

North American Golden Eagle Science Meeting Fort Collins, Colorado 21 Sept. 2010

A collaborative critique of the Golden Eagle's
uncertain future in North America
(Minutes and notes)



Participants from left to right; Pete Bloom, Karen Steenhof, Robbie Knight, Steve Oberholtzer, Tim Breen, Chuck Preston, Mike Collopy, Clint Boal, Robert Murphy, Geoff Holroyd, Bill Howe, Jill Birchell, Jeff Smith, Craig Koppie, Steve Lewis, Mike Kochert, Dale Stahlecker, Terry Grubb, Carol McIntyre, Diana Whittington, Dave Bittner, Brian Milsap, Mike Lockhart, Mike Green, Lupita Bravo-Vinaja, Al Harmata, Mark Fuller, Bob Oakleaf, Dan Driscoll, Todd Katzner, Matt Stuber, Rick Harness, Margi Coyle, Tim Craig, Robert Mesta, Erica Craig, James Driscoll, Jim Watson, Terra Kelly, and Charles Maisonneuve. Photo(s) by Jeep Pagel.



**North American Golden Eagle Science Meeting:
A Collaborative Critique of the Golden Eagle's Uncertain Future in
North America
Minutes and notes¹
21 September 2010
USGS Science Center, Fort Collins, CO**

Table of contents

Introduction	4
Implications of new rule and NEPA decision under the Eagle Act – how does it relate to today's meeting? (Diana Whittington)	4
Brief review of current Golden Eagle research and monitoring activities in North America (facilitated by Clint Boal)	4
Summaries from Golden Eagle Science Meeting participants regarding their Golden Eagle inventory, monitoring, and research work.	5
Identify and rank threats to Golden Eagles (moderated by Clint Boal)	15
Synopsized comments and discussion of risks (broken into categories)	20
Golden Eagle threats from law enforcement perspective (Steve Oberholtzer and Jill Birchell)	23
Questions for research and applied studies; listing of what we currently do not know for Golden eagle.	24
Research needs prioritization; what are the main questions?	26

¹ Notes contributed by: Dr. Geoff Holroyd, Mr. Robbie Knight, Mr. Steve Lewis, Dr. Robert Murphy, Dr. Jeep Pagel, Ms. Karen Steenhof, and Ms. Diana Whittington. **These minutes were collated from handwritten and typed notes, and are not intended to be a stenographic account, direct quotes, or complete transcription of the presentations or discussions.**

Table of contents (continued):

Final hour; population, habitat and disturbance.	26
Generally agreed upon points about research needs and prioritization.	28

Meeting Participants:

Jill Birchell	Dave Bittner	Pete Bloom
Clint Boal	Lupita Bravo-Vinaja	Tim Breen
Mike Collopy	Margi Coyle	Erica Craig
Tim Craig	Dan Driscoll	James Driscoll
Mark Fuller	Rick Harness	Al Harmata
Geoff Holroyd	Bill Howe	Mike Green
Terry Grubb	Todd Katzner	Terra Kelly
Robbie Knight	Mike Kochert	Craig Koppie
Steve Lewis	Mike Lockhart	Charles Maisonneuve
Robert Mesta	Brian Millsap	Carol McIntyre
Bob Murphy	Bob Oakleaf	Steve Oberholtzer
Jeep Pagel	Chuck Preston	Jeff Smith
Dale Stahlecker	Karen Steenhof	Matt Stuber
Jim Watson	Diana Whittington	

INTRODUCTION

Participants at the Golden Eagle Science meeting included invited biologists and eagle experts from federal and state agencies, Tribes, universities, and non-government organizations in the U.S., Mexico and Canada who are conducting research and monitoring of Golden Eagles. This meeting also included those who are assessing and reducing threats to conserve the species in North America.

The following is a meeting summary by topic sequence.

IMPLICATIONS OF NEW RULE AND NEPA DECISION UNDER THE EAGLE ACT – HOW DOES IT RELATE TO TODAY’S MEETING? (Diana Whittington)

- Discussion centered on developing networking of Golden Eagle specialists from throughout North America. Goal of meeting was to assemble known Golden Eagle experts in North America and discuss the panoply of threats facing the species, and redevelop a network of experts who will work toward Golden Eagle conservation.

BRIEF REVIEW OF CURRENT RESEARCH AND MONITORING ACTIVITIES IN NORTH AMERICA (facilitated by Clint Boal)

- There were 21 responses to the questionnaire sent out to Golden Eagle Science Meeting participants prior to the meeting. This questionnaire was developed to ascertain the extant level of research and monitoring of Golden Eagles. Most research activities conducted by the participants concentrate on breeding, reproductive trends, dispersal, mortality and habitat use. Survival, migration, contaminants and home range delineation studies are also being conducted, but in few projects. Genetics of wintering birds is being conducted by only one project.
- Further work on Golden Eagles conducted by the participants was reported to examine anthropogenic impacts including energy, development (housing), military activities, recreation, take by Native Americans for religious use, and contamination.
- Eleven of 21 respondents to the questionnaire indicated that they were marking eagles; only 5 indicated that they were using GPS-PTT, PTT, or VHF telemetry.
- Fifteen respondents were involved in monitoring projects in approximately 10 – 20 areas in N. America, involving 200+ territories. Some of these projects were started over 30 years ago; some have been discontinued. Four respondents indicated that their projects began before 2000; these older studies were not noted by respondent’s questionnaires, but were discussed at the Golden Eagle Science Meeting.

- Eleven respondents have collected blood samples to examine contaminants (heavy metals and DDT/DDE), genetics, disease, and for archiving purposes.
- Most research indicated by the Golden Eagle Science Meeting respondents had been initiated during the past 10 years. Some of this work is in the study area(s) of older projects, allowing for comparison; e.g. Dave Bittner working in Dixon study area.

SUMMARIES FROM GOLDEN EAGLE SCIENCE MEETING PARTICIPANTS REGARDING THEIR GOLDEN EAGLE INVENTORY, MONITORING, AND RESEARCH WORK.

1. *Jim Watson (Washington and US Pacific Northwest):*
 - WA has small Golden Eagle population which includes residents and migrants.
 - A portion of his research has been studying contaminants.
 - Jim is also marking Golden Eagles with PTTs and now GPS-PTTs: Currently he has data on 16 adults and 3 HY birds:
 - Looking at localized movements, home range size.
 - His survey and research work indicates a slow breeding population decline ostensibly due to loss of prey (primarily jackrabbit). This loss of primary prey species appears to have been caused by habitat change. Eagles in territories which appear “stable” are eating prey that appear to have stable populations (e.g. marmots, coyote pups).
2. *Carol McIntyre (Alaska):*
 - Carol’s research has been done in remote (i.e. wilderness) habitat within Denali National Park, Alaska. Resource extraction not present in the Park.
 - Her work has focused on a variety of topics including contaminants, migration, site occupancy, life history parameters; now does much of her work with satellite telemetry. She has documented 97 territories; currently her study population is 80-85 breeding pairs:
 - She has been monitoring this Alaska population for 23 years.
 - Several publications of this work are available.
 - Relatively stable population (or group of territory holders):
 - No decline in occupancy of territories.
 - No information on individual identity of those birds regarding territory turnover.
 - Population dynamics shadow snowshoe hare cycle closely.
 - Little human-caused changes besides climate change.
 - Some recreational use but no impact on productivity.
3. *Mike Green (Oregon):*
 - Mike Green spoke for Kevin Maurice.
 - Starting a statewide survey in 2011 to evaluate current condition of Oregon’s golden eagle breeding population.

- Will be examining productivity and occupancy at known nest sites, and evaluating anthropogenic effects.
4. *Al Harmata (Montana and northern U.S. Rocky Mountains):*
- Has conducted golden eagle work in Montana for over 30 years.
 - Much of this work was to examine contaminants; (lead, mercury, selenium, others) – to date, no significant contaminant issues in the study population.
 - Has had 3 general study areas; evaluated population status:
 - SE MT – population ok.
 - SW MT (n = 117 territories) – population appears stable.
 - Central MT (n = 36 territories) – 50% decline in occupied territories.
 - Recent (2010) study to examine effects of banding at nests was delayed due to poor weather.
 - Plans a PTT study to look at survival.
 - From 317 migrants banded, have very few band returns (3 recoveries within 50 miles of banding location).
5. *Maria (Lupita) Guadalupe Bravo-Vinaja (Mexico):*
- Not much information on Golden Eagles in Mexico.
 - Her doctoral work is being done in Chihuahua, Mexico.
 - Has monitored 33 territories:
 - Only 30% active in 2010.
 - Her study will be looking at relationships between productivity and landscape factors.
 - Primary issues in Mexico appear to be:
 - Electrocutation of adults, i.e. antiquated power distribution system.
 - Death of golden eagles in stock water tanks seemingly a large issue in Mexico.
 - Mexico has a Golden Eagle working group.
 - Mexico has endangered species list under review: Golden Eagle considered “under threat.”
6. *Dale Stahlecker (Texas and US Southwest):*
- Has done considerable work on Golden Eagles.
 - Currently working with Native American Tribes – Northern New Mexico and southern Colorado:
 - Fixed-wing surveys to monitor several hundred territories.
 - Tribes keep data confidential.
 - Data on 100+ territories, however data incomplete (i.e., not all territories checked every year).
 - In Texas, to date no obvious downward trend in occupancy:
 - Notes 2 years of low reproductive output – due to 2 bad years (back to back) of jackrabbit numbers.

7. *Charles Maisonneuve (Eastern North America; Canada):*

- He has placed PTTs on Golden Eagle near wind-development projects in Quebec, Canada; so far 3 years on current project:
 - eagles from 13 territories are currently being monitored.
 - Examining overlap of home range with wind facilities to direct where to place turbines and to see if some need to be moved.
- Also looking at lead contamination from spent ammunition from moose hunting in province.
- Collecting pre and post construction data from wind facilities.
- Using PTT tags to examine migration and wintering areas; currently Golden Eagles migrate to the United States to spend fall and winter (see Katzner below).

8. *Todd Katzner (Eastern North America, US):*

- Working on relationships with wind energy development in eastern United States and migration ecology in central Appalachian Mountains. Is on the other end of migration of birds marked in Quebec (i.e., eastern Golden Eagle population).
 - Uses hourly GPS telemetry; however data not sufficient. E.g. locations weren't working for their migration models.
 - Using new GPS-GSM technology that transfers GPS location data via cell phone network:
 - Locations collected every 15 min during winter and 30 sec locations while in migration.
 - Examining risks from wind development during migration.
- Examining the genetic uniqueness of the eastern North America Golden Eagle populations. Doing mark-recapture studies; alternative-non-invasive studies using feathers.
- Approximately 1,000 – 2,000 Golden Eagle are passing through migration locations in eastern United States; however indicated that we have no solid information on the current numbers of Golden Eagle in eastern North America.
- Other comments:
 - PTTs and survival studies can be problematic, however indicated that alternative to survival estimates using GPS telemetry may be useful as they show three dimensional use of habitat.
 - Indicated that legislation regulating research on eagles is holding back some research; i.e. difficulty in getting timely research permits.

9. *Jamie Driscoll (Arizona):*

- In Arizona, he is looking at approximately 70 territories which were documented during surveys in 1970s (outside reservation boundaries).
- In 2006, volunteer effort to go back to sites – of the 70 territories, only 12 were still occupied (unfunded survey).
- This effort led to further investigations:

- Approximately 115 records of territories in AZ.
- Recently started Arizona's Southwest Golden Eagle Management Committee.
- Got funding for complete population survey in 2011:
 - Surveys will be helicopter-based.
 - No real sampling 'design' – will look at certain slopes (topography over 50 degrees) and places where development might be an issue.
 - There is some access to military lands.
 - This effort will be a one time survey, however may be a good method to determine if survey bias between ground and air inventory methods exist.

10. *Margi Coyle (North Dakota):*

- In 2002, revisited past survey effort in North Dakota:
 - Took 6 years to compile and digitize data.
 - During work, she visited 641 historical territories; found that only 450 still existed:
 - Historic surveys in North Dakota were poorly designed so determining trends from the data was difficult.
 - She designed a new survey incorporating detectability:
 - 48% detectability.
 - 35 occupied nests; 22 other nest sites indicating occupancy.
 - Many of the nests being found are new to the survey.
- Has put PTTs on 18 birds over 2 yrs. for a migration study:
 - Only 1 or 2 still surviving.
 - Fledged successfully but died soon after.
 - Most mortalities were caused by electrocution, 'stuck in the mud', wind storms, West Nile Virus (detected), lead poisoning, and shooting (associated with pheasant hunting).
- Pheasant "hunters" bragged about shooting raptors, including Golden Eagles:
 - 2 people shot 176 raptors.
- Genetics work to look at relatedness:
 - Found cooperative hunting between pairs.
- Approximately 66 occupied territories in state-wide population survey (used fixed wing aircraft):
 - 7% occupancy of historic sites.

11. *Terra Kelly (California):*

- Contracted by California Department of Fish and Game to look at lead poisoning in avian predators; examined Golden Eagles found in California habitat within the current range of California Condor:
 - Tested scavenging birds before and after ban on lead ammunition within California Condor habitat (field work started in 2007, and is finishing now).

- Looked at the range of contaminants and disease within the Golden Eagle population; also examining causes of mortality in Golden Eagle per information from rehabilitation centers in the state.
- Unknown as to the extent of West Nile virus impact on Golden Eagles. Currently examining diseases in state population.

12. *Teryl Grubb (Utah and Rocky Mountain States):*

- In Utah, developed a U.S. Forest Service-funded study of the effects of heli-skiing on Golden Eagles in mountain habitat:
 - Behavior uninfluenced by helicopter use.
 - Also looked at U.S. National Guard helicopter flights;
 - No real issues at nests.
 - 20 territories monitored (study complete; 1 year of data collection).
- Noted that sheep herders are still shooting eagles.
- Untold numbers of golden eagle nest sites on public lands are being affected by additional activities. The real disturbance is not heliskiing and military disturbance, but that many nests in other areas (away from good skiing locations) are being affected by Off-Highway Vehicles (OHVs), sheep herders, camping, climbing, etc.

13. *Bob Oakleaf (Wyoming):*

- In Wyoming, Golden Eagle data collected secondarily:
 - Data arose from trying to find locations to hack Peregrine Falcons that were not near Golden Eagle nests (within 2 miles).
 - Data also arose from before and after studies of oil and gas extraction and wind energy development.
 - All work was conducted during breeding season.
- Territory occupancy seems stable (anecdotal collection efforts).
- Golden Eagle was a low priority in state but some places looked at effects of development, some survey work, and some desire to sample state population.
- Questions from some datasets:
 - What does occupancy rate mean?
 - In some parts of Wyoming it seems to mean nothing while in others, occupancy rate appears to be a very important metric.
 - What is occupancy rate versus actual numbers?
 - How many Golden Eagle do we need to maintain a stable population (how many is enough)?
 - What time frame do we use to 'anchor' the numbers?

14. *Rick Harness (Western US):*

- Electrocutations – what is happening in western U.S. and Canada:
 - Surveyed western jurisdictions for information on electrocution mortality.
 - Surveys suggested that approximately 68 eagles per year killed – probably under-reported.

- In Wyoming, there appears to be approximately 60 Golden Eagle mortalities per year over last 21 years (per data, this is a low estimate).
- Electrocutation continues, far too frequently.

15. *Dan Driscoll (California and Arizona):*

- Golden Eagle survivorship at Altamont in California (published with Grainger Hunt) – 240 VHF transmitters.
- Sex determined by measuring tarsus.
- Need to establish standardized protocols; Grainger Hunt and Dan have created a nest territory sampling protocol which may be used by others so that surveys are done the same way.
- Worked with Juan Vargas in Mexico putting out PTTs (all PTT's failed).
- Plan to put 200+ PTTs on Colorado Plateau on Navajo lands:
 - Survivorship study.
 - Unfunded currently.
- Recommends development of international protocol for blood and other samples; some of this material may need to be curated for long-term analysis.

16. *Chuck Preston (Wyoming):*

- Has examined Golden Eagles as part of predator/prey dynamics study in Greater Yellowstone ecosystem area of Wyoming.
- Study in Bighorn Basin of Yellowstone (~2000 km²):
 - Fixed wing surveys followed by ground based surveys.
 - In 2009, found 42 nests.
 - In 2010, found 60 nesting territories, 30 occupied.
 - Monitoring occupancy, productivity, and survival.
 - Modeling habitat around nests (0.5 km and 1 km), human activity, and other variables.
 - Entering nest sites for prey remains and to collect Golden Eagle feathers for analysis.
- Local dogma that eagles are taking lots of Sage Grouse – prompting many Sage Grouse hunters to shoot eagles. Believes that hunters are killing quite a few Golden Eagles.
 - Working on lek surveys for Sage Grouse.
 - Working on diet studies and some prey availability studies (Sage Grouse, mammal surveys).
- Will be capturing and banding Golden Eagles; have planned to use patagial markers.
- Will hopefully be capturing migrants; band recoveries may help determine source (hoping to find out with bands).
- Initiating education curriculum for K-12 using eagles as model of conservation; e.g. for ecological principles.

17. *Robbie Knight (Utah):*

- Working in the U.S. Army's Dugway Proving Ground, nw Utah (with Mark Fuller).
- Coordinating across agencies and NGOs to create map of military operation areas with all known territories and nesting areas (Golden Eagle, Ferruginous Hawk, and Burrowing Owl).
- Plans to conduct more inventories.
- Note: State wildlife action plans – may be a good way to get funds for Golden Eagle work.

18. *Pete Bloom (California):*

- Has marked Golden Eagles to try to learn about site fidelity and dispersal in California; started his work in 1974. Also part of Golden Eagle workforce for NW Nevada in the mid 1970's. Work has been self-funded; i.e. pro-bono.
- Has banded 180 HY and 200 adults.
- Has also looked at 110 territories (1-14 nests per territory):
 - In the past has published food habits data.
 - As well as prepared some reproductive data for publication.
- Noted that Butch Olendorff's work in Pawnee National Grasslands on Golden Eagles could be revisited.
- Found relationship between recreational hunting and blood-lead incidence in Golden Eagles while working on California Condor study in CA (being revisited by Terra Kelly):
 - Found that 1 in 3 Golden Eagle had elevated lead (> 0.2 ppm) during hunting season.
- Terra Kelly repeating some aspects of his original contaminants study – i.e. comparison with study from 1980s.
- Lots of nests being found on or near solar/wind farms – need to get all information from the companies and their consultants for a complete census of nest sites; it will be important for the FWS to safely collate and archive these data. Not all information being reported to agencies.

19. *Mike Collopy (Western US):*

- No current Golden Eagle work; see literature for past work.
- Recent work with graduate student on Sage Grouse, perch deterrent (discourager) – Golden Eagles weren't really taking many Sage Grouse.

20. *Mike Kochert (Idaho):*

- Has concentrated his Golden Eagle work in SW Idaho (collaborating mostly with Karen Steenhof).
- 64 nesting areas (territories) intensively monitored since 1970 (some data back to 1966).

- Three study periods looking at home range and habitat use (see Mazluff and Knick 1997. Auk).
- Trends:
 - Number occupied in 2009 vs. those in 1971 = 30% decline.
 - Total young fledged has not really changed (within range).
 - Suggests a few territories doing a lot of the producing; i.e. most of young produced in the study population coming from just 'a few' territories.
- Currently looking at Golden Eagle vs. OHV use with Karen Steenhof (she is giving talk on this subject at 2010 Raptor Research Foundation meeting).
- Diet data – within their study area, abundance of black-tailed jackrabbits had direct relationship on eagle numbers (weather also confounding factor).
- Given large changes in habitat due to fires (loss of shrub habitats), still have some birds producing there:
 - Would like a study to compare with non-burned areas.

21. *Jeff Smith (Western US):*

- Has done considerable migration work in western U.S. (formerly with Hawkwatch, now independent):
 - Data from migration monitoring throughout the west suggests declining trends in Golden Eagle numbers (but with some confounding details).
 - Thinks that long-term decline is real.
- Has found some differences between Great Basin vs. Rocky Mountain Front Golden Eagle migration routes; trends in locations and seasonality:
 - Ups and downs in counts in Great Basin.
 - Steady declines in Rocky Mountains.
- Has put PTTs on juvenile migrants – working on publication:
 - This work provides insight into where birds on different migratory pathways are originating from.
- Is working with Robbie Knight on Dugway Proving Ground (discussed above):
 - 110 territories (50-60 territories were found to be occupied each year);
 - Started work during drought and watching population recover after end of drought.
 - What are issues with cheatgrass taking over after fires (nesting habitat change).
- Currently looking at a 2.5 year retrospective analysis in se UT and sw WY:
 - 10-year helicopter study in UT, longer work in WY.
 - Looking at effects of oil and gas development.
 - During development, occupancy rates down but seemed to recover once initial development ends and just under production.
- Recently published a perch guard study in J. Wildlife Management.

22. *Erica Craig (Western US and Alaska):*

- Working with Tim Craig, Mark Fuller, Mike Collopy, and Diana Whittington.
- Work in western US; concentrated on Golden Eagle wintering ecology.
- Wintering birds and contaminants:
 - Nine-yr. study – approximately 340 birds captured.
 - approximately 50% had elevated lead levels (> 0.2 ppm in blood).
 - Also tested some juvenile birds – found no elevated lead levels.
 - Found no elevated levels of mercury.
 - All blood samples archived for future use.
- Six PTTs deployed – max time the units worked was 1.5 yr (data in BLM Technical Note 1998 – available on-line).
- Looking at information of wintering bird distribution and breeding season to develop a predictive model for survey design.
- Attempting to do a Western genetic analysis of archived blood (wintering population), samples of breeding birds, and samples from other cooperators to examine population connectivity.
 - Key questions may be; can you identify birds from different origins by genetic analysis?
 - Is the genetic structure of Golden Eagle populations “changing” from year to year?
- In Alaska:
 - Has been examining relationship between Golden Eagles and development projects on BLM lands.
 - Conducted one-time survey of raptors along the Dalton Highway in 2010, including Golden Eagles.

23. *Dave Bittner (California):*

- In Dixon’s original study > 100 pairs, or territories in sw California. Current study suggests decline from 88 “original” pairs in his study area from just over 20 years ago to 46 territories currently. Some breeding studies in southern CA:
 - Fire ecology and population work.
 - Housing development reducing number of territories.
 - Recreational climbing an issue to the eagles.
- Some migration studies in Montana (PTTs deployed) – had some birds end up in Alaska (several there currently).
- Currently doing Mojave Desert work related to wind energy issues.
- Recommends that the Service needs to develop a better way to protect and share information.

24. *Bob (Murph) Murphy (US Southwest):*

- New Mexico Golden Eagle Information:

- PTT pilot study – want to learn about survival of different age classes in Four Corners region.
- Wind energy development will be an important focus of the study.
 - Goal = 5 year study, up to 12 PTTs deployed/ year.
 - So far, 8 HY Golden Eagles have been marked.
 - Look at wind energy issues;
 - Gather information on dispersal.
- Take for Native American religious purposes has been an issue in the U.S. southwest.
- This project is looking for collaborators on a demographics study.
- Also, USFWS Southwest Region heads the WEST, Inc. Golden Eagle fixed wing surveys:
 - Pilot study in 2003 – 4 BCRs in western US (roughly three-fourths of the Golden Eagle breeding population in the western states).
 - Systematic survey – 217 transects, 100 km in length:
 - Mid-Aug to mid-Sept when HY birds are still on territories.
 - Has been done for 5 years.
 - Point estimate = approximately 25,000 birds (range of 18,000 – 32,000).
 - No clear trends from this data, too early to tell. However, declining numbers of juveniles in southwest region are of concern.
 - Using data from this survey to guide decision making under new permit program.
 - Developing indirect index of productivity; USGS, Population and Habitat Assessment Branch (Patuxent) will be taking over.
 - Brian Millsap added that the USFWS is using this survey to inform population models used to calculate thresholds for take.

25. *Brian Millsap (Southwest US)*

- Using Grainger Hunt's Moffett's equilibrium model to analyze WEST data.
- Hopefully the data and analysis will help biologists understand and express a level of risk regarding Golden Eagle 'take' and conservation.

26. *Clint Boal (Texas):*

- Not currently doing Golden Eagle work.
- In TX, revisited previously known Golden Eagle nest territories.
- Preliminary data suggests that there may be a population decline of 30% - 50% (but some issues with survey design).
- Perhaps issue was in part juniper encroachment, however true reason of decline is not known.

27. *Mark Fuller (Great Basin and Northern Rockies):*

- Two projects on Dugway Proving Ground, Utah:
 - Survey and monitoring.
 - Developing long-term monitoring strategy of raptors – will concentrate on occupancy modeling.
 - Wants to develop something repeatable over time.
 - Wants to develop a practicable approach that optimally uses personnel.
 - Using an intensive survey design to find nests and monitor during training and testing activities.
 - Also will ascertain the effects of training and testing on breeding raptors.
 - Work will occur mostly during breeding season but will also include some non-breeding season work.
 - Identify nests, radio-mark birds to look at movements relative to training activities.
- Create a map of where studies have been done to date. Information and data are not in a centralized data base.
- Need to develop some method to capture point location (site specific) information.
- Wants to get data into Coordinated Bird Monitoring Database (CBMD):
 - Allows data sharing.
 - Data owner controls on who may access and use the information.
- Started with Mike Yates sending out a survey (questionnaire) to agencies, NGOs, and individual biologists.
- Send another survey to contribute to Diana Whittington's call for information on Golden Eagles.
- Making one more pitch to contribute data to CBMD – why?
 - Lots of data out there that are not being analyzed.
 - Lots of turnover in agency personnel can lead to lost data.
 - Will provide a map to show where gaps in data occur.
- Outcome:
 - Identifying studies that should be continued for long-term monitoring.
 - Outline what information exists and show directions on where to go.

IDENTIFY AND RANK THREATS TO GOLDEN EAGLES (moderated by CLINT BOAL)

Results of threat assessment survey sent to meeting invitees:

- 26 respondents had various manipulations of replies; 21 of the respondents could be used for analysis.
- Nine variables ranked at 1-5 by 1-18 respondents.

- Most concerns per Golden Eagles regarded.
 - Habitat loss (82 % of respondents).
 - Collision.
 - Electrocutation.
 - Renewable energy.
 - Range and grazing management.
 - Lead (32 % respondents).
- Despite statistical limitations, the survey was meant to get participants to consider short-term and long-term threats to Golden Eagle and to generate discussion here at the North American Golden Eagle Science meeting.
- Variation in responses appears to be influenced by location (region) from which respondents had the bulk of their experience and also the breadth of experience of the respondent.
- Recommend a more definitive and well constructed survey of risks to develop publishable results. This survey may serve as a good baseline because of the trends conveyed by the respondents.
 - Other comments: (**NOTE; These are not direct quotes**).
 - Climate change not listed on survey but thought by some to be a large threat.
 - Need to distinguish risks to individuals and risks to the population. (*Bob Oakleaf*)
 - May wish to evaluate the benefits and detriments of alternative energy production to Golden Eagles; e.g. wind generation facilities become, in some instances, *de facto* habitat because of losses of habitat to urbanization. (*Dan Driscoll*)
 - It will become important to extract data on sources of mortality. (*Brian Millsap*)
 - It will also be important to share satellite information (data) from various past and current studies. (*Carol McIntyre*)
 - Will need to examine regional risks; e.g. difference between e and w North America Golden Eagles. (*Todd Katzner*)
 - How do we define regions; based on ecology, natural vegetation, administrative boundaries? (*Clint Boal*)
 - Need context of what we can do something about; i.e. we will not be able to stop wind farms and subdivisions. It is important to put Golden Eagle conservation in context of what we can actually do. (*Al Harmata*)
 - What is the general recognition of primary risks (see threats analysis)? (*Clint Boal*)

- We do not really know the current impact of wind energy on Golden Eagles; missing data on mortalities. (*Dave Bittner*)
- All of the concern on Golden Eagles comes back to a question of scale. (*Chuck Preston*)
- May need to develop a ranking of direct or indirect mortality due to habitat loss. (*Margi Coyle*)
- Shooting of Golden Eagles did not make it into the top 5 list of threats; the Office of Law Enforcement sees a considerable amount of mortality due to shooting. (*Steve Oberholtzer*)
- Taking Steve's comment further; there are other forms of mortality which we (researchers) are not aware of; e.g. 200-300 eagles recently taken for the illegal feather trade. All of us are working in a small area and may not see what others see in other regions. (*Brian Millsap*)
- In CA (Altamont Pass Wind Resource area), are finding occupancy and productivity at core territories based on availability of ground squirrels around the towers which cause considerable mortality. Also, in peripheral areas in Arizona, we are finding people (as seen by Golden Eagle field crews) hunting eagles (ostensibly for the feather trade); once "hunters" find an eagle territory, the eagles disappear. There may be a "sink" of human-caused "take" of eagles that may not be fully appreciated. (*Dan Driscoll*)
- Habitat loss is a considerable threat to Golden Eagles. Electrocutions and losses associated with renewable energy take all age classes of Golden Eagles, and are a significant loss to the population. However, there is also concern regarding lead poisoning. You don't find lead poisoning unless you are specifically looking for it. There is also background "noise" or loss of Golden Eagles associated with West Nile virus and rodenticides. For example, in s. California, Red-tailed Hawk and Red-shouldered Hawk populations are down significantly; and White-tailed Kites are essentially "gone." (*Pete Bloom*)
- Another source of data which may be tapped to derive sources of mortality is raptor rehabilitators. Presumably there could be data gleaned by the FWS from these cooperators. (*Chuck Preston*)
- Lead and rodenticides were, from her perspective, in the top three with electrocutions and collisions. May need to do a retrospective study to determine the key causes of mortality. (*Terra Kelly*)

- The Eagle Repository is potentially a key source of information, however there is currently a lack of data from this facility which is available for analysis. (*Rick Harness*)
- Appears to be comparable threats assessment from those colleagues with common experience. (Raptor Information System) system has considerable information which may be helpful during future Golden Eagle work. (*Mark Fuller*)
- Risks from solar farms and associated habitat loss are considerable. For example, the “paving” of multiple +8000 acre areas in wintering habitat will have potential negative effects. (*Erica Craig*)
- Related to Rick Harness’s comments; recently (within the last three months) had a band recovery of a 24-year-old eagle from the Golden Eagle Repository; however the Repository was unable to provide even the most basic information on this bird-including location of death. What a loss of knowledge! (*Pete Bloom*)
- Golden Eagles have fed at dump sites where euthanized pets have been discarded. This suggests that there are other sources of Golden Eagle mortality which may affect the population; current threats analysis may be somewhat biased. (*Brian Millsap*)
- Adding to Brian Millsap’s comments; some of these Eagles fed at dumps, and then went to power poles and were electrocuted; is source of mortality the power pole or the poisoning that induced lack of coordination of the eagles? (*Rick Harness*)
- Feather isotope work necessary; need to determine which are the migratory birds and the resident birds with regard to threats and mortalities. (*Jim Watson*).
- Have put out 100+ VHF transmitters. During recovery, have found desiccated birds from which no samples could be recovered. Believes that poisoning and lead may be a larger issue to the population. (*Dave Bittner*)
- Has been able to recover her telemetered birds quickly; perceives an “alley of death” in Alberta. Starvation and poisoning may be a larger issue of Golden Eagle mortality; available data may just be scratching the surface. (*Carol McIntyre*)
- From his experience, eagles were often emaciated when they got to rehabilitators. However, there appears to have been no follow-up on those eagles as to the original cause of emaciation. (*Clint Boal*)
- It may become important to develop a network of people who can respond to “downed” eagles (transmitter equipped eagles who are thought to be

dead or injured) to get causal information on eagle mortalities quicker, and develop a standard protocol of what could be done when the eagles are located (site location, photographs, samples, etc.). (*Brian Millsap*)

- With PTT and GPS PTT is it easier to send people to the specific location quicker. (*Dale Stahlecker*)
- Specific protocol exists in Arizona for recovering eagles; all birds are sent to the National Wildlife Health Center (Madison). A preliminary result of this is that we found that some nestlings have West Nile virus and are living with it. (*Jamie Driscoll*)
- This is an important consideration; local people can get out faster. (*Jim Watson*)
- Are there private land issues for access for finding downed eagles? (*Clint Boal*)
- In North Dakota, we have had 100% land owner cooperation. State agencies may differ with others on objectives. (*Margi Coyle*)
- With his banding impact study, have had difficulties with land access. Approximately 60% of territories were off limits by the landowners; e.g. could not enter the property. This appears to be more of a problem with “new” landowners. This may be due to the difficulty of the “wolf” issue, and that new landowners are looking at researchers as “enemies.” (*Al Harmata*)
- With regard to landowner access; could the USFWS Office of Law (OLE) Enforcement help? (*Brian Millsap*)
- USFWS Law Enforcement can access to private lands. Asks that researchers include OLE in their communications, and extends a hand of cooperation to eagle researchers. The USFWS Forensic Lab (Ashland) is used heavily by OLE to determine causes of mortality. (*Steve Oberholtzer*)
- Indicated that on domestic sheep lands, generally no access was allowed; however for lands where cattle were grazed, generally good access. (*Jeff Smith*)
- Found that in Arizona, no difficulties with access for first 3 years of their study. However, after the listing of a snake (on endangered species list), there were new restrictions to private lands; the landowners did not want to allow access to eagle researchers. (*Dan Driscoll*)
- Carcasses and parts representing 635 eagles were recovered from 01 Oct 2009 – 26 August 2010; 496 of these were in the USFWS Mountain-

- Prairie Region. Numbers do not equal all birds collected; only those tabulated here. (*Steve Oberholtzer*).
- Afternoon discussion; (continued discussion regarding Golden Eagle threats)
 - Lead poisonings may be overstated based on his experience. (*Al Harmata*)
 - Secondary poisoning of Golden Eagles is worth considering. (*Matt Stuber*)
 - Newer literature suggests that the cut-off for defining lead exposure may be lowered to 0.05 – 0.1 ppm, versus current 0.2 ppm. Current studies may be sampling only the “middle” level of exposure; sublethal levels of lead exposure occur. For example healthy birds may be avoiding lead exposure, those with high levels may not be healthy enough to find food (in her study instance, bait). (*Terra Kelly*)
 - Must weigh risk of exposure to lead poisoning versus the risk of harm; for example risk of exposure in the Rockies may be high, but the risk of harm is unknown. (*Chuck Preston*)
 - More research on lead contamination is undoubtedly necessary. (*Clint Boal*)
 - Levels indicated by Terra equate to their recent findings. (*Jim Watson*)
 - Golden Eagles may be getting repeated exposure; breeding and non-breeding areas. Long term exposure is a concern. (*Erica Craig*)
 - Disagrees with Al; condors are trapped quarterly and chelated due to repeat exposure of lead poisoning even with the lead ban in California Condor habitat in California. (*Pete Bloom*)
 - May need to look at data regarding the banning of lead shot and relation to eagle contamination. (*Clint Boal*)

SYNOPSIS COMMENTS AND DISCUSSION OF RISKS (BROKEN INTO CATEGORIES):
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Risks Missed on threats survey:

- Stock tanks:
 - Is the apparent high mortality at stock tanks really due to drowning?
 - Or are birds coming to tanks because poison has caused them to crave water and they subsequently die from poison?
- Unknown risks (e.g., Phenobarbital in euthanized pets left in landfills).
- Law enforcement staff thinks shooting issues are missed in a lot of studies.
- Solar farms weren't mentioned but could be a big risk due to habitat loss.

- Illegal take of Golden Eagle for feather trade.

Issues Associated with Risks:

- What is the scale of the risk?
 - Is the risk to INDIVIDUAL(S)?
 - Is the risk to POPULATION(S)?
- Categories of risks and effects vary:
 - One-time but permanent – e.g., habitat loss.
 - Chronic – e.g., electrocution.
- What determines the level of risk?
 - Persistence of the threat on the landscape.
 - Capacity to cause disturbance and mortality.
- Importance of regional perspective on risks; perspectives will vary per the known and perceived risks which vary per regions and per researcher.
- Need to also incorporate benefits and trade-offs into risk discussion:
 - e.g., Altamont is now the only grassland left in that area of c California due to urbanization of surrounding lands, thus it still provides food for eagles while also presenting risk (and continued known mortality) from turbines.
- Partition risks: DIRECT vs. INDIRECT mortality factors.
- Wind energy may be the “tip of the iceberg” with regard to a primary cause of Golden Eagle mortalities-whether this is a fear or reality remains to be seen.
- Issues with private land ownership?
 - USFWS OLE suggest that access to private land is possible if the need exists (e.g., to recover birds).
 - Should include State and Federal law enforcement in searches for PTTs and other mortalities. Increase coordination between researchers and OLE.
 - Access (or cooperation) sometimes depends on landowner – e.g., sheep herders very uncooperative while cattle herders were fine.

Other Sources of Information on Risks:

- Collectively, we could ‘mine’ transmitter data (both PTT and VHF tag) for causes of mortality, potential risks, and other information (research need).
 - PTTs represent opportunity to learn about causes of mortality (‘risks’) that often can’t be learned by solely banding birds.
 - Transmitter allows us to find dead birds in remote areas.

- Disease and poisoning could be bigger risk than thought because we aren't likely to find birds killed this way.
- "Movebank," an online data repository and community for animal tracking and photo monitoring, could serve to pool PTT data.
- Need to develop a western states and provinces network of field capable personnel able to respond if a tagged bird goes down and have standard protocol on how to process birds and what analysis to be done.
- Raptor rehabilitation facilities are a good source of information.
 - Based on Terra Kelly's experience, lead and rodenticides are in top 3 for causes of mortality.
 - Noted that raptor rehab facilities (in CA) put out publication about causes of mortality every few years.
- Birds coming into National Eagle Repository – could be a great source of untapped data.
 - However, we should remember that some sources of data on mortality could be biased (such as birds turned in to the Repository).
- Look at declines of other species and consider which risks affect Golden Eagle.

General Comments of Risks:

- We should focus on risks that we can do something about.
- We need to educate the public about threats to Golden Eagles.

Listing of Risks by Regions:

In order of threat risk suggested by most participants:

Direct Mortality:

- Electric Infrastructure (included electrocutions and collisions with wires).
- Lead:
 - General feeling that we are underestimating lead poisoning;
 - However, some questions about the risk of lead:
 - What are the levels we are talking about?
 - Is lead a proximate cause of other mortality causes (e.g., starvation, disease, accidents, collisions, etc.) or is it the ultimate cause of mortality?
- Wind Energy Development (collision mortality)
- Shooting
- Trapping – incidental to furbearer trapping (mainly e Canada).
- Water Tanks – drowning in livestock watering tanks
- Collision with Vehicles

- Poisoning.

Indirect Mortality:

- Habitat Loss
- Recreation
- Research Impacts
- Climate Change

GOLDEN EAGLE THREATS FROM LAW ENFORCEMENT PERSPECTIVE (Steve Oberholtzer and Jill Birchell)

Working Lunch Presentation from US FWS Law Enforcement personnel.

Law Enforcement information will be released by the Office of Law Enforcement, and made available at a later date due to the sensitivity of the discussion items.

QUESTIONS FOR RESEARCH AND APPLIED STUDIES; LISTING OF WHAT WE CURRENTLY DO NOT KNOW FOR GOLDEN EAGLE.

1. What facilitates recruitment into breeding and floating populations?
2. What are causes of mortality of Golden Eagle?
3. Quantify current causes of mortality; i.e. Work with Office of Law Enforcement and the National Eagle repository, researchers, raptor rehabilitation facilities, and other state and federal agencies that may have dead eagles in their possession.
4. What is the relative importance of lead poisoning and what are major spatial, temporal, and age-specific factors in lead poisoning Golden Eagle?
5. What are trends in territory (and individual nest) occupancy?
6. What is seasonal habitat use across the species' range?
7. What is the current knowledge of the species core area use?
8. What is the extent of the species winter habitat use?
9. What is overall distribution of the species through their movement ecology; i.e. inter-relatedness and interdependence of floating population as they move about the continent prior to reaching adulthood.
10. What is the extent and role of floaters within each region?
11. What are the geographic patterns of recruitment and dispersal?
12. Where are the most critically important migration, wintering, and breeding areas?
13. What migration corridors are important to the species? Are lesser used corridors as important?
14. What is the overall population size and structure (i.e., age class distribution)?
 - a. What is the current population size and trajectory?
 - b. What is current lambda?
15. What are current and projected levels of productivity and recruitment throughout the species' range in North America?
16. What are costs and benefits of using PTTs to address information gaps? [Are concerns for answers per cost versus sample size surmountable?]
17. What are effects of disturbance: short term, long term, and cumulative?
18. What is the biological basis for, and effectiveness of, buffer distance recommendations to avoid and minimize disturbance impacts?
19. Determine buffer efficacy; use past projects and associated project specific recommendations to ascertain buffer effectiveness. Provide validation of recommended distances per activity.

20. What is current condition of local and national prey populations?
Determine effects of climate change; i.e. provide a temporal framework and identify baseline information needs.
21. What is an appropriate population or sustainability goal and what are biological and social justifications for such?
 - a. What is a sustainable population and how is this determined?
 - b. What evidence do we have of what a sustainable population for Golden Eagle might be?
 - c. Need to answer this as a biological and social question.
22. How can a harvestable surplus be maintained for Native American take.
23. How can take by industry be mitigated? How will take due to loss of habitat (OHV, housing development) be mitigated?
24. How adaptable is the Golden Eagle; i.e. what comprises a situation where Golden Eagle can adapt? What is the regional and site-specific plasticity of the species?
25. From Office of Law Enforcement;
 - a. Requests that researchers plan, and carry out research which will help mitigate identified risks to the species; i.e. how do we put wind projects in the places where they will not harm eagles (Golden Eagle and BAEA)?
 - b. What level of loss can different populations (or regions) sustain? This goes back to the “harvestable” situation.
 - c. Can a tiered approach be developed to give wind companies recommendations, advice, and direction on where to build wind farms and site individual turbines? Must help industry be proactive; e.g. avoidance of take.
26. What is the most appropriate metric(s) of risk for Golden Eagle (i.e. need to determine an objective analysis of risk using legal, biological and ecological definitions)?
27. What is the habitat equivalency for the loss of an eagle or nest site? How are situation-specific factors, e.g., age class or nest site history (i.e., productivity) taken into account?
28. How much is an eagle worth? (could use California Condor and Peregrine Falcon recovery efforts as examples of how to estimate what the cost of an eagle, and potential eagle recovery effort, might be)
 - a. Would determining the “cost” of an eagle make it so that some individuals may be undervalued or devalued?
 - b. How would “super-producing” nest sites be valued?

- c. How will that cost be altered if Golden Eagle populations continue to decline?
 - d. Who will bear financial burden of potential recovery effort?
29. What are optimal methods and templates for site specific management plans for Golden Eagles?
30. What are short term, long term, and cumulative impacts of Off Highway Vehicles and recreation (i.e. rock-climbing) Golden Eagle?

RESEARCH NEEDS PRIORITIZATION; WHAT ARE THE MAIN QUESTIONS?

After discussion, these 5 research needs surfaced as the top priorities:

1. What are the critical habitat factors across all seasons (breeding, floaters, migration, and wintering) and age classes, including 3-dimensional attributes such as physiographic influences on wind dynamics during migration and use of airspace around a territory?
2. What are minimally biased, age-specific survival rates (especially for adults) and causes of mortality?
3. What is the population size and trend over multiple scales (WEST, Inc. surveys may be providing this information for parts of western U.S. but there is no comprehensive survey effort in California, the Pacific Northwest, e U.S., Alaska, and Canada)?
4. What are basic attributes of population demography; i.e. age structure, natality, and mortality?
5. What is the range of (variance) natal dispersal distances (including movement patterns from subadult to adult) within and among regions?

FINAL HOUR; POPULATION, HABITAT AND DISTURBANCE.

- WEST surveys may have detectability problems.
- Need to develop a strategic research and conservation effort, on par with the Northern Spotted Owl demographic studies. Research consistency is necessary; i.e. for demographic studies within and among regions. This will help all involved glean other species experiences and share logistical support. A regionalized approach must have consistency. (*Mike Collopy*)

- Need to develop a standardized database. A possible avenue here is the Avian Knowledge Network. This is a coordinated database that can allow access control. PRBO, Cornell and USGS are working on this. Might be a place to store sensitive data and give data owners control over who sees it.
- Need to develop an acceptable demographic study of Golden Eagles. Would it be modeled on Grainger Hunt's work at Altamont, Keller's work, and/or the Snake River Bird of Prey Area research? Northern Spotted Owl demographic studies may not be completely representative of that species across its range. The current Northern Spotted Owl work cannot answer clearly population trajectory, nor determine the species' real status, as most of the demographic sub-studies were done in prime habitat. The strategy for a well-done study will be to look across the population, i.e. the range of the species. Thus, a thought-out sampling strategy and study design will be necessary, and that methodology should be linked across large areas (North America). (*Mark Fuller*)
- Funding will be a major determinant. (*Brian Millsap*)
- Pagel read from Grainger Hunt's note (Grainger could not attend the meeting) "*I understand that a central theme of your meeting is to discuss how golden eagles are faring over their continental range, and how surveys might best be approached. To that end, I think the most efficient way to detect and monitor large-scale population trends is to do a "North American Golden Eagle Survey" just like we did with peregrines from the late 1960's to the late 1990's. As you remember, lots of people across the continent had knowledge about peregrine territories, some local, and in some cases, expansive. Contributors included state and federal staff, non-governmental professionals, and many were competent amateurs with considerable local knowledge*" Pagel added from his personal experience the peregrine falcon effort provided considerable information on the species, developed a network of experienced researchers who worked fairly well together, and was relatively inexpensive and may serve as a favorable model. (*Jeep Pagel*)
- However, the peregrine falcon effort focused mainly on breeding locations. Must avoid basing a population study on known nest sites; need a study design which gets at peripheral, representative habitat. (*Mark Fuller*)
- May wish to develop a task team from a smaller group attending this meeting. (*Clint Boal*)
- Important to include presence and absence data in any inventory and demographic analysis. (*Margi Coyle*)
- Should identify areas with high site fidelity. (*Charles Maisonneuve*)
- Long term studies are great, but need answers now. (*Mike Green*)

- For people designing surveys, genetics should be documented to understand population demography. Important to identify individuals [Golden Eagles] and understand survivorship and turnover rates at territories; to do so, researchers could collect feathers at nest sites, especially in the xeric locations throughout their range. Eagles are perfect species for genetics, individual identification, and the use of feathers to ascertain additional knowledge. (*Todd Katzner*).
- Past Bald Eagle working groups serve as favorable models or approaches to attain higher levels of coordination. (*Bob Murphy*)
- Alaska has an Alaska Raptor Group which serves to coordinate raptor work throughout the state. (*Carol McIntyre*)
- Arizona agencies come together in a similar fashion; they pool funding and obtain/share leads on how to get funding. (*Dan Driscoll and Terry Grubb*)
- Other meetings may be important as we develop a national and international monitoring strategy; this Golden Eagle Science meeting is just a start. (*Mike Green*)
- Possible 2-day Golden Eagle workshop at next year's Duluth Raptor Research Foundation Meeting (uses Geoff Holroyd's 2nd International Burrowing Owl Symposium (Raptor Research Foundation) in 1998 as model). (*Jeep Pagel*)
- Greater Yellowstone Ecosystem coordination serves as a good model, as it involves agencies and non-governmental organizations. (*Charles Maisonneuve*)

GENERALLY AGREED UPON POINTS ABOUT RESEARCH NEEDS AND PRIORITIZATION:

- Research needs listed above should be location- (i.e., region) specific.
- Research and applied studies will need consistency in approach and methodology.
 - A minimum standard of data to collect (i.e., a baseline).
 - Need a unified sampling design across the range.
- We may be able to draw upon examples of other studies and from other species.
- A good start might be a meta-analysis of existing data.
 - Could be done like was done for Peregrine Falcon.
- We should delineate a task force to design ways to answer these research questions.
 - Need to get this going as soon as possible given that some states have surveys starting next field season.

Minutes and notes compiled by Steve Lewis, Bob Murphy, Jeep Pagel and Diana Whittington. Notes graciously provided by Geoff Holroyd, Robbie Knight, Steve Lewis, Bob Murphy, Jeep Pagel, Karen Steenhof and Diana Whittington. Minutes and notes released 20 Oct. 2010 by the USFWS Office of Migratory Birds.