

GOLDEN EAGLES (*Aquila Chrysaetos*) NESTING IN OREGON, 2011

1st Annual Report, Revised



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ABSTRACT

Historical (pre-2011) golden eagle nest locations (n = 1,520) from many sources were compiled for Oregon. Nest locations were grouped into 653 potential breeding areas and used to guide golden eagle nest inventory, survey, and monitoring. Five-hundred-seventy-six nest locations at 324 historical and 135 previously undocumented breeding areas were observed, resulting in a minimum of 788 potential breeding areas for the state. Surveys of 459 breeding areas (58.2%, n = 788) found 280 occupied or with evidence of occupation (61.0%, n = 459), 177 occupied with known outcome (63.2%, n = 280), 119 successful nesting attempts (67.2%, n = 177), and 169 young. Productivity was 0.95 young per occupied breeding area with known outcome and brood size was 1.42 young per successful breeding pair. Statewide minimum population size and productivity estimates based on 788 breeding areas and observed occupation rate (61.0%) and productivity (0.95) were 481 occupied breeding areas and 457 young in Oregon during 2011. Continued inventory of historical locations, expanded survey of likely habitat, and increased monitoring to determine nesting outcome are recommended for 2012.

INTRODUCTION

The golden eagle (*Aquila chrysaetos*) is distributed throughout the northern hemisphere, primarily between 20° and 70° N latitudes (Watson 1997:22). In North America, the species is most abundant west of 100° W longitude from the arctic slope to

central Mexico (Kochert et al. 2002:1). Golden eagles have been observed throughout Oregon and nesting has been documented or was suspected in all counties except Hood River east of the Cascades and in 9 of 18 counties west of the Cascades (Carey 2003:161, Isaacs & Opp 1991).

Golden eagles are protected by the Migratory Bird Treaty Act in Canada, the U.S., and Mexico, and by the Bald and Golden Eagle Protection Act in the U.S. (Kochert et al. 2002:29). In Oregon, golden eagles are designated as protected nongame wildlife by Oregon Department of Fish and Wildlife (2010). Suspected long-term population decline (Kochert et al. 2002:26) and recent extensive resource development have resulted in concerns about the status and future of the species in the western U.S. (U.S. Fish and Wildlife Service 2010).

The breeding population of golden eagles in Oregon was estimated at a minimum of 500 nesting pairs in the mid-1980s, however that estimate was based on limited and inconsistent monitoring and rough estimates of survey coverage. In addition, statewide population trends could not be determined because of inadequate monitoring (Isaacs & Opp 1991). However, local studies in Oregon correlated golden eagle nesting success to black-tailed jackrabbit (*Lepus californicus*) abundance during 1966-1980 in southeastern Oregon (Thompson et al. 1982) and suggested population decline in central Oregon from 1966-1984 (Anderson 1985). Despite those efforts, the size, distribution, and productivity of the population of golden eagles nesting in Oregon has not been determined and statewide trends in those parameters are unknown.

Current efforts by U.S. Fish and Wildlife Service to protect golden eagles and ensure no declines in breeding populations (Pagel et al. 2010:2) require baseline and

trend information on size, distribution, and productivity of those populations. The objectives of this project were to determine the size, distribution, and productivity of the nesting population of golden eagles in Oregon. The goal was to provide baseline information required to determine long-term trends in the status of the golden eagle breeding population as was accomplished for peregrine falcons (Henny & Pagel 2003, Isaacs 2008) and bald eagles (Isaacs & Anthony 2011). This report contains results of golden eagle nest survey, inventory, and monitoring in Oregon during 2011.

ACKNOWLEDGEMENTS

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Gary Clowers, Raven Research West, Madras, OR, and Jim and Sue Anderson, Natural Selection, Sisters, OR deserve special mention for their contributions. Their knowledge of golden eagles in general and regional nest locations and histories in particular were invaluable. In addition, their long-term perspectives on golden eagle population and habitat changes, and the impacts of increasing human population on the species were enlightening.

Additional, in-kind assistance came from Renewables Northwest Project, wind industry cooperators, wildlife consultants – especially Rick Gerhardt of Northwest

Wildlife Consultants, Inc., agency cooperators, golden eagle experts, and volunteers. Many people contributed site-specific monitoring results and deserve credit for their valuable contributions. Volunteers deserving special mention were Bill Price, Hillsboro, OR; Jim Harper, Medford, OR; and Gary Landers, Sisters, OR. Northwest Wildlife Consultants, Inc., 2Morrow Energy, Portland General Electric, WEST Inc., and ABR Inc. generously contributed results of their golden eagle surveys.

I am grateful to all who contributed to this project; it could not have been completed without their participation and support. My apologies to the deserving I failed to recognize. I alone am responsible for the accuracy of data summaries and conclusions, and am accountable for any errors in this report.

STUDY AREA

The study area was the U.S. state of Oregon which is located halfway between the equator and north pole on the west coast of North America. The state is roughly rectangular in shape, with the widest points being ~620 km (385 mi) east to west and ~476 km (296 mi) north to south. Oregon is divided into distinctly different east and west regions by the Cascade Mountains. Roughly 1/3 of the state is west of the crest of the Cascades and 2/3s is east of the mountains. Western Oregon is mostly forested, below 914 m (3000 ft) elevation, and has a maritime climate. Eastern Oregon is mostly higher than 914 m elevation, has more open grassland and shrub-steppe than forest, and has a continental climate that is drier and has greater temperature extremes than west of the Cascades (Marshall et al. 2003:4–21). In general, eastern Oregon and portions of

southwestern Oregon are typical golden eagle habitat with large open areas for hunting and abundant cliffs, rock outcrops, and trees for nesting.

METHODS

Historical (pre-2011) records of golden eagle nest locations and use were solicited from state and federal government agencies, conservation organizations, private companies, and private individuals. Records were compared to previously reported inventories (Isaacs & Opp 1991, Isaacs & Popp 1994) and compiled into an updated inventory for the state. Each record included location and history of use information. Precision of locations varied from general legal locations to relatively precise point locations. Use history was recorded by year and location. Histories varied from reports of locations with no history attached to locations with annual nesting outcomes for many years. Historical monitoring protocol and terminology used to describe nest status were not standardized, consequently often were not comparable between regions, locations, observers, or years.

Individual nest locations were grouped into suspected breeding areas based on proximity of location and nesting history. A breeding area was defined as the area used by one pair of golden eagles to nest and could include more than one nest or nest location. In general, nests that were greater than 3.2 km (2 mi) apart were considered to be different breeding areas. Locations closer than 3.2 km were designated as different breeding areas if both locations had evidence of occupation by different breeding pairs during the same year. If necessary, breeding area designations can be changed based

on results of future surveys. Historical data provided the baseline of nest locations and potential breeding areas for field work conducted during 2011.

Field work during 2011 consisted of inventory of historical locations, surveys of likely habitat for previously unreported nests, and monitoring of occupied breeding areas to determine nesting outcomes. Project personnel, some agency cooperators, and most volunteers conducted field work on the ground; most results reported by industry consultants and some by agency cooperators and volunteers were from aerial surveys. Field work was conducted during March–September and was targeted rather than distributed evenly over the study area. Inventory and survey work were targeted for several reasons, including focus on energy-related project areas, re-survey of areas with monitoring history, proximity to historical nest locations, seasonal accessibility, and local interest. Inventory and survey work consisted of visiting historical nest locations and adjacent potential nesting habitat, searching for nests and golden eagles, and recording observations on data sheets (Appendix 1) or in field notes. Primary results of inventories and surveys were coordinates of nests determined as precisely as possible; results of monitoring were descriptions of golden eagle behavior observed at breeding areas.

Locations of nests and outcome codes for breeding areas observed during 2011 were inserted into the statewide historical dataset. Nest locations were designated by seven-place, alpha-numeric codes, e.g. H0001AC or C0001AC. Location codes consisted of an era prefix (“H” = historical location reported prior to 2011, or “C” = current nest location reported in 2011), a four-digit breeding area number starting with “0001” and assigned sequentially as breeding areas were added to the inventory list

(0001–0999 used for historical locations, and 1000+ used for previously unreported nest locations), a letter for the sequence in which the location was added to the breeding area list (“A” = first location, “B” = second location, etc.), and a letter designating the nest substrate (“C” = cliff, “T” = tree, “P” = artificial structure, “G” = ground, “_” = not reported). Thus, H0001AC describes the first nest location (A) for breeding area 0001 that was reported prior to 2011 (H) and was on a cliff (C). Each breeding area also was given a unique name based on local geography. Historical breeding areas could have both prefix H (historical) and prefix C (current) locations that may or may not have referred to the same nest location; previously unreported (new in 2011) breeding areas consisted of prefix C locations only.

Monitoring terminology, protocol, and data summary were based on Postupalsky (1974, 1983), Steenhof (1987), and Steenhof and Newton (2007) with modifications and details described in Isaacs and Anthony (2011:20), and the addition of code “OCES” created for this project. An annual outcome code (Appendix 2) was assigned to each breeding area based on the extent of monitoring and observations of eagle behavior. Age of eaglets was based on illustrations in Hoechlin (1976). Outcomes were tabulated and summarized to produce data on population size, occupation rate, success rate, productivity, and brood size, by county and statewide.

RESULTS

Golden eagle nest locations documented prior to 2011 (n = 1,520, Figure 1) were grouped into 653 potential breeding areas. During 2011, 576 nest locations were observed (Figure 2) and included 135 previously unreported breeding areas. The

combined historical and 2011 golden eagle nest locations (n = 2,096, Figure 3) were assumed to represent 788 breeding areas distributed over 25 counties in Oregon (Table 1, Figure 3).

Inventory, survey, and monitoring efforts included 459 potential breeding areas representing 58.2% of the potential breeding areas listed for the state (n = 788, Table 1). At least one adult golden eagle or solid evidence of golden eagle use for raising young were reported for 280 of 459 potential breeding areas surveyed (61.0% occupation rate), and nesting outcome was determined at 177 (63.2%) of 280 occupied breeding areas. Golden eagles nesting at 177 breeding areas with known outcome were successful at 119 nest sites (67.2% success rate) where a total of 169 young were counted. Productivity was 0.95 young per occupied breeding area with known outcome and brood size was 1.42 young per successful nesting attempt (Table 1). Statewide minimum breeding population size and number of young produced in 2011, estimated using the observed 61% occupation rate and 0.95 young per occupied breeding area, were 481 breeding pairs (788 breeding areas X 61% occupied) and 457 young (481 occupied breeding areas X 0.95 young per occupied breeding area).

Golden eagle nests or golden eagles were found at 278 (85.8%) of 324 historical potential breeding areas surveyed and no nests or eagles were found at 46 (14.2%), suggesting a long-term loss of potential breeding areas of 14.2%. The distribution of historical breeding areas where nests or eagles were not observed suggested that long-term loss of breeding areas was concentrated in the Deschutes County area of central Oregon (Figure 4). Deschutes County contained 36 potential breeding areas that were surveyed (7.8%, n = 459, Table 1) and nests or eagles were not located at 9 (25%, n =

36 surveyed) even though search, inventory, and monitoring effort was similar to or greater than for other areas.

DISCUSSION

Through 1935, Gabrielson and Jewett (1940:195) recorded golden eagles in Oregon every month of the year and in every eastern Oregon county except Jefferson and Sherman. They did not quantify golden eagle abundance, however they categorized the species as “rare” west of the Cascades and “...a common breeding species and permanent resident” of eastern Oregon. Circa 1970, the population of golden eagles in Oregon was estimated at 1,600 individuals, minimum (Snow 1973). Isaacs and Opp (1991) summarized data on nest locations reported in Oregon through 1982 and estimated that at least 500 nesting pairs occurred in the state. Carey (2003: 161) categorized the species as a “common to uncommon year round resident in all counties east of the Cascade Range”, and reported that the population trend in the state was unknown (Carey 2003:162). Results of this study suggested there were a minimum of 481 breeding pairs in Oregon in 2011. Many areas have not been searched for golden eagle nests and are approximated by the blank areas of Figure 3 that are interspersed among nest locations in eastern and southwestern Oregon. Consequently, future field work in those areas could result in addition of many (>100) previously unknown potential breeding areas, based on the results of field work conducted in 2011.

Statewide reproductive statistics shown in Table 1 are the first such data for Oregon. Similar statistics have been reported for populations in other states, and regions within Oregon (Table 2). Occupation rate and brood size for Oregon during 2011

were the lowest of those presented while success rate and productivity were similar to other results. These data should be interpreted with caution because of differences in terminology and protocol between studies. In addition, the 2011 Oregon results may have biases related to coverage, technique, or timing. Population size and occupation rate could have been underestimated and nesting success and productivity may have been overestimated because of breeding areas that were not surveyed or not surveyed to recommended technique and timing protocol for occupation or productivity (Pagel et al. 2010:10).

The disproportionate number of historical breeding areas where no golden eagle nests or golden eagles were observed in central Oregon suggests a long-term decline in breeding areas in that region. Anderson (1985) reported similar results for 20 breeding areas in central Oregon from 1965–1984. During that period, the occupation rate was 100% in 1966 (n = 13), 50% in 1977 (n = 14), and 25% in 1983 (n = 20). Suspected causes of that decline were reduced prey – especially jackrabbits, increased human activity – especially off-road recreation and rodent shooting, and habitat change – especially loss of “old-growth” trees (Anderson 1985). Other golden eagle populations in the contiguous U.S. also have been reported to be declining (Pagel et al. 2010:4). The trends in size and productivity of the nesting population statewide in Oregon are unknown because of insufficient monitoring, and trends may vary by region and have different causes.

RECOMMENDATIONS

- 1) Continue to review and compile historical records – Historical (pre-2011) records of golden eagle nest locations provided the starting point for this project. Gathering and compiling historical records is ongoing but has reached a point of diminishing returns. Another year of compiling historical records should complete most of that work.
- 2) Continue to inventory historical locations – Fifty percent of historical locations (n = 653) were inventoried in 2011. The remaining half of historical locations should be inventoried as soon as possible; the goal for 2012 should be to inventory 75% of the historical locations.
- 3) Expand searches for “new” nests in likely habitat – During 2011, 135 previously unreported golden eagle breeding areas were documented. Those were discovered by searching likely habitat >2 miles from known nest locations. Large areas of eastern and southwestern Oregon have not been searched; the goal for 2012 should be to locate another 50+ previously unreported breeding areas.
- 4) Increase monitoring – Monitoring should include as many breeding areas as possible. However, inadequate monitoring (breeding area(s) visited but nesting status not determined) is an inefficient use of time and resources. Cooperators will be encouraged to monitor as many sites as they can, without sacrificing recommended protocol (Pagel et al. 2010).
- 5) Improve monitoring efficiency – Nesting outcome was determined at 22.5% of breeding areas (177 occupied breeding areas with known outcome, n = 788). Fifty percent monitoring efficiency would improve confidence that the reproductive statistics accurately represent the population, and should be the goal for 2012.

6) Establish long-term monitoring goals, routes, and protocols – Attempting to monitor all breeding areas is valuable to refine survey technique and timing, determine accurate baseline reproductive statistics, and provide input to project managers on short notice. However, large-scale monitoring won't continue indefinitely. Consequently, establishing long-term monitoring goals, routes, and protocols should be done in conjunction with this project.

7) Review existing banding records – Band returns can provide valuable information on movements, longevity, and causes of mortality. Existing band return records for golden eagles banded in Oregon and golden eagles banded elsewhere that were encountered in Oregon should be collected, summarized, and evaluated for relevance to current information needs.

8) Band nestlings – Banding nestlings is not funded in this study but may be the best way to collect information on movements and mortality of a large number of resident golden eagles. Banding crews could coordinate with people monitoring nests to establish locations and timing for entering nests, banding nestlings, and collecting other information or objects (prey remains, addled eggs, feathers, blood samples, etc.).

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Table 2. Comparative reproductive statistics for selected golden eagle nesting populations.

Table 2. Comparative reproductive statistics for selected golden eagle nesting populations.

Source	Area	Year(s)	Breeding Areas Surveyed	Occupation Rate	Nesting Success Rate	Young/Occupied Breeding Area With Known Outcome (Productivity)	Young/Successful Breeding Pair (Brood Size)
This study	Oregon	2011	59	61%	67%	0.95	1.2
Thompson et al 1982	southeast Oregon	1940	7		57%	0.86	1.50
Thompson et al 1982	southeast Oregon	1966-1980	5-18		8%-83%	0.20-1.67	1.42-2.00
Anderson 1985	central Oregon	1965-1984	261	63%	92%	1.48	1.62
Steenhof et al 1997	southwest Idaho	1971-1994			60%		1.57
Beecham & Kochert 1975	southwest Idaho	1969-1971			65%		1.60
Bates & Moretti 1994	eastern Utah	1981-1992	233	78%	60%		
Mcintyre 2002	Denali National Park	1988-1999	56-76	83%	42%-88%	0.16-1.16	1.45

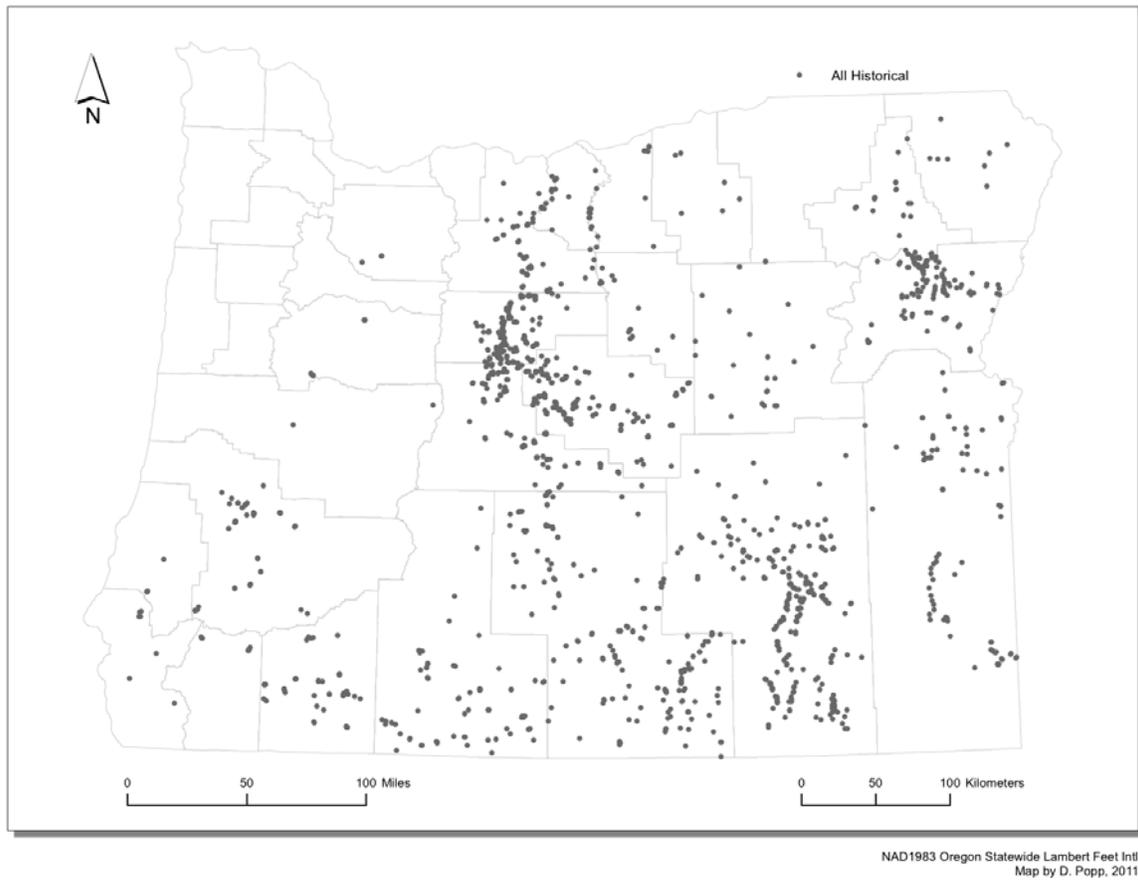
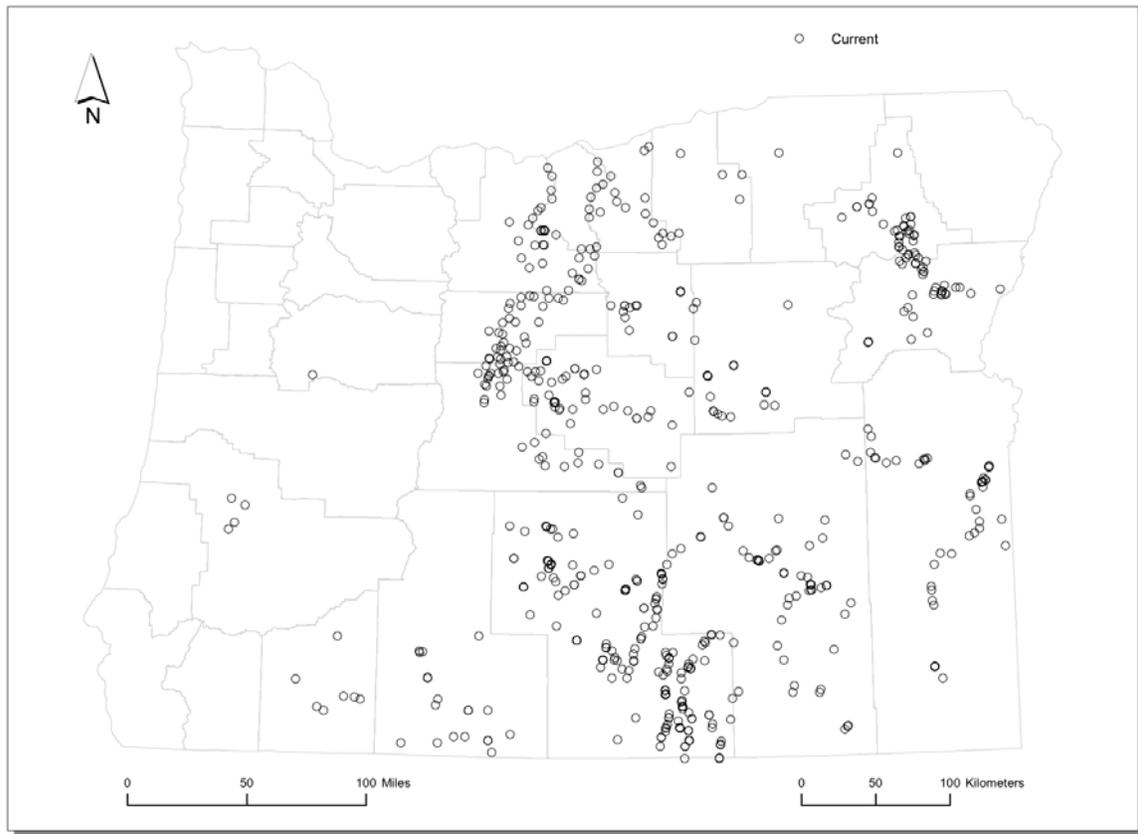


Figure 1. Locations representing 1,520 historical records of golden eagle nests documented prior to 2011 in Oregon.



NAD1983 Oregon Statewide Lambert Feet Inll
Map by D. Popp, 2011

Figure 2. Locations of 576 golden eagle nests surveyed during 2011 in Oregon.

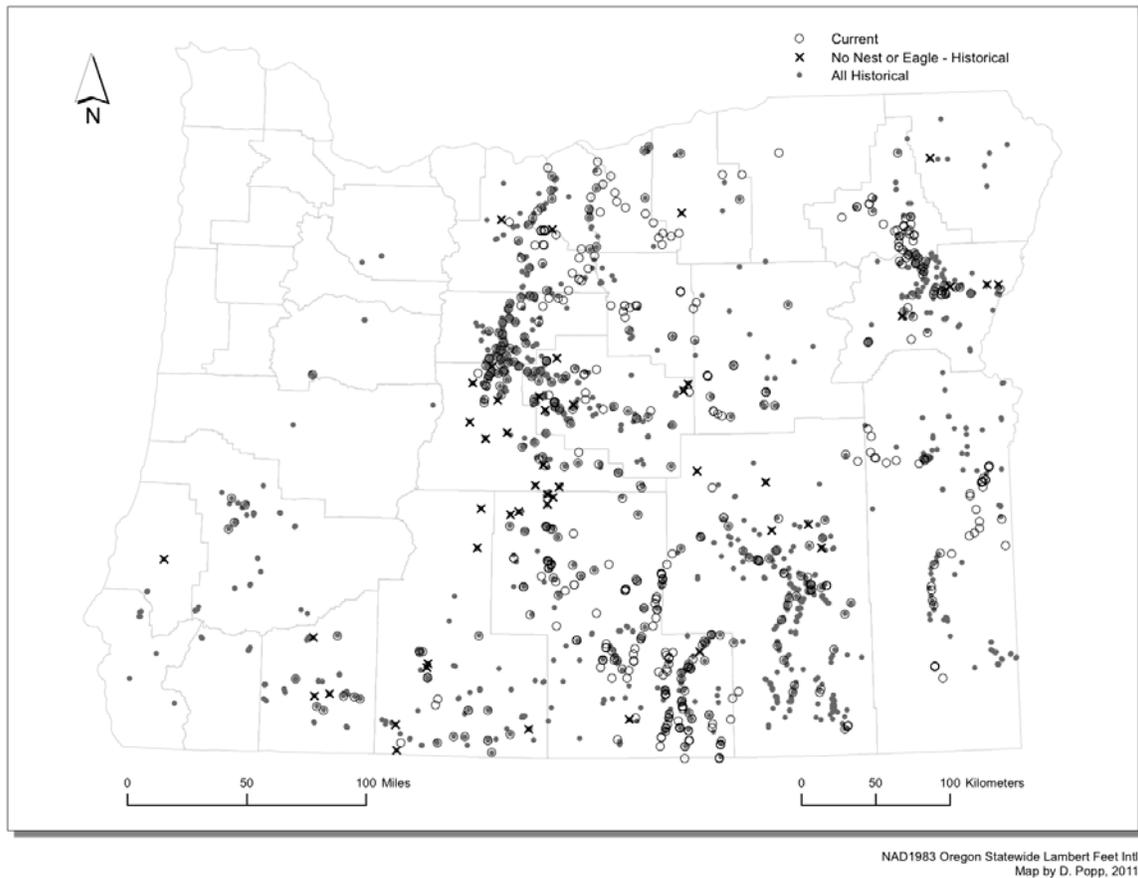
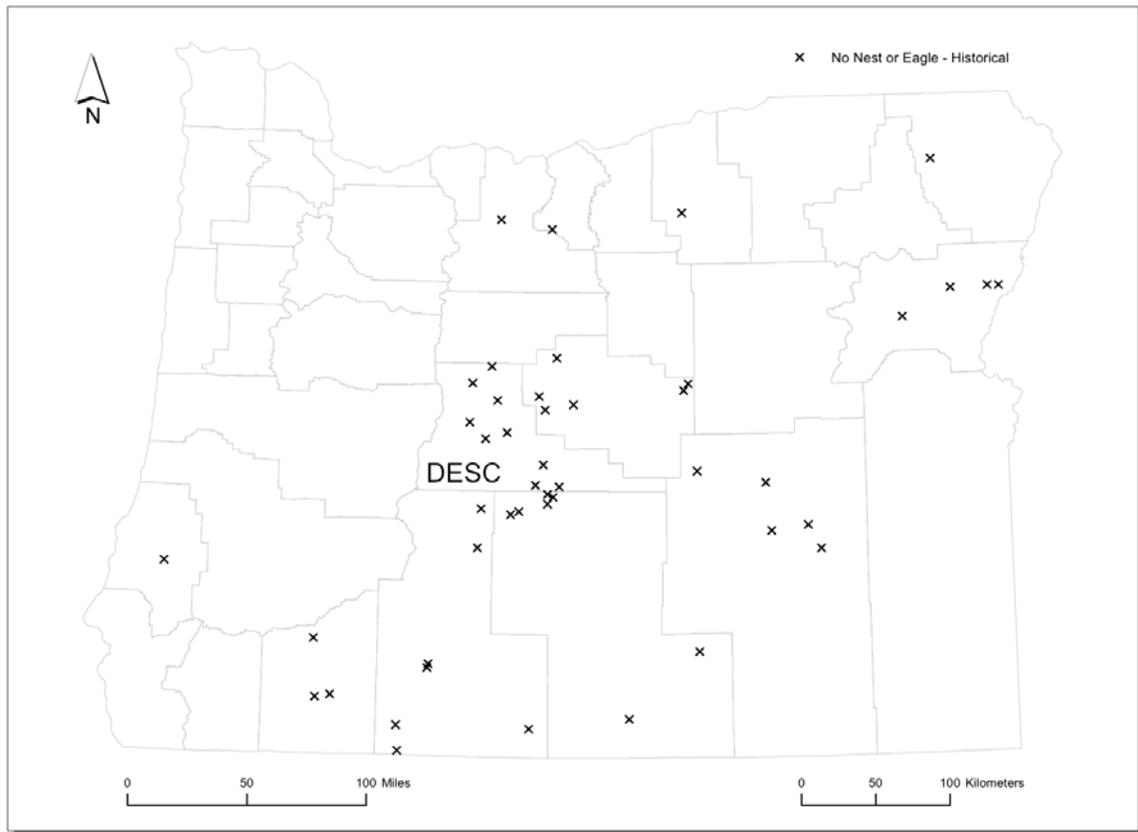


Figure 3. Historical (n = 1,520) and current (n = 576) golden eagle nest locations documented in Oregon through 2011. Locations covered by an “X” were historical nest locations that were inventoried during 2011 and where no golden eagle nests or golden eagles were observed.



NAD1983 Oregon Statewide Lambert Feet Intl
Map by D. Popp, 2011

Figure 4. Historical nest locations (n = 46) that were inventoried and where no golden eagle nests or golden eagles were observed during 2011 in Oregon (DESC = Deschutes County).

Appendix 2. Codes (underlined) and definitions used to categorize annual results of monitoring golden eagle breeding areas in Oregon, 2011.

NS = NOT SURVEYED

UNOC = UNOCCUPIED - Nest present, but no breeding-age eagles detected.

UNOX = POSSIBLY UNOCCUPIED - Not enough information to be certain; outcome unknown; also used for: repaired nest but no eagles.

OCXX = POSSIBLY OCCUPIED - Not enough information to be certain; outcome unknown; also used for: eagles but no usable nest.

OCCX = OCCUPIED - Breeding-age eagle(s) observed but number of eagles not reported; outcome unknown.

OC1X = OCCUPIED 1 - 1 breeding-age eagle and a nest; outcome unknown.

OC2X = OCCUPIED 2 - 2 breeding-age eagles and a nest; outcome unknown.

OCEX = OCCUPIED, EVIDENCE OF EGGS - Outcome unknown; also used for all sites where fresh eggs were collected.

OCCF = OCCUPIED, FAILED - Breeding-age eagle(s) and a nest observed; no evidence of eggs.

OC1F = OCCUPIED 1, FAILED - 1 breeding-age eagle and a nest observed; no evidence of eggs.

OC2F = OCCUPIED 2, FAILED - 2 breeding-age eagles and a nest observed; no evidence of eggs.

OCEF = OCCUPIED, EVIDENCE OF EGGS, FAILED - Evidence of eggs, but no young.

OCES = OCCUPIED, EVIDENCE OF EGGS & SUCCESS - Evidence of fledged young, no young observed.

1d = SUCCESSFUL, 1 SMALL YOUNG - Nestling less than 7 weeks old.

2d = SUCCESSFUL, 2 SMALL YOUNG - One or both nestlings less than 7 weeks old.

3d = SUCCESSFUL, 3 SMALL YOUNG - At least one nestling less than 7 weeks old.

1 = SUCCESSFUL, 1 YOUNG - Nestling or fledgling 7 weeks old or older.

2 = SUCCESSFUL, 2 YOUNG - Nestlings or fledglings 7 weeks old or older.

3 = SUCCESSFUL, 3 YOUNG - Nestlings or fledglings 7 weeks old or older.