to Carbon Mountain continued into April to determine whether or not nesting would be attempted in 2007. On 6 April, we observed the female sitting low in nest B in an incubating position. A food delivery by the male eagle was also observed on 6 April, and the female was observed out of the nest only to eat. Because the nest was empty on 30 March, the earliest possible date of egg-laying (first egg) and initiation of incubation was 31 March; whereas, the latest possible date was 6 April.

The earliest possible hatch date, based on the earliest possible date of egg-laying and initiation of incubation (31 March), and the shortest known incubation period (41 days), was 11 May. The latest possible hatch date, based on the latest possible date of egg-laying and initiation of incubation (6 April), and the longest known incubation period (45 days), was 22 May. The expected date of hatching, based on the average incubation time for golden eagles (42), ranged between 12 and 19 May.

We conducted one short, interim ground visit to Carbon Mountain during the incubation stage, on 2 May. During this monitoring period, the female eagle was observed sitting low in the nest, in the incubating posture. A subsequent ground visit was conducted on 22 May, the day after the last possible hatch date (first egg), and was intended to provide information on hatching success. During this visit, the female was also observed sitting low on the nest. At this time, it was assumed that hatching had occurred, and that the female was brooding. It is also possible that incubation of a second egg was still occurring, if a second egg had been laid. No additional aerial surveys of the nest at Carbon Mountain were conducted because the supplemental regional aerial survey occurred on 30 April (Appendix A), which was still well within the expected incubation period for the Carbon Mountain eagles and would not yield information on hatching success or potential fledging success.

We estimated a range of the earliest possible fledge date that was based on the earliest possible hatch date (11 May), the age eaglets can first achieve self-sustained flight (~65 days), and the oldest documented fledgling age. This estimate ranged between 15 and 31 July. After hatching was presumed on 22 May, we did not conduct any ground visits until the week of 9 July, which was approximately 1 week before the expected earliest possible fledge date. We first observed the nest from the ground on 11 July; and, at that time, the nest appeared to be empty.

We observed the nest for an approximate 2-hour time period, and we did not observe either adult eagle. In addition, no fresh whitewash was visible around the nest. We visited the nest again on 12 and 13 July, and no adult eagles were seen in Ridges Basin. On 18 July, both adult eagles were observed flying and perched at Carbon Mountain, but no juvenile fledglings were observed. We conducted a final ground visit on 20 July, with no young seen in the nest and no adults observed in the vicinity.

CONSTRUCTION ACTIVITIES

Few construction activities were documented in Ridges Basin by Ecosphere biologists during eagle monitoring in 2007. These activities included truck and heavy equipment traffic along the haul road and in the vicinity of the retention pond, and construction activities at and downstream from the dam site (noted by noise only). These construction activities involved the use of truck and heavy equipment that increased noise level in Ridges Basin; however, many of these activities occurred outside of view from nest B on Carbon Mountain. During ground visits to Carbon Mountain, we did not observe any negative responses by the golden eagles to the noise created by any construction activities.

DISCUSSION

Summary 2003−06

The Carbon Mountain golden eagles nested successful in 2004, 2005, and 2006, fledging two, two, and one young, respectively (Ecosphere 2004, 2005, 2006). In 2003, the eagles did not nest at any of the three historic nests on Carbon Mountain, and the female was not observed in Ridges Basin for 89 days between March and July (Ecosphere 2003). Several hypotheses were developed to explain the events observed in 2003. First, the eagles may not have attempted to nest due to low local prey abundance. Second, the eagles nested at a site other than the three historic nests on Carbon Mountain. Third, the female eagle was killed, died of natural causes, or left the male eagle and his territory, and a female floater became paired with the male by July of that year.

In April of 2003, we attempted to locate an alternate nest on Basin Mountain and on adjacent Southern Ute Indian Tribe (SUIT) lands, with no success (Ecosphere 2003). In our 2003 summary report, we speculated on the potential impacts of construction activities in Ridges Basin, associated with the ALP Project, on the breeding activities of the Carbon Mountain eagles, or lack thereof, in 2003. However, given that the eagles successfully fledged young from 2004−06, it would appear that eagle productivity at Carbon Mountain has been mostly unaffected by the ALP Project.

2007

The golden eagles at Carbon Mountain were not successful at rearing young in 2007. Reported nesting success for golden eagle populations ranges from 32−88% (Beecham and Kochert 1975, Steenhof et al. 1997, McIntyre and Adams 1999). A nest failure is not considered unusual; however, 2007 is the first year since initiating eagle monitoring at Carbon Mountain in 2003 that we observed a failure after egg(s) were laid. There are three possible scenarios explaining the possible causes of nest failure. These include egg failure, predation, and nestling loss due to factors other than predation.

Egg Failure

Only a few studies have reported on hatching success for golden eagles (Kochert et al. 2002); however, what has been reported is less than 90%. In Utah, Smith and Murphy (1979) reported the lowest documented hatching success at 57%. Hatching success was 65% in Idaho (USGS unpublished data in Kochert et al. 2002) and 86% in Montana (Reynolds 1969, in Kochert et al. 2002).

Egg failure may be the result of a variety of causes, including infertility, exposure, and accidental cracking or crushing. An egg is not viable unless fertilized by a male prior to being laid by the female. An un-fertilized egg may be the result of improper timing of or an unsuccessful attempt at copulation prior to egg-laying. Exposure during incubation may also result in egg failure if the eggs are left unattended and environmental conditions are cold and/or wet. For example, while female golden eagles perform the majority of incubation, the male may relieve her for short bouts in which she may eat or hunt. In some cases, the nest may be left unattended for short periods of time (Ecosphere 2004). Cold weather has been documented as a cause of egg failures in a variety of raptor species (Fairhurst and Bechard 2005, Woodbridge 1998).

In the 2007 nesting season local weather conditions during the incubation period were unseasonably cold and wet, with several snowstorms in April and early May. If the egg(s) were left unattended for some of these cold periods, egg failure may have resulted. Finally, egg(s) may fail if accidentally cracked or crushed by adults during the incubation period (Beecham and Kochert 1975).

At Carbon Mountain in 2007, at least one egg should have hatched on or before 22 May. Although the female was sitting on the nest on 22 May, we could not confirm hatching because no food deliveries or feedings were observed. If the egg(s) did not hatch, the female may have continued to incubate in anticipation of hatching; and, at some point after 22 May, abandoned her efforts.

Predation

Predation of golden eagle eggs has not been documented and is highly unlikely for the Carbon Mountain nest because the female was observed incubating through the longest possible incubation period (45 days). Nestling predation was possible, but unlikely because 1) nest B is not accessible to mammalian predators, and 2) golden eagles defend their young from other raptors (Denali National Park, unpublished, http://www.nps.gov/archive/dena/home/resources/wildlife/birdweb/index/birdwatchGE.htm).

Other Causes of Nestling Loss

It is possible that nest failure occurred after the egg(s) had hatched. The lack of fresh whitewash around the nest by mid-July suggests that if hatching did occur, the young died shortly thereafter. Only a few studies have reported estimates of golden eagle nestling survival (Kochert et al. 2002), and survival rates range from 46−80% (Reynolds 1969 and USGS unpublished, in Kochert et al. 2002, Smith and Murphy 1979.

Failure post-hatching could have been due to starvation, especially if prey were not delivered for several days early in nestling life. To date, construction activities associated with the ALP Project have included vegetation clearing in Ridges Basin which has resulted in some reduction of habitat for the primary prey species (prairie dogs, cottontails). Numerous studies have demonstrated a positive correlation in reproductive success and prey abundance (e.g., Bates and Moretti 1994, Steenhof et al. 1997, Watson 1997); although, these studies focused on egg-laying rates, rather than nestling loss, with respect to prey abundance.

Nest failure during the nestling period may also be a result of exposure to heat or cold. Exposure to heat caused the death of 13% of golden eagle nestlings in Idaho (Beecham and Kochert 1975). Steenhof et al. (1997) found that nesting success was inversely correlated to higher temperatures (>32°C). Mosher and White (1976) demonstrated that golden eagle young are susceptible to thermal stress during first 6 weeks after hatching. In Ridges Basin in 2007, temperatures were not abnormal after mid-May, however.

CONCLUSIONS AND RECOMMENDATIONS

It was unclear whether ALP Project construction had a negative affect on the Carbon Mountain golden eagles (Ecosphere 2003). However, golden eagles have continued to occupy this historic territory and have nested each of the last 4 years despite construction activity. Furthermore, the pair has successfully fledged young during 3 of the last 4 years during dam and reservoir construction.

Although the nesting attempt was initiated relatively late in the 2007 season, we did not observe any negative reactions or unusual behavior by the eagles in response to construction activities. A variety of studies have demonstrated that golden eagle reproductive success varies from year to year depending on local prey abundance (Steenhof et al. 1997, Watson 1997, McIntyre and Adams 1999) and/or weather conditions (Beecham and Kochert 1975, Mosher and White 1976, Steenhof et al. 1997). Therefore, fluctuations in productivity of the Carbon Mountain eagles may be a result of one or both of these factors. Local, that is within 10 miles of Carbon Mountain, golden eagle productivity in 2003 was considerably lower than that of 1996−97 and 2004−06 (Appendix A).

Similarly, local eaglet production in 2007 decreased markedly from 2006. Monitoring the local or even the Ridges Basin prey population was not part of this study. Subsequently, we cannot correlate the fluctuations in eagle productivity with prey abundance. However, we suspect that the apparent failure to nest in 2003 and the nesting failure of 2007 were more related to local environmental factors than to disturbance from construction activities associated with the ALP Project.

Information on disturbance-related impacts to golden eagles are scarce (Watson 1997); therefore, the data we have collected from 2003−07 is invaluable in evaluating the effects of construction activities on golden eagles and planning for future land management and development activities in eagle habitat. We recommend that the data be incorporated into a manuscript for submission

into a scientific journal, such as the *Journal of Raptor Research*, so that the information we have collected may be disseminated into the scientific community and utilized by land managers in the future.

After construction is completed and the lake begins to fill (~2009), we recommend continued monitoring of the Carbon Mountain territory to determine if the loss of foraging habitat and increase in human recreational activity in Ridges Basin affects occupancy. This is consistent with the Final Supplemental Environmental Impact Statement for the ALP Project which contains a requirement for an additional 4 years of post-operational monitoring for golden eagles (Bureau of Reclamation 2000). Further, we recommend continued monitoring of the golden eagle population within a 10-mile radius of Carbon Mountain, because that data can, as in 2003, substantiate, non-ALP impacts on the Carbon Mountain golden eagle territory (refer to Appendix A).

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APPENDIX A

SUPPLEMENTAL REPORT:

GOLDEN EAGLE TERRITORY OCCUPANCY AND PRODUCTIVITY WITHIN A 10-MILE RADIUS OF CARBON MOUNTAIN: 2003-2007

Prepared by:

Dale Stahlecker
Eagle Environmental, Inc.
30 Fonda Road
Santa Fe, NM 87508
dwseagle@gmail.com

INTRODUCTION

As part of preliminary environmental work for the Animas-La Plata (ALP) Project, Bureau of Reclamation (Reclamation) contractors documented 16 golden eagle nests in 7 breeding areas within a 314 mile^2 (10 mile radius circle; hereafter 10MRC) of the Carbon Mountain nests (Figure 1: Harmata 1996, Harmata and Flath 1997). At the beginning of construction late in 2002, the U. S. Fish and Wildlife Service (USFWS) required Reclamation to monitor the effects of construction activities on the Carbon Mountain eagles. Reclamation's current contractor, Ecosphere recommended resumption of aerial and ground surveys of the 10MRC and Reclamation agreed. In 2003, when there was no nesting attempt at Carbon Mountain, Reclamation was able to show the U.S. Fish and Wildlife Service that nesting was attempted in only two of the seven occupied territories that year, deflecting implications of disturbance problems at Carbon Mountain. Monitoring of all known eagle nests in the 10MRC has continued through 2007. While this report provides data collected in 2007, it more importantly summarizes the results of 5 years of population monitoring and makes recommendations for future monitoring.

METHODS

Rotor wing aerial surveys (Phillips et al. 1984) of the 10MRC were conducted 30 March 2007 to document active golden eagle nests and on 30 April 2007 to recheck inactive nests and to determine which active nests had successfully hatched young. Aerial surveys were conducted by three observers and a pilot, concentrating on known nest sites throughout the 10MRC. The helicopter allowed close approach and the opportunity to hover and be certain of the status of each nest site visited (Phillips et al. 1984). Ground visits were made to each territory where an active nest was not identified to confirm aerial survey results and to see if the territory was occupied by at least one adult golden eagle.

Ageing of young was based on Watson (1997). Terminology generally followed Steenhof (1987), and we assumed that nestling golden eagles greater than 51 days old, 80% of youngest natural fledging age (~62 days) as recommended by Steenhof (1987), would ultimately fledge.

RESULTS

2007

Only four golden eagle pairs nested the 10MRC in 2007, down from eight pairs in 2006. Three nests were successful at hatching young and it is likely that at least four young were fledged. Occupancy was confirmed at seven of nine known territories. A brief description of each breeding area follows; the full breeding histories for all territories within the 10MRC are summarized in Sub-Appendix A.

Carbon Mountain -- This pair nested late in 2007. Fresh greenery was observed in one nest on the 30 March flight. Incubation began between approximately 31 March and 6 April, but the nesting attempt was unsuccessful (see main report).

North Bridge Timber – This pair nested approximately 2 miles from their 2003–2006 nest sites, but in a nest used in 1997. One downy chick was observed on 30 April. By 1 June it was >50 days old and likely fledged by mid-June.

Weasel Skin – No search was made for this territory as 2003 to 2006 searches have been unsuccessful. However, we observed an adult flying from a new nest with greenery about half way between active nests at Carbon Mountain and North Bridge Timber during the aerial survey on 30 April. The eagle could have been from either of these territories, but could be indicative of an attempt to re-establish the Weaselskin territory, which has not been known to be active since 2003. If true, the foraging area of this nest/territory would be to the south of the nest.

Barnroof Point – Fresh greenery in the nest on 30 March, as well as an adult perched above the cliff on 30 April confirmed continued occupancy of this territory.

Wildcat Canyon – Fresh greenery on 30 March documented continued occupancy of this territory; however, no eggs had been laid by 30 April.

Falls Creek – As in 2006, this cliff was occupied by an adult pair of peregrine falcons (*Falco peregrinus*) on 30 March. No golden eagles were seen within this territory during 2007, so it is not certain that this territory remains occupied.

Animas Mountain/*Rock Slide* – This pair again nested in a small cave-like hollow on southwestern Missionary Ridge, across the valley from Animas City Mountain. As in previous years, the incubating adult was difficult to see in the shadows of the hollow on 30 March. On 30 April the adult female was brooding. She was perched within the "cave" on 1 June and the large amount of mute was indicative that at least one young had hatched and likely fledged around 1 July.

Junction Creek – This nest has not been occupied by a raptor since 1997, when the nest was described as "in good condition". There was no evidence of nest repair or adult raptors seen on 30 March 2007, and no further visits were made to this site.

Upper Florida River – Greenery was observed in the nest on 30 March; however, there was no change to the nest by 30 April.

Lower Florida River – This ponderosa pine (*Pinus ponderosa*) nest near Durango-La Plata County Airport, was active when ground-checked on 29 March. Two large downy young were seen on 30 April, and on 1 June two 45–50 day-old young were observed. They likely fledged before the end of June.

Hereford Canyon – Neither the 2006 ponderosa pine nest nor the nearby cliff alternate nest was active on 30 March, nor did either have greenery. An effort to document occupancy from the ground in April was unsuccessful.

Summary 2003-2007

Between 2003 and 2005, 6 to 7 of 7 known golden eagle territories within the 10MRC were documented as occupied (Figure 2). In 2006, two additional occupied territories were 9 miles southeast of Carbon Mountain, an area not searched 2003–05 because no territories were found there in 1996–97.(Harmata and Flath 1997). Therefore in 2006 and 2007 we monitored nine territories in the 10MRC. Throughout the 5 years of monitoring, 90% of known territories were documented as occupied.

Low productivity, such as occurred in 2003 (Figure 3), occurs in every golden eagle population when prey populations are also low (Kockert et al. 2002). The 10MRC golden eagle population between 2003 and 2007 produced a minimum of 0.57 fledgling per occupied territory (Figure 3), above the 0.5 fledglings per occupied territory that maintained a stable population in Switzerland (Haller 1996).

DISCUSSION AND RECOMMENDATIONS

Ground counts of fledgeable young were difficult on several of the successful nests in 2006 and 2007, resulting in minimum estimates of fledged young instead of accurate counts. By June it would have required at least two more helicopter flights to have made accurate counts of young that were at least 55 days old. This would have doubled the cost of the aerial surveys. While this could be done, it is occupancy and nesting attempts that are most important to Reclamation.

Monitoring of the 10MRC golden eagle population is relatively simple and inexpensive. Knowledge of the percentage of golden eagle pairs laying eggs within the 10MRC may be useful to Reclamation, as this trend is indicative of non-ALP Project impacts on breeding within the population. While the next major phase of ALP, filling of the reservoir, will not begin until 2009, monitoring in 2008 would maintain continuous data on the breeding percentage trend (Figure 2) leading into that phase. This data could prove important to determine if there is a third active nest site between Carbon Mountain and North Bridge Timber as a replacement nest for the long inactive Weaselskin territory.

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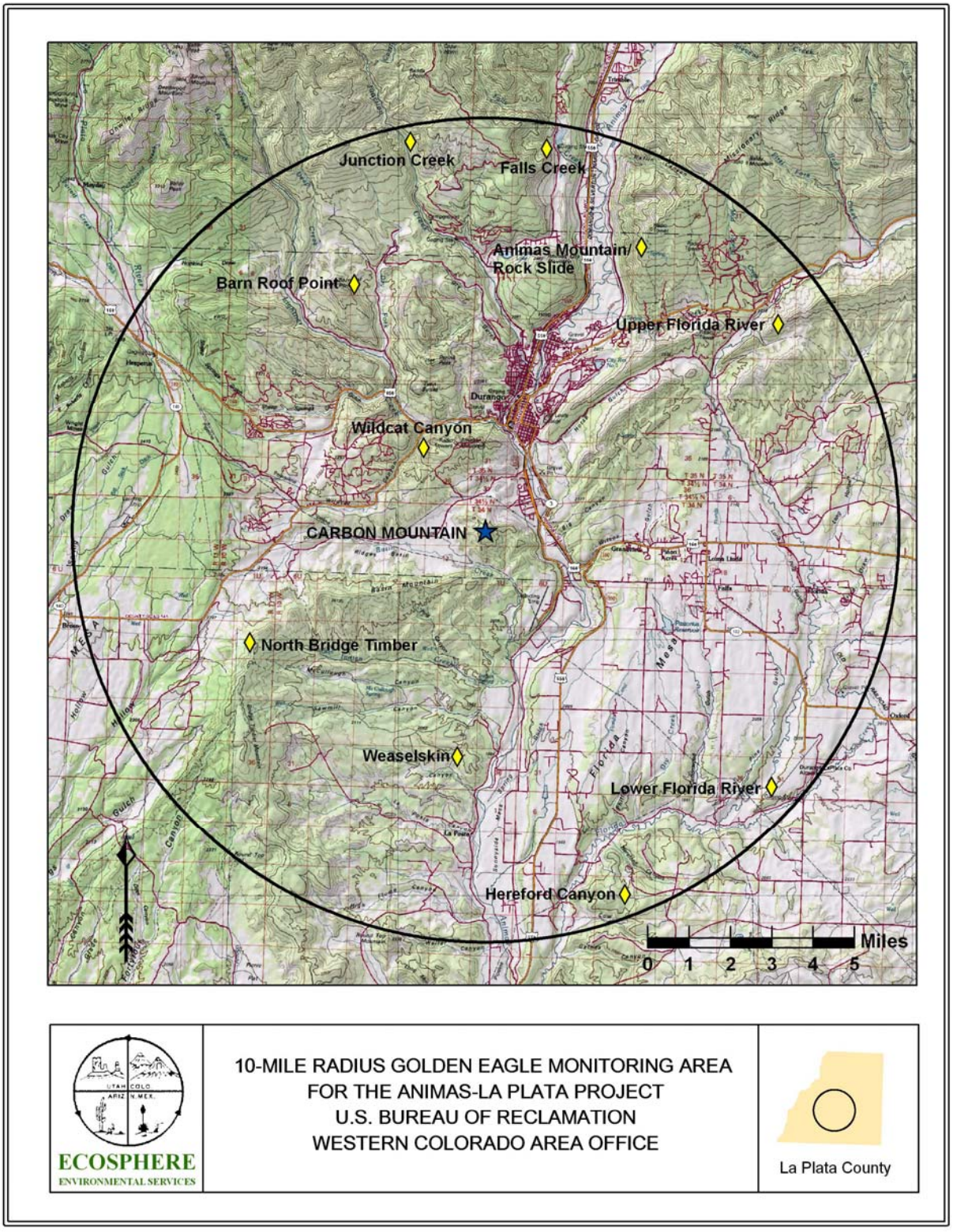

Figure 1. The 10MRC (10-mile radius circle), ALP, La Plata County, Colorado.

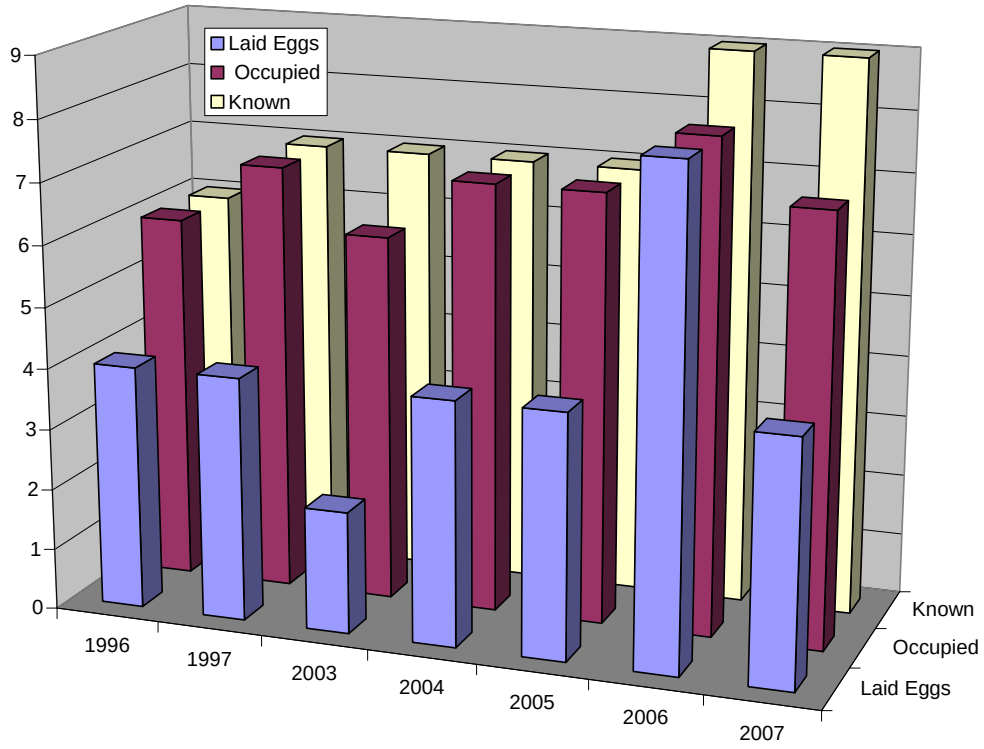

Figure 2. Known Golden eagle territories in the 10MRC, those known to be occupied, and those in which eggs were laid, 1996–97 and 2003–2007.

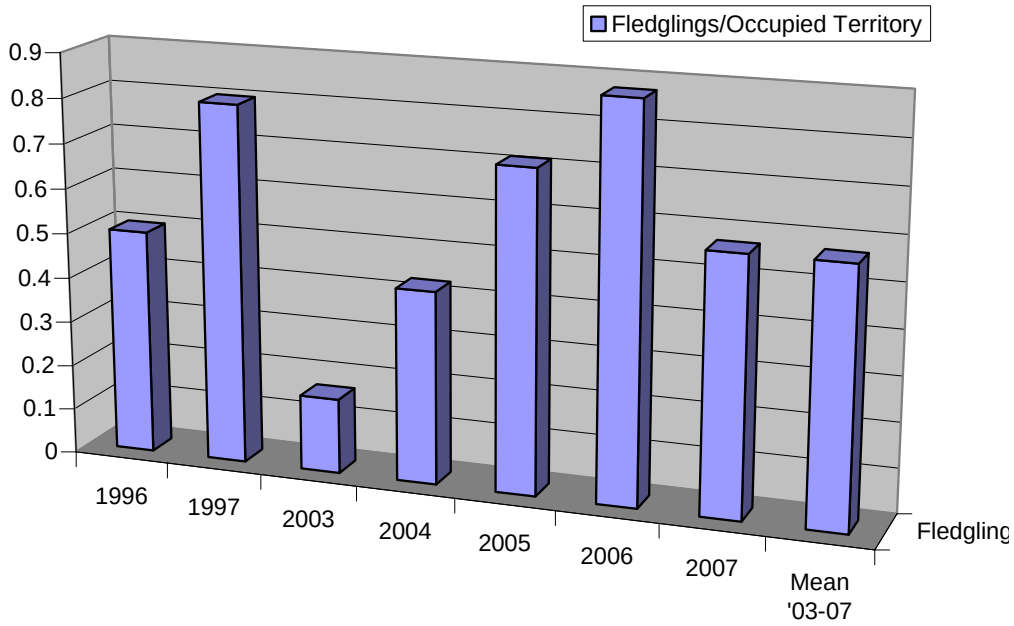

Figure 3. Minimum golden eagle fledglings/occupied territory in the 10MCR, 1997–97 and 2003–2007, and 5-year mean.

Table 1. Occupancy and productivity of golden eagle territories within a 10MRC of Carbon Mountain, La Plata County, Colorado, 1996–97 and 2003–07.

TERRITORY	YEAR	AERIAL SURVEY DATE(S)	SURVEYTYPE	OCUUPIED BY PAIR	LAID EGGS	# HATCHED YOUNG	# FLEDGED YOUNG
Carbon Mountain	1996	Jun	Rotor	Yes	No	0	0
	1997	Jun	Rotor	Yes	Yes	1	1(1)
	2003	Mar, Apr	Fixed wing	Yes	No	0	0
	2004	None	Ground	Yes	Yes	2	1(2)
	2005	None	Ground	Yes	Yes	2	2
	2006	None	Ground	Yes	Yes	1	1
	2007	Mar	Rotor, ground	Yes	Yes	0?	0
North Bridge Timber	1996	Jun	Rotor	Greenery?	?	?	0
	1997	Jun	Rotor	Yes	Yes	1	1(1)
	2003	Mar, Apr	Fixed wing	Yes	Yes	1	?
	2004	Mar-Jun (3)	Both	Yes	Yes	1	1(1)
	2005	None	Ground	Yes	Yes	0	0
	2006	Mar, May	Rotor	Yes	Yes	0	0
	2007	Mar, May	Rotor	Yes	Yes	1	1
Weasel Skin	1996	Jun	Rotor	Yes	Yes	1	1
	1997	Jun	Rotor	Yes	Yes	1	1
	2003	Mar, Apr	Fixed wing	Tree down	N/A	N/A	N/A
	2004	Mar	Fixed wing	Yes (1 ad)	N/A	N/A	N/A
	2005	Mar	Fixed wing	No	N/A	N/A	N/A
	2006	Apr	Fixed wing	No	N/A	N/A	N/A
	2007	None	None	NA	NA	NA	NA
Barnroof Point	1996	Jun	Rotor	Yes	Yes	1	1(1)
	1997	Jun	Rotor	Yes	No	0	0
	2003	Mar-Jun (3)	Fixed wing	Greenery	No	0	0

TERRITORY	YEAR	AERIAL SURVEY DATE(S)	SURVEYTYPE	OCUUPIED BY PAIR	LAID EGGS	# HATCHED YOUNG	# FLEDGED YOUNG
Barnroof Point, cont.	2004	Mar-Jun (3)	Both	Yes? (1)	No	0	0
	2005	Mar, May	Rotor	Yes	Yes	1	1
	2006	Mar, May	Rotor	Yes	Yes	2	1+
	2007	Mar, Apr	Rotor	Yes	No	0	0
Wildcat Canyon	1996	Jun	Rotor	Not seen	NA	NA	NA
	1997	Jun	Rotor	Not seen	NA	NA	NA
	2003	Mar, Apr	Fixed wing	Yes	Yes	0	0
	2004	Mar	Rotor	Yes	No	0	0
	2005	Mar, May	Rotor	Yes	No	0	0
	2006	Mar, May	Rotor	Yes	Yes	2	0
	2007	Mar, Apr	Rotor	Yes	No	0	0
Falls Creek	1996	Jun	Rotor	Yes	Yes	1	1
	1997	Jun	Rotor	Greenery	No	0	0
	2003	Mar, Apr	Fixed	Greenery	No	0	0
	2004	Mar-Jun (3)	Both	Yes	Yes	1(2)	1(2)
	2005	Mar, May	Rotor	Yes	No	0	0
	2006	Mar, May	Rotor	No	No	0	0
	2007	Mar, Apr	Rotor	No	No	0	0
Animas Mountain/	1996	Jun	Rotor	No	NA	NA	NA
Rock Slide	1997	Jun	Rotor	Greenery	No	0	0
	2003	Mar	Fixed	Not seen	No	NA	NA
	2004	Mar	Rotor	Not seen	No	NA	NA
	2005	Mar, May	Rotor	Yes	Yes	1+	1+
	2006	Mar, May	Rotor	Yes	Yes	2	2
	2007	Mar, Apr	Rotor	Yes	Yes	1+	1+

TERRITORY	YEAR	AERIAL SURVEY DATE(S)	SURVEYTYPE	OCUUPIED BY PAIR	LAID EGGS	# HATCHED YOUNG	# FLEDGED YOUNG
Junction Creek	1996	Jun	Rotor	Not seen	No	0	0
	1997	Jun	Rotor	No	No	0	0
	2003	Mar	Fixed	No access	NA	0	0
	2004	Mar-May	Both	No access	NA	0	0
	2005	Mar, May	Rotor	No access	NA	NA	NA
	2006	Mar	Rotor	No access	NA	NA	NA
	2007	Mar	Rotor	No access	NA	NA	NA
Upper Florida River	1996	Jun	Rotor	Yes	Yes	0	0
	1997	Jun	Rotor	Yes	Yes	1	1
	2003	Mar, Apr	Fixed wing	Yes	No	0	0
	2004	Mar-Jun (3)	Both	Yes	Yes	?	0
	2005	Mar, Apr	Rotor	Yes	Yes	0	0
	2006	Mar, May	Rotor	Yes	Yes	2	2
	2007	Mar, Apr	Rotor	Yes	No	0	0
Lower Florida River	1996	N/A	N/A	N/A	N/A	N/A	N/A
	1997	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A
	2004	N/A	N/A	N/A	N/A	N/A	N/A
	2005	NA	NA	NA	NA	NA	NA
	2006	Apr.	Fixed; ground	Yes	Yes	2	2
	2007	Mar, Apr	Fixed; ground	Yes	Yes	2	2
Hereford Canyon	1996	N/A	N/A	N/A	N/A	N/A	N/A
	1997	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A
	2004	N/A	N/A	N/A	N/A	N/A	N/A
	2005	NA	NA	NA	NA	NA	NA

TERRITORY	YEAR	AERIAL SURVEY DATE(S)	SURVEYTYPE	OCUUPIED BY PAIR	LAID EGGS	# HATCHED YOUNG	# FLEDGED YOUNG
Hereford Canyon,	2006	Apr.-May	Fixed-wing; ground	Yes	Yes	1	1
cont.	2007	None	Ground	No	No	0	0
TOTALS	1996	NA	NA	6	NA	3	3
	1997	NA	NA	5	NA	4	4
	2003	NA	NA	5 or 6	2	1	?
	2004	NA	NA	6 or 7	4	3	3(5)
	2005	NA	NA	7 or 8	6	5+	5+
	2006	NA	NA	8	8	14	10+
	2007	NA	NA	7	4	4-5	4+

Table 2. UTM coordinates for historic (documented from 1996–97) and recent (2003–07) golden eagle nests within a 10MRC of Carbon Mountain.

TERRITORY NAME	ALTERNATE NEST NO.	YEAR(S) NEST ACTIVE[a]	UTM COORDINATES[bc]
Carbon Mountain	1(A)	None	4123873, 243093
	2(B)	2005, 2007	4124064, 243045
	3(C)	2004, 2006	4124326, 242950
North Bridge Timber	1	2007	4121697, 236819
	2	2003–06	4120088, 234164
Weaselskin	1	None	4115635, 242236
	2[d]	None	4122271, 240390
Barnroof Point	1, 2[e]	2005–06	4134088, 238236
Wildcat Canyon	1	2003, 2006	4127685, 240927
Falls Creek	1	2004	4138735, 245803
Animas Mountain/Rock Slide	1	None	4133254, 245973
	2	None	4133374, 246117
	3	2005–07	4135540, 249402
Junction Creek	1	None	4139659, 240426
Upper Florida River	1	None	4132516, 254735
	2	None	4132564, 254807
	3	2006	4133302, 256247
	4	2004–05	4133581, 257397
Lower Florida River	1	2006–07	4114457, 254480
Hereford Canyon	1	2006	4110253, 248760
	2	None	4111595, 248061

[a] Includes only years 2003–07.

[b] UTM datum is NAD83, Zone 13.

[c] UTM coordinates were obtained during aerial surveys conducted between 1996–97 (Harmata and Flath 1997) and 2003–07 or were based on estimates of locations on topographic maps. UTMs are not exact.

[d] New nest between Carbon Mountain and North Bridge Timber territories; possible replacement nest for Weaselskin territory.

[e] Two nests are located within 100 m of presented UTM coordinates; nests were too close to each other to obtain separate UTM coordinates via aerial surveys.