



Golden Eagle Breeding Ecology in South-central Montana

2011 Interim Report

In spring of 2010, Craighead Beringia South began monitoring a breeding population of golden eagles (*Aquila chrysaetos*) in south-central Montana. The impetus for this effort was evidence suggesting declines in both breeding and migratory golden eagles in the Intermountain West and a need for more information in order to accurately assess the reality and degree of this apparent decline. Our study area near Livingston, Montana provided an ideal setting for this effort due to an unusually high density of breeding golden eagles and because information exists on this segment of the population dating back to 1963. This is one of the oldest datasets on a breeding population of golden eagles in North America, giving us the unique ability to compare current and historic trends in order to accurately gauge the status of this population. With a successful pilot season completed in 2010, we continued our efforts in 2011 to monitor this breeding population and also began a tracking aspect to the project to assess areas being used by breeding adults year-round. Beginning in 2011, we began extending our research into a more comprehensive project aimed at identifying important areas for the birds, distance of seasonal movements, survival rates of adult birds and habitat utilization on both local and landscape scales. The following provides a summary of our 2011 field season.

Monitoring

In order to identify active golden eagle territories we first located all known, historically used nesting locations documented during the previous phases of the study (1963-68, 1993-94, 2010). In addition, we searched for new territories in areas where historic nests had not been documented and also found new territories opportunistically while traveling around the study site. We visited historic, known nest sites for two 2-hour periods early in the breeding season to document whether adult eagles were present in the territory. If no adult eagles were detected during those visits, we classified the territory as “inactive.” If we located at least one adult eagle during our initial survey periods of the territory, we continued to watch for signs of breeding behavior. These behaviors include carrying nest material, nest building, escorting (when one adult escorts another eagle out of its territory), territorial flights, copulation and/or incubation. If any of these behaviors were observed, we classified the territory as “active” and continued monitoring to determine if pair initiated incubation. Since not all eagles in active territories initiate egg laying (the rate of egg laying varies significantly from year to year based on food availability), we defined a territory as an “active nest” only if we saw an adult incubating eggs. If we did not see an adult on eggs at any point during the breeding season but did see territorial birds, we defined this as an “active non-nesting pair.”

Entering the 2011 nesting season, there were 30 known territories within the study area. We located an additional 13 territories in 2011, bringing the total golden eagle territories in the study area to 43. Of the previously known 30 territories, 29 (96.7%) were occupied in 2011. When calculating proportion of

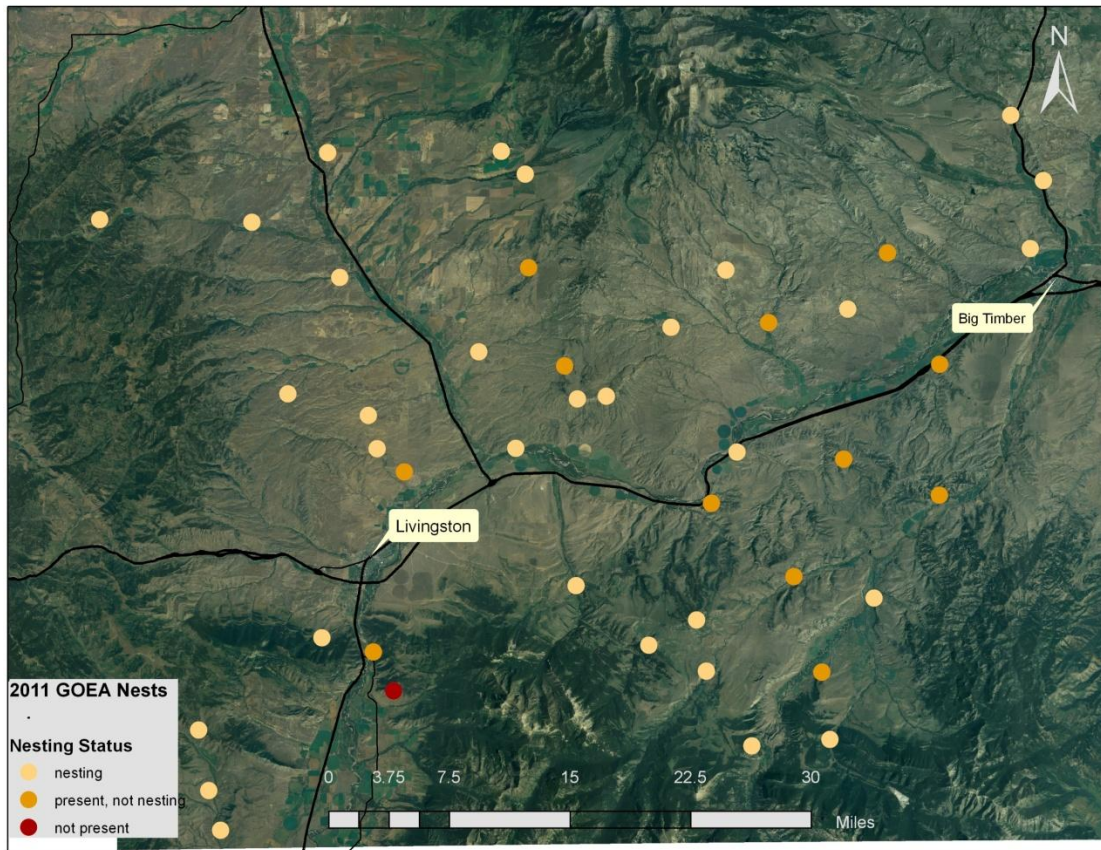
active territories, only historically located territories were used due to our inability to locate new, inactive territories for any given year. Since productivity is a function of total young produced per active territory, nesting or not, we use all territories when calculating that estimate. From all 43 territories, 29 (67.4%) initiated nests while 13 (30.2%) were active, non-nesting pairs and the remaining territory was unoccupied in 2011. Of the 29 territories that initiated nesting, 16 (53.3%) were successful in fledging a total of 20 young resulting in a productivity rate of 0.47 young/active territory. Of the 29 active nests, 16 (55.2%) were located on cliffs and 13 (44.8%) were located in trees. The tree nests were primarily found in Douglas Firs (*Pseudotsuga menziesii*) but also in cottonwoods (*Populus sp.*).

In 2010, we estimated a productivity rate of 0.66 young/active territory but 100% nest initiation compared to 67.4% this year. In the 1960's, productivity rates were typically calculated as number of young fledged per active *nest* instead of the current definition which is number fledged per active *territory*. This takes into consideration not all active territories will nest each year. Considering only the active nests when determining productivity produces an inflated estimate because production of non-nesting territorial pairs are not considered. Productivity rates in the 1960's varied from 0.78-1.53 young/ active nest but were 0.54-1.30 young/active territory (after taking active non-nesting territories into account) with an average of 0.83 young/active territory. Other studies (1990's to present) completed in the region have shown fledge rates varying from 0.66 to 0.79 with an average of 0.72 young/territory.

Table 1. Summary of all phases of Livingston study. Note all values for the 1960's are an average of all years combined.

	1960's	2010	2011
# Active Territories	24.8	30	42
# Nests/yr	18.2	30	29
# Successful	13.8	19	16
Total Fledged	19.8	20	20
# Fledged/Territory	0.83	0.67	0.47
# Cliff/Tree Nest	11.8/5.0	18.0/12.0	16.0/13.0

Figure 1. Location and nesting status of Golden Eagle eyries found in study area in 2011. *note: some nest locations have been altered to protect land owner privacy*



Tracking of Breeding Adults

Beginning in 2011, we initiated a new aspect of the project that involved tracking adult breeding eagles. During 2011 we were able to capture 3 adult males and outfitted each with a GPS tracking device on the bird to gather detailed information on their movements. The devices attach to the back of the eagle much like a backpack and are under 3% of the birds weight to minimize the potential of impacting the birds' mobility. Depending on type of transmitter used, we get one GPS location per hour or one location every 20 minutes. With the information we collected and are continuing to collect, we will be able to assess the area eagles use areas during the breeding season as well during the non-breeding season on a micro-scale. To date, we have collected over 6,000 locations from the three birds. One of the three transmitters failed shortly after the breeding season so we are no longer receiving location data from that individual. This information will be used in the next few years to develop habitat models to clearly define ideal nesting and seasonal habitats.

Figure 2. Adult breeding male golden eagle with a 30g solar GPS satellite transmitter. The transmitter is affixed using a backpack style harness with a break-away link and is 0.7% of the bird's body mass.



Figure 3. Adult male golden eagle hourly GPS locations from 3/24 – 9/23/11. One chick was produced from this territory in 2011.

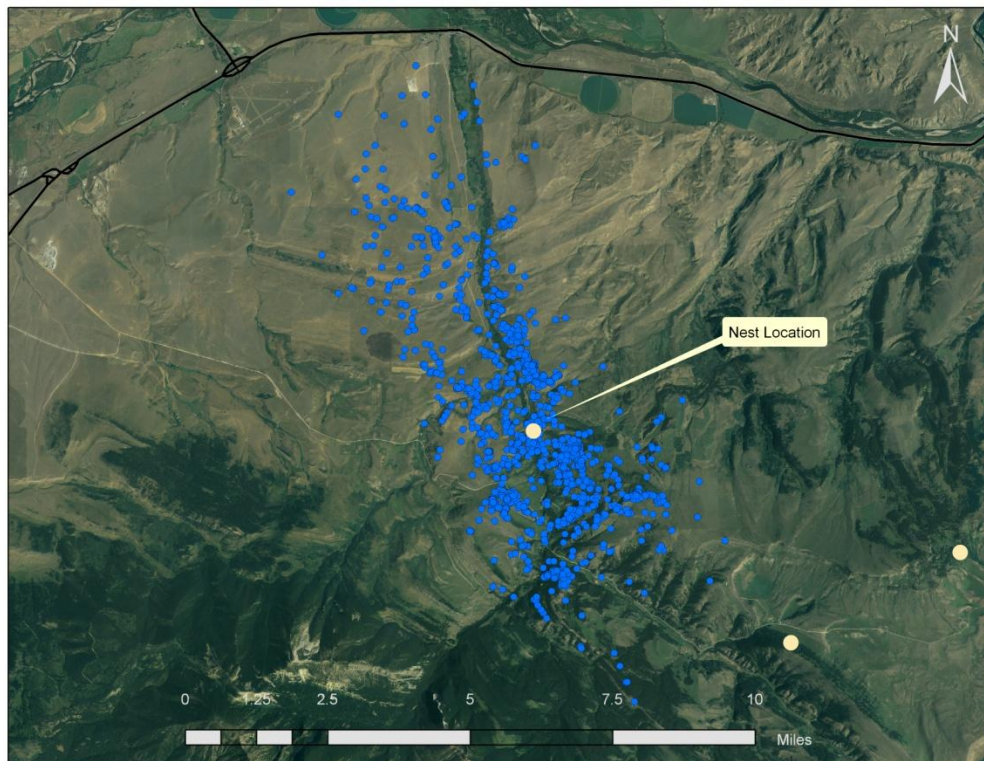


Figure 4. Adult male golden eagle hourly locations from 4/6 – 9/23/11. One chick was produced from this territory in 2011.

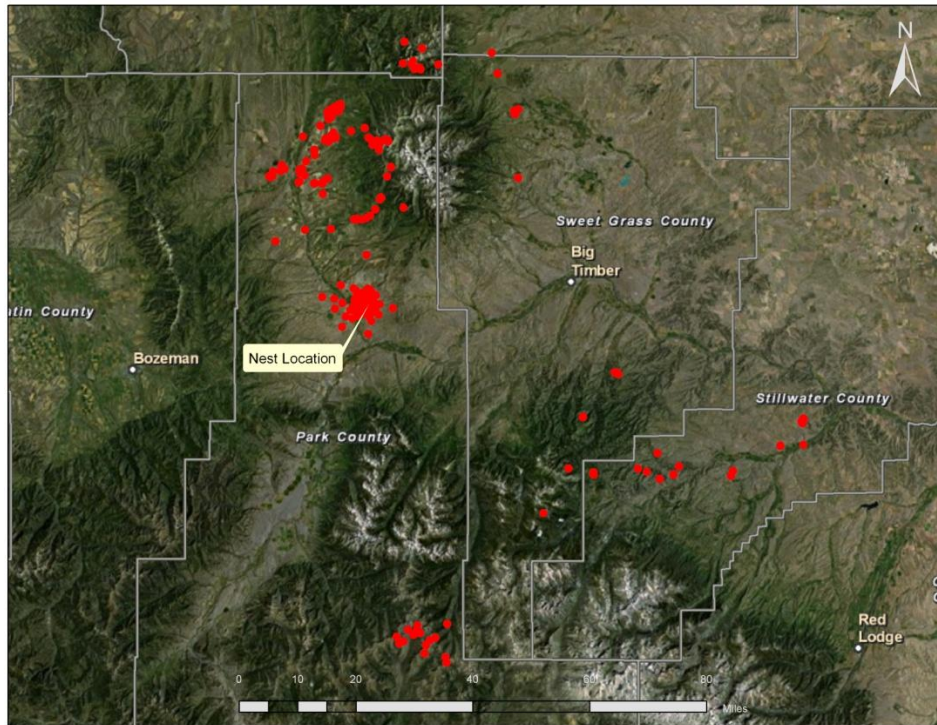
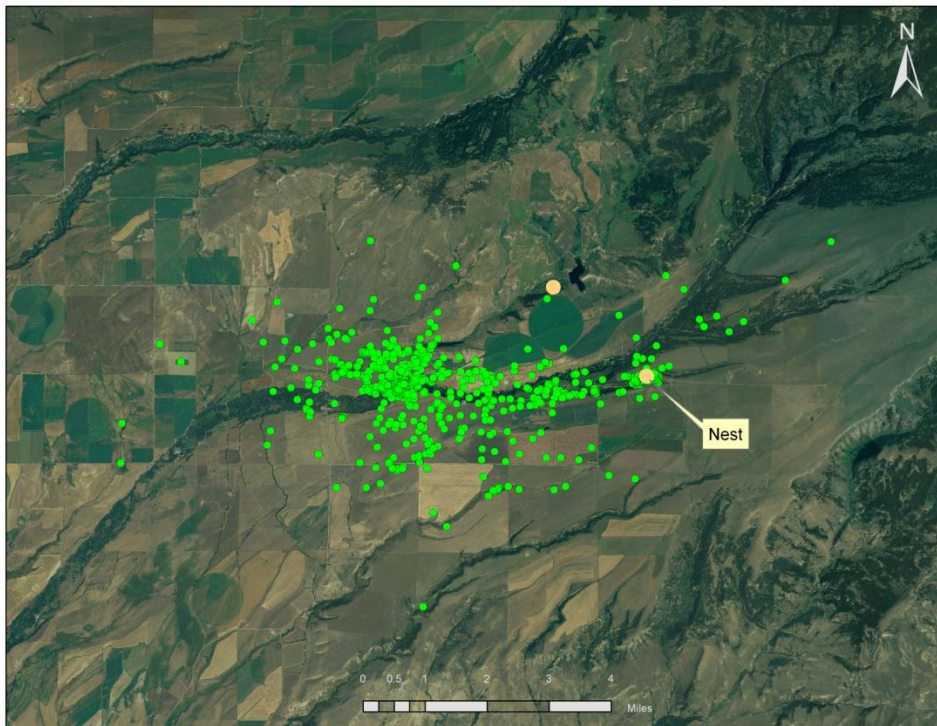


Figure 5. Adult male golden eagle 20 minute locations from 4/7 – 5/16/11. No chicks were produced from this territory.



Future Research Plans

We plan on continuing our work on this project until at least 2013. We will continue monitoring all known territories to determine site occupancy and productivity rates to get a firm understanding of current trends of this breeding population. Due to the annual fluctuation of breeding attempts of golden eagles, it is important to monitor the population for a number of years to accurately assess population status. We also plan on continuing tracking adult breeding birds to gather the required amount of information to create the models of resource selection. Other plans for future research include tracking nestling birds through the first 2 years of life via GPS transmitters to evaluate dispersal distances, stopover sites, and survival rates. This will help us begin to fully understand this population beyond just calculating productivity. By utilizing the new technology provided by GPS transmitters we can estimate the total number of immature eagles that survive beyond the time of high mortality (typically during the 1st year of life) and where important use areas for non-breeders may be. We also plan on monitoring prey selection for comparison with data on prey selection collected in the 1960's.

In 2011, Craighead Beringia South biologist Ross Crandall began his M.S. using aspects this project for his thesis. He is being co-advised by Dr. Eric Greene and Dr. Tom Martin at the University of Montana.